

# Pattern and Fracture Comparisons and Conclusions

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# Pattern and Fracture Comparisons and Conclusions

## 1 INTRODUCTION

This procedure is for the comparison of items bearing toolmarks (referred to as toolmark in the remaining document) or of fractured items of evidence (referred to as fracture in the remaining document). In addition, this procedure outlines the methods for comparison microscopy.

Pattern examination includes the evaluation of submitted items to determine the value of a suspected toolmark that may be present, and the physical and microscopic examination of a toolmark (striated and/or impressed) to determine a source conclusion. (i.e., excluded as having been fired in the same pistol, fired from the same barrel, produced by the submitted tool, inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics to identify or exclude<sup>1</sup> the two toolmarks as having originated from the same source, etc.).

Fracture examination includes the evaluation of submitted items to determine the value of any fracture that may be present, and 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 instrument
  - Measurement equipment
  - Microscope (stereozoom/comparison)
- Material
  - Known exemplars
  - Personal protective equipment (PPE)
  - Casting medium

## 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.

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<sup>1</sup> The Department of Justice Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline – Pattern Examination allows for a source exclusion to be based upon differences in individual characteristics. A source exclusion based upon differences in individual characteristics is not approved by the FBI Laboratory Firearms/Toolmarks Discipline. This determination is based on the observations that indicate individual characteristics may not significantly duplicate or be permanent.

## 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

When a comparison is performed between two toolmarks or two surface contours, like material should be used to produce exemplars. When casts are produced of a surface contour of an item or for a questioned toolmark, any test marks produced from a tool must be cast to ensure toolmark arrangement is equivalent for comparison.

### 7.1 Level 1 Analysis – Comparison of Items Bearing Toolmarks or Fractured Surfaces

- A. Review the class characteristics and determine the following:
  - 1. **Source Exclusion**; a discernible or measurable difference in class characteristics.
    - i. A source exclusion (i.e., excluded, elimination) result, when required, will be verified in accordance with the [FTD-121](#).
  - 2. **Exclusion**; an opinion that two or more fractured items do not physically fit together.
  - 3. **Agreement in class characteristics or could not determine**; continues in Level 2 analysis.
- B. Attempt to determine the impact of any possible subclass characteristics on the comparison examination.

### 7.2 Level 2 Analysis – Comparison of Individual Characteristics

#### 7.2.1 Pattern Examination

- A. Using comparative microscopy, compare the individual characteristics between two toolmarks and render one of the following conclusions:
  - 1. **Source Identification**; the two toolmarks originated from the same source.
    - i. When no known tool is submitted, careful consideration is given for the presence of subclass characteristics. If a considerable degree of gross marks exists within a toolmark, where subclass cannot be eliminated, source identification may not be possible.
    - ii. A source identification will be verified in accordance with the [FTD-121](#).

2. **Inconclusive**; insufficient quality and/or quantity of corresponding individual characteristics such that the examiner is unable to identify or exclude<sup>1</sup> the two toolmarks as having originated for the same source.
  - i. If an inconclusive result between two cartridge cases is rendered using virtual comparison microscopy (VCM), light comparison microscopy (LCM) will be used to compare individual characteristics.
  - ii. If an inconclusive result between two cartridge cases is rendered using LCM, VCM will be used to compare individual characteristics.
  - iii. The examiner will record in the case records the reason for not using VCM.
  - iv. For an inconclusive result between items, additional information may be reported through the use of other FTD Technical Procedures.

### 7.2.2 Fracture Examination

- A. Using comparative microscopy and/or physical fit, compare the corresponding surfaces of the fractured items and provide one of the following conclusions:
  1. **Fracture Fit**; opinion that two or more fractured items were once part of the same object. This conclusion can only be reached when two or more fractured items physically fit together or when a comparison of the corresponding surfaces of the fractured items reveals a fit.
    - i. A fracture fit result will be verified in accordance with the [FTD-121](#)
  2. **Inconclusive**; opinion that there is an insufficient quantity and/or quality of observed characteristics to determine whether two or more fractured items could have originated from the same object.
    - i. For an inconclusive fracture examination result, additional information may be reported through the use of other FTD Technical Procedures.

