

Firearms/ Toolmarks Discipline Standard Operating Procedure for Fracture Examinations

1 Scope

This procedure is designed for the evaluation and classification of fractured items of evidence (referred to as item in the remaining document). Fracture match examinations are the physical and microscopic examination of surface contours of two objects to determine if they were once joined.

This procedure applies to Firearms/Toolmarks Discipline (FTD) personnel conducting forensic examinations in the following categories of testing:

- Toolmarks

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

- **Fracture**: three-dimensional surface contour variations that were produced due to the separation of an object under the action of stress.
- **Physical Characteristics**: Observable features of a specimen which indicate a restricted group source and are determined prior to manufacture (e.g., shape, color, design).
- **Class Characteristics**: Measurable or discernable features of a specimen which indicate a restricted group source. They result from design factors and are determined prior to manufacture.
- **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.

2 Equipment/Materials/Reagents

- Known exemplars (casts)
- Measurement equipment
- Microscope (stereozoom/comparison)
- Personal protective equipment (PPE)

3 Standards and Controls

Known exemplars produced from evidentiary items during examination serve as controls. Exemplars produced from a fractured surface will be treated as secondary evidence in accordance with the *FTD SOP Documentation and Preparation of Evidentiary Items* and marked in accordance with the *FTD QAM Marking and Examination of Evidence*.

4 Performance Checks

4.1 Performance checks of the measurement equipment will be performed and recorded as outlined in the *FTD SOP 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 Examination in *Laboratory Reports* are specific to the items/portions that were examined.

6 Procedures

6.1 Evaluation of an Item Bearing Fractured Surfaces

6.1.1 Review all previous observations of the item that were recorded in accordance with the *FTD SOP 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 SOP Documentation and Preparation of Evidentiary Items*.

6.2 Level 1 Analysis – Evaluation and Classification of the Fractured Surfaces

6.2.1 Physical and/or Class Characteristics

6.2.1.1 Evaluate the properties of the questioned item containing the fracture mark, treating each fracture mark independently, to determine any class and/or physical characteristics that may be present, such as, but not limited to:

- Shape
- Size of material
- Method of separation
- Color/paint surface
- Extrusion/manufacturing marks
- Physical composition of material
- Patterns
- Surface impressions

6.2.1.2 Depending on the size and shape of the fractured surfaces, it may be necessary to cast the fracture mark for evaluation of the class/individual characteristics and for preservation for future comparisons.

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

6.3 Level 2 Analysis – Evaluation, Classification and Comparison of Fractures Surfaces

6.3.1 Individual Characteristics / Surface Contours

6.3.1.1 Evaluate the individual characteristics of the observed fracture mark to determine if the surface contours are of value for comparison purposes. Value refers to the suitable quality and quantity of the individual characteristics represented. This evaluation can result in 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 All observations of the fracture mark, to include evaluations of the physical, class and individual characteristics, will be recorded on the appropriate *FTD Worksheet* located in Appendix B of *FTD QAM Case Assignment, Records, Results and Verifications*.

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

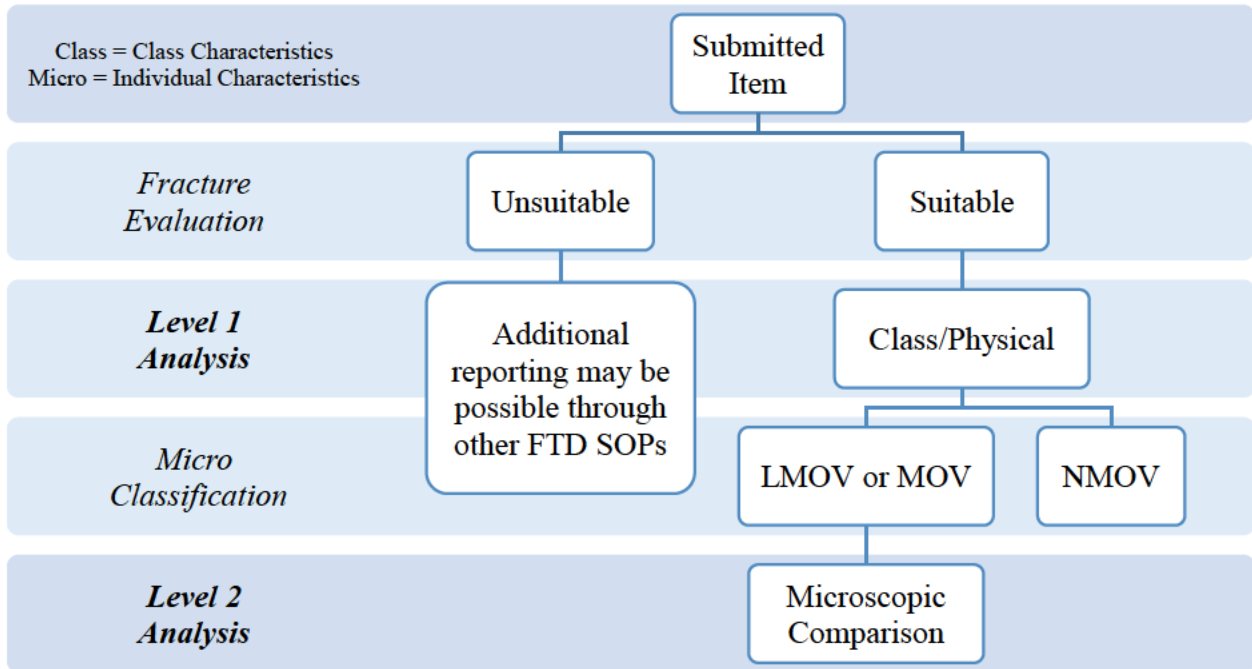


Figure 1. Fracture Process Chart

6.4 Level 2 Analysis – Comparison and Fracture Matching

6.4.1 A comparison of fractured items of evidence will be performed in accordance with the *FTD SOP Comparison and Fracture Matching*.

7 Calculations

Not Applicable.

8 Measurement Uncertainty

Not Applicable.

9 Limitations

Due to wear, corrosion, abuse or substrate type, surface contours created from the fracture of an object are not always identifiable.

10 Safety

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

11 References

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FBI Laboratory Operations Manual

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Rev. #	Issue Date	History
0	03/02/20	Original issuance. Created from FTD SOP Toolmark Examinations.

Approval

Redacted - Signatures on File

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Date: 02/28/2020

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