Ammunition and Ammunition Component Examinations

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1 Introduction

This procedure is designed for the evaluation and examination of bullets/projectiles, cartridge cases, shotshell cases, other ammunition components, and unfired ammunition (referred to as ammunition component in the remaining document).

Firearm examinations include the evaluation of ammunition components to determine the value of any toolmarks that may be present, and the physical and microscopic examination of toolmark (striated and/or impressed) to determine a source conclusion.

2 Scope

This procedure applies to Firearms/Toolmarks Discipline (FTD) personnel or authorized personnel when conducting forensic examinations in the FTD.

3 Equipment

- Equipment
  - 3D toolmark topographical instruments
  - Measurement equipment
  - Microscope (stereozoom/comparison)
  - Scale/balance
- Material
  - Casting material
  - General laboratory supplies
  - Known exemplars
  - Personal protective equipment (PPE)
  - Open-source references (i.e., online databases)

4 Standards and Controls

Known exemplars produced from evidentiary items during examination serve as controls and may include test fires (i.e., bullets, cartridge cases, casts) produced by a known firearm. Exemplars will be treated as secondary evidence in accordance with FTD-121 and FTD-240 documents.

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 Use of a 3D Instrument

A. Based upon the discretion of the Examiner and condition of evidence, a cartridge case may be entered into a 3D instrument if it meets one of the following criteria:
    1. The incoming request contains multiple cartridge cases for intercomparison.
    2. The incoming request contains a cartridge case and firearm for comparison.
    3. The incoming request contains cartridge case evidence with previous inconclusive results, using LCM, for reexamination.
B. Reexamination requests involving virtual comparative microscopy (VCM) will be handled using the following criteria:
    1. A submission previously examined by FTU will proceed to section 7.1.C.
        i. The case file 1A generated during the original examination will be used to populate case information within the 3D instrument.
    2. A submission previously examined by an external laboratory will be treated as a new submission.
C. A cartridge case that is selected for VCM will be entered into an approved instrument as outlined in manufacturer's manual.

7.2 Level 1 Analysis – Classification

A. Examine the class characteristics of a toolmark.
B. Examine for any subclass characteristics and its impact on future comparisons.
C. 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.
D. 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.
E. The documentation should include whether the characteristics are visual observations, based on calculations, or generated through open-source references.

7.2.1 Class Characteristics of Fired Bullets

A. The documentation may include the following, as appropriate:
    1. diameter;
    2. projectile weight;
    3. number of land and groove impressions discernable;
    4. direction of twist;
    5. land impression width(s);
    6. groove impression width(s);
    7. composition (core material, jacket material, shot material, etc.);
    8. bullet/projectile design (round nose, hollow point, etc.);
    9. characteristics of base;
    10. manufacturer/marketer;
    11. number and type of cannelures;

12. damage (including indications of mismatched or improper ammunition used with a firearm); and
13. presence of foreign material (material, paint, sheetrock, etc.).

7.2.2 Class Characteristics of Fired Cartridge Cases

A. The documentation may include the following, as appropriate:
   1. headstamp;
   2. caliber;
   3. manufacturer/marketer;
   4. ignition system (centerfire, rimfire, etc.);
   5. composition and/or finish of the cartridge case and primer;
   6. any observable toolmarks from cycling or firing (firing pin impression, breech face marks, extractor/ejector mark(s), chamber marks, anvil marks, magazine marks, ejection port marks, etc.);
   7. any observable toolmarks from loading/reloading (resizing marks, etc.);
   8. class characteristics present within the firing pin and breech face marks; and
   9. damage (including indications of mismatched or improper ammunition used with a firearm).

7.2.3 Class Characteristics of Fired Shotshell Cases

A. The documentation may include the following, as appropriate:
   1. headstamp;
   2. information printed on shotshell case;
   3. gauge/bore/caliber;
   4. manufacturer/marketer;
   5. ignition system (centerfire, rimfire, etc.);
   6. length;
   7. composition and/or finish of shotshell case, battery cup, and primer;
   8. any observable toolmarks from cycling or firing (firing pin impression, breech face marks, extractor/ejector mark(s), chamber marks, shell stop/latch marks, ejection port marks, etc.);
   9. any observable toolmarks from loading/reloading (resizing marks, etc.);
   10. class characteristics present within the firing pin and breech face marks; and
   11. damage (including indications of mismatched or improper ammunition used with a firearm).

7.2.4 Class Characteristics of Unfired Ammunition

A. The documentation may include the following, as appropriate:
   1. headstamp;
   2. caliber/gauge;
   3. manufacturer/marketer;
   4. ignition system (centerfire, rimfire, etc.);
   5. composition and/or finish of the cartridge case, shotshell, primer, and/or bullet;

6. bullet/projectile design (round nose, hollow point, etc.);
7. information printed on shotshells (if necessary to establish shot type and shot size, disassembly of the shotshell may be required);
8. any observable toolmarks from cycling (magazine marks, extractor/ejector marks, etc.), partial firing pin impressions, etc.;
9. any observable toolmarks from the manufacturing process that could be mistaken for toolmarks created by a firearm (striated marks on primer, impressions on the head of the cartridge case, etc.);
10. any observable toolmarks from loading/reloading (resizing marks, etc.); and damage.