### 7.3 Level 1 and Level 2 – Conclusions Rendered

A. The following opinion workflow will aid in reviewing the details pertaining to the opinion(s) rendered during a pattern examination:

Level 1 Conclusions	Level 2 Conclusions
<b>Comparison of Class Characteristics:</b> <ul style="list-style-type: none"> <li>• Disagreement</li> <li>• Agreement</li> <li>• CND</li> </ul>	<b>Comparison of Individual Characteristics:</b> <ul style="list-style-type: none"> <li>• Suitable                             <ul style="list-style-type: none"> <li>○ Limited marks of value (LMOV)</li> <li>○ Microscopic marks of value (MOV)</li> </ul> </li> </ul>
<b>Conclusion:</b> <ul style="list-style-type: none"> <li>• <b>Source Exclusion:</b> Difference in class characteristics</li> </ul>	<b>Conclusion:</b> <ul style="list-style-type: none"> <li>• <b>Source Identification:</b> Sufficient agreement in individual characteristics</li> <li>• <b>Inconclusive:</b> Sufficient agreement not observed in individual characteristics</li> </ul>
<b>Verification Requirement:</b> <ul style="list-style-type: none"> <li>• <b>Source Exclusion:</b> Measurable difference in class characteristics</li> </ul>	<b>Verification:</b> <ul style="list-style-type: none"> <li>• <b>Source Identification</b></li> </ul>

B. The following opinion workflow will aid in reviewing the details pertaining to the opinion(s) rendered during a fracture examination:

Level 1 Conclusions	Level 2 Conclusions
<b>Comparison of Physical and Class Characteristics:</b> <ul style="list-style-type: none"> <li>• Disagreement</li> <li>• Agreement</li> </ul>	<b>Comparison of Individual Characteristics:</b> <ul style="list-style-type: none"> <li>• Suitable                             <ul style="list-style-type: none"> <li>○ LMOV</li> <li>○ MOV</li> </ul> </li> </ul>
<b>Conclusion:</b> <ul style="list-style-type: none"> <li>• <b>Exclusion:</b> Difference in physical/class characteristics</li> </ul>	<b>Conclusion:</b> <ul style="list-style-type: none"> <li>• <b>Fracture Fit:</b> Sufficient agreement in individual characteristics</li> <li>• <b>Inconclusive:</b> Sufficient agreement not observed in individual characteristics</li> </ul>
<b>Verification:</b> <ul style="list-style-type: none"> <li>• <b>Exclusion:</b> Measurable difference in class characteristics</li> </ul>	<b>Verification:</b> <ul style="list-style-type: none"> <li>• <b>Fracture Fit</b></li> </ul>

## 8 LIMITATIONS

### 8.1 Pattern Examination

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”.

Pattern Examination is an empirical science that relies on objective measurements and a subjective comparison of individual characteristics.

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.

### 8.2 Fracture Examination

Fracture Examination is an empirical science that relies on objective measurements and a subjective comparison of individual characteristics.

Due to variation in substrate, changes in tool working surfaces from wear, corrosion, and abuse, or the employment of unusual tool/work piece orientations, toolmarks created by the same tool are not always identifiable.

## 9 SAFETY

Take standard precautions for the handling of all evidentiary items, certified reference materials and working standards. PPE should 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 FTD-121-00: Records, Results, Reporting, and Reviews Page 13 of 13 Issue Date: 02/18/2022 Firearms/Toolmarks Discipline – Fracture Match 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 Match 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	11/01/2022	Drafted with new template requirements. Merged documents FTD-234 and FTD-235. Section 7 – Updated conclusion descriptions to be in line with the language in the appropriate ULTR.