

Toolmark and Fracture Examinations

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Toolmark and Fracture Examinations

1 INTRODUCTION

This procedure is for the evaluation and examination of items bearing toolmarks and/or fractures (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.

Fracture match examinations are the physical and microscopic examination of surface contours of two objects to determine if they were once joined.

2 SCOPE

This procedure applies to Firearms/Toolmarks Discipline (FTD) personnel or authorized personnel when conducting forensic examinations in the FTD. The FTD is composed of personnel from the Firearms/Toolmarks Unit (FTU) and the Scientific and Biometrics Analysis Unit-Toolmark Group (SBAU-TG).

3 EQUIPMENT

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

4 STANDARDS AND CONTROLS

Known exemplars produced from evidentiary items during examination serve as controls. Exemplars produced from the known item will be treated as secondary evidence in accordance with the [FTD-121](#) and [FTD-240](#) documents. Exemplars may include toolmarks produced by a known tool and/or casts collected from a toolmarked item or fractured surface.

5 PERFORMANCE CHECKS

Performance checks of the appropriate instrumentation will be performed and recorded as outlined in the [FTD-240](#) procedure.

6 SAMPLING

- A. Statistical sampling is not applicable in the FTD.
- B. 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 Examination in Laboratory Reports are specific to the items/portions that were examined.

7 PROCEDURE

7.1 Level 1 Analysis – Classification

7.1.1 Class Characteristics of a Toolmark

- A. Examine the class characteristics of a toolmark which may include:
 - o Measurable features that result from the working surface(s) of the tool
 - o Observed action(s) of the tool that produced the toolmark
 - o Type of tool that may have produced the toolmark
 - o Evaluation for any subclass characteristics and their impact on future comparison examination.
- B. 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.
- C. 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.

7.1.2 Assessment of Microscopic Marks

Value refers to the significant quality and/or quantity of the individual characteristics present on an item. This assessment can result in any of the following classifications:

NMOV	Microscopic marks are of no value	No microscopic comparison
LMOV	Microscopic marks are of limited value	Suitable for microscopic comparison
MOV	Microscopic marks are of value	Suitable for microscopic comparison

7.1.2.1 Individual Characteristics of a Toolmark

- A. Examine the individual characteristics of any observed toolmarks to determine if the microscopic marks are of value for comparison purposes.
- B. Examine 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.
- C. All observations of a questioned toolmark, to include evaluations of the physical, class, subclass, and individual characteristics, will be recorded on the [FTD Worksheet](#).

7.1.2.2 Individual Characteristics / Surface Contours of Fractured Surfaces

- A. Examine the individual characteristics of the observed fracture mark to determine if the surface contours are of value for comparison purposes.
- B. All observations of the fracture mark, to include evaluations of the physical, class, and individual characteristics, will be recorded on the [FTD Worksheet](#).