7.2.5 Class Characteristics of Cast Surfaces

A. Depending on the size and shape of the marked surface, it may be necessary to cast toolmarks on ammunition components for examination of the class/individual characteristics and preservation for future comparisons.
    1. Casting marked surfaces will be conducted in accordance with the FTD-240.

7.2.6 Subclass Characteristics

A. Examine for any subclass characteristics in the toolmarks
B. If possible, attempt to determine the impact on the comparison examination.

7.2.7 Assessment of Microscopic Marks

Value refers to the significant quality and/or quantity of the individual characteristics present on an ammunition component. 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

7.2.8 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 (barrel, slide, etc.) 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 firearm functions, etc.
C. All observations of toolmarks on ammunition components, to include evaluations of the physical, class, subclass, and individual characteristics, will be recorded on the FTD Worksheet.

7.2.9 Ammunition Components with No Microscopic Marks of Value

A. For ammunition components with no observed class characteristics and NMOV, no further examinations will be performed.

B. For ammunition components with observed class characteristics and NMOV, additional information may be reported using other FTD Technical Procedures or database searches, as appropriate.
    1. FBI Laboratory General Rifling Characteristics (GRC)
    2. Association of Firearm and Tool Mark Examiners (AFTE)
        i. Class Characteristics Matrix
        ii. GRC Search
    3. Reference Materials
    4. NIBIN
    5. CartWin Pro
    6. ForFiX

7.3 Level 2 Analysis – Classification, Comparisons, and Conclusions

7.3.1 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.

7.3.2 No Additional Items for Comparison

A. If an ammunition component is submitted with no additional items for comparison, a search of the appropriate database (i.e., general rifling characteristics file, reference ammunition file or reference firearms collection) may be performed in accordance with section 5.14 of FTD-211 or section 7.2.9.B above to produce a list of firearms that could have fired the ammunition component.

7.3.3 Comparisons and Conclusions

A comparison of items will be performed in accordance with the FTD-242.

8 CALCULATIONS

Using the following equation, the diameter of a mutilated bullet can be determined using the land and groove measurements (sum of land and groove measurements equals the circumference):

Circumference = π x diameter

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 toolmark reproduction.

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.

Identifiable microscopic marks may not be reproducible from shot to shot due to changing of the barrel, corrosion, leading, etc. Under such circumstances it may be impossible to identify the known test bullet with each other. Further, mutilated, corroded, and deformed bullets may be of no value for comparison purposes.

10 SAFETY

Take standard precautions for handling of all evidence and standards. Personal protective equipment should also be utilized during the handling, use, and operation of a submitted firearm in accordance with FTD Quick Reference Guide for the Safe Handling of Firearms and Ammunition.

11 REFERENCES

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.

FBI Corporate Policy Directive 0989D, Laboratory Division Statement of Authorities and Responsibilities, Federal Bureau of Investigation, latest revision.

ANSI/ASB Standard 096, Standard Method for the Examination and Documentation of Ammunition and Ammunition Components, First Edition, 2022, Sections 4.5 and 4.6.

ANSI/ASB Standard 093, Standard Test Method for the Examination and Testing of Firearms, First Edition, 2020, Section 4.11.

ANSI/ASB Best Practice Recommendation 068, Safe Handling of Firearms and Ammunition, First Edition, 2020, Sections 4.3 and 4.4.

Association of Firearm and Tool Mark Examiners (AFTE) GRC Search | Class Characteristics Matrix. Web. Accessed 16 February 2023.

AFTE Glossary, AFTE Standardization and Training Committee, 6th Edition, Version 6.091222.

Fact Sheet – National Integrated Ballistic Information Network. Web. Accessed 16 February 2023.

ForFiX – Forensic Firearms Expert System. Web. Accessed 16 February 2023.

TopMatch-3D High Capacity – Cadre Forensics. Web. Accessed 16 February 2023.

TopMatch Manual, latest version, Cadre Forensics

12 REVISION HISTORY

Revision	Issued	Changes
05	03/02/2020	Updated Title of SOP, Reformatted Scope and added terminology to Section 1. Equipment listing updated in Section 3. Titles for referenced SOPs were updated in Section 3. Referenced new SOP in Section 4. Clarified sampling options in Section 5. Procedures were updated throughout Section 6. Referenced new SOPs in Section 6.4.1 and 6.4.2. Updated Section 8 title. Updated references in Section 11.
06	03/03/2023	Drafted with new template requirements. Merged documents FTD-202-05 and FTD-210-05. Incorporated examinations on unfired ammunition in section 7.2.4. Updated additional class characteristics databases in section 7.3.2.B. Also defined and incorporated the E3CV methodology. Limitations statement was updated in section 9 to include subclass and toolmark reproduction.