C. The following fracture process chart will aid in determining the comparison examination workflow for fracture marks:

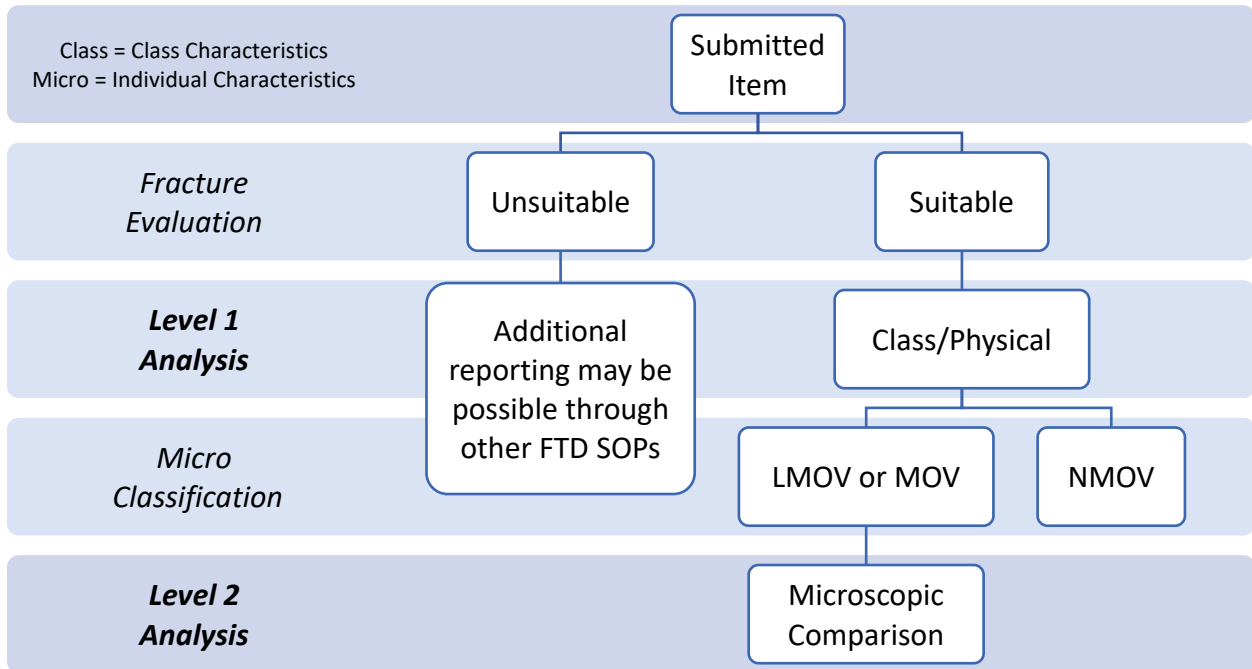


Figure 1. Fracture Process Chart

7.1.3 Class Characteristics of a Known Tool

- A. Examine the known item to determine the following:
- o Observed action(s) of the known item, to include all working surfaces
 - o Measurable features of the known item
 - o Evaluate for potential subclass characteristics and their impact on future comparison examination.

7.1.4 Physical and/or Class Characteristics of Fractured Surfaces

- A. Examine the properties of the questioned item containing the fracture mark, treating each fracture mark independently, determine any class and/or physical characteristics that may be present, such as, but not limited to:
- o Shape
 - o Size of material
 - o Method of separation
 - o Color/paint surface
 - o Extrusion/manufacturing marks
 - o Physical composition of material
 - o Patterns
 - o Surface impressions

7.1.5 Casting Marked Surfaces

- A. Depending on the size and shape of the item bearing the toolmarks or the fractured surfaces, it may be necessary to cast the toolmarks or fracture marks for evaluation of the class/individual characteristics and preservation for future comparisons.
 - 1. Casting marked surfaces will be conducted in accordance with the FTD-240.

7.2 Level 2 Analysis – Classification, Comparisons, and Conclusions

7.2.1 Classification in the Level 2 Analysis

- A. The assessment and classification of microscopic marks (e.g., individual, class, or subclass) may continue in the Level 2 Analysis of the toolmark.
 - 1. Documentation of any assessment and classification changes will be recorded in the [FTD Worksheet](#).

7.2.2 Toolmarks/Fractured Surfaces with No Microscopic Marks of Value

- A. For items with no observed class characteristics and NMOV, no further examinations will be performed.
- B. For items with observed class characteristics and NMOV, additional information may be reported using other [FTD Technical Procedures](#).

7.2.3 Comparisons and Conclusions

A comparison of items will be performed in accordance with the [FTD-242](#).

8 LIMITATIONS

8.1 Toolmark Examinations

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

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 variations in substrate, changes in tool working surfaces from wear, corrosion, subclass, damage, or the employment of unusual tool/work piece orientations, toolmark reproduction may be incomplete or insufficient, as a result it may not be possible for an examiner to reach a source conclusion.

8.2 Fracture Examinations

Due to variation in substrate, corrosion, and abuse, fracture/contour marks created from the fracture of an object are not always identifiable.

9 SAFETY

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

10 REFERENCES

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 – Fracture Examination. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1284761/download>.

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 Examination. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1284766/download>.

11 REVISION HISTORY

Revision	Issued	Changes
00	03/03/2023	Drafted with new template requirements. Merged documents FTD-213-11 and FTD-236-00. Updated the limitation statements. Limitations statement was updated in section 8.1 to include subclass and toolmark reproduction.