

	<b>FAPM 2.0 Physical Examination &amp; Classification of Fired Bullet Evidence</b>	
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	Document Manager: Andrew Carriveau	Approved By: Ryan Larrison

## 2.0 Physical Examination & Classification of Fired Bullet Evidence

### 2.1 Introduction

The initial examination of any fired bullet evidence will include the completion of a worksheet in Forensic Advantage. The worksheet should include a complete description of the item as it was received. A photograph of the fired evidence will serve as an additional source to document the condition of the evidence as received.

### 2.2 Safety Considerations

Examinations performed in the Firearm and Tool mark Section are inherently hazardous. These procedures involve hazardous chemicals, firearms, ammunition, and power tools. All hazardous procedures must be performed in compliance with the Laboratory Operations Manual and the Health and Safety Manual.

### 2.3 Preparation of Cleaning Solutions

#### 2.3.1 Bleach Solution

- Prepare a Bleach Solution as needed by combining 10 milliliters of bleach to 90 milliliters of distilled water
- Discard after use

### 2.4 Instrumentation

- Comparison Microscope
- Stereo Microscope
- Caliper/Micrometer/Ruler
- Scale/Balance
- Ammunition references
- The assigned unique identifier or serial number of the instrumentation used shall be maintained on the Firearms Discipline space in Qualtrax.

### 2.5 Minimum Analytical Standards and Controls

Appendix A

### 2.6 Procedures or Analysis

The evidence will be marked in accordance with the [Laboratory Operations Manual Section 4.3](#). A systematic approach should be used for the physical examination and classification of fired evidence, with recording of findings and observations in notes.

There will be instances where multiple fragments are received packaged in a single container. When a fragment displays characteristics that will be used for a classification, comparison, or both, it must be

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itemized individually. If there are multiple fragments that have no useful characteristics, are received in the same individual container and appear to be the same type of metal they may be itemized together. Itemizing multiple fragments together does not indicate that they were at one time a single item or part of a larger single item.

Items that have been processed by the MSP Biology Units are typically given item numbers/identifiers that contain the lab number and subsequent identifier unique to that item. For ease of documentation and review, all firearms personnel may omit the preceding lab number and use the subsequent unique identifier. The preceding lab number of an item shall not be omitted if doing so creates a duplicate item number. If the preceding lab number is omitted from items in the results section of the lab report, a notation should be made at the end of the report stating as much.

### 2.6.1 General, Visual, Physical, and Trace Examination

The initial examination of any bullet will include a bullet worksheet.

Examine the bullet visually and microscopically for any trace material. Determine if further examination of material is necessary and consult the appropriate section prior to the removal of any trace evidence. Document findings and observations and record in notes.

Once the bullet has been examined for the presence of pertinent material, visual and physical examinations are conducted to determine the following bullet features, to be documented on the worksheet. There will be occasions where, due to damage and/or mutilation to the fired projectile, certain features will remain undetermined. The general notes about the item condition should reflect what features were able to be determined and recorded.

- Presence or absence of trace material
- Caliber/gauge
- Bullet/slug weight (record weight of bullets in grains; record weight of slugs in ounces or grains)
- Number of land and groove impressions on a fired bullet
- Direction of twist
- Measured width of the land impressions (representative sample)
- Measured width of the groove impressions (representative sample)
- Measured diameter (if base is intact)
- Bullet composition
- Bullet style
- Possible manufacturer/marketer of the bullet/projectile (optional)
- Description of the base of the bullet
- Number of cannelures
- Presence of gunpowder and/or powder imprints adhering to the base (optional)
- Condition of the fired evidence as received

### 2.6.2 Trace Material Examination

Evidence recovered during an investigation may contain trace material transferred from the crime scene. This material may be in the form of blood, tissue, plaster, paint, hairs, fibers, glass, etc. Removal and/or preservation of this material may be necessary to allow a complete examination of the evidence. Once

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the presence or absence of trace material is documented and if it is found to be of no additional forensic value, the item should be cleaned and sanitized prior to continuing any further examinations.

### 2.6.3 Caliber Determination

Caliber, or the base diameter, is one of the class characteristics of a fired bullet and is written as a numerical term that, when applicable, shall be depicted with a decimal point when appropriate. The determination of caliber will aid the examiner during the identification or elimination of a submitted firearm(s). If no firearm is submitted, the bullet's caliber may be used in determining the General Rifling Characteristics of the firearm involved. For bullets identified as having been fired in a submitted firearm there is no need for a caliber determination using this process. The following may be utilized to determine the caliber of a fired bullet. The condition of the bullet will determine which steps can be used:

- Measure the base diameter of the evidence bullet using a calibrated caliper or micrometer and compare this measurement with known measurements published in reference literature
- Determine the number and widths of the land and groove impressions.
- Physical characteristics of the evidence bullet, such as weight, bullet shape, composition, nose configuration, and number and placement of cannelures may aid in caliber determination
- If the Ammunition Reference Collection is used, the unique identifier of the sample shall be listed in the notes section of the worksheet
  - [Refer to LOM 2.5.1.1, 2 and 3](#) for specific maintenance requirements of reference collection standards.
  - [AR 3125](#) 6.4.3.2 and [ISO 17025:2017](#) 6.4.13 (f)

### 2.6.4 Methods of Measuring Lands and Grooves

One of the class characteristics used in the discipline of firearm identification is the width of the land and groove impressions. These measurements may aid the examiner during the identification or elimination of a submitted firearm. If no firearm is submitted, these measurements will be used in determining the General Rifling Characteristics of the firearm involved. The measuring of land and groove impressions on a fired bullet can be accomplished by utilizing either the air gap method or by utilizing the measuring feature within the Leica Application Suite

In measuring a fired bullet to determine the width of the land impression or the groove impression, it is paramount that the points used for beginning and ending a measurement comply with the discipline-wide practice. If no land and groove beginning and end points (margins) can be identified, the measurement(s) may not reflect the true caliber. The examiner must determine if the margins are consistent and reliable, if not this information should be documented in the worksheet notes.

It may be necessary to measure several of the suitable land and groove impressions to obtain a reliable measurement.

When a fired bullet or bullets are identified as having been fired from a submitted firearm, it is not necessary to measure the lands and grooves. For a fired bullet or bullets NOT identified as having been fired from a submitted firearm, at a minimum, one land and one groove impression measurement, recorded to the nearest hundredth or thousandth of an inch should be recorded in the notes for each bullet. For multiple bullets previously identified as having been fired from the same firearm, only one bullet needs to be measured.

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### 2.6.4.1

In the air gap method, the fired bullet in question is mounted on one stage of a comparison microscope. The measuring device is mounted on the other stage. It is important to ensure that the magnification level is the same for both.

Align the image of the land or groove impression with one of the anchor points corresponding with the anvil of the micrometer or measuring jaw of the caliper. Rotate the micrometer's spindle to the next anchor point of the micrometer or the other jaw of the caliper to the land or groove impression and record the measurement gap (opening) of the micrometer/caliper to the nearest hundredth or thousandth of an inch.

### 2.6.4.2

The measurement features of the Leica Application Suite may be used to determine land and groove widths. The stage micrometer of the Leeds LCF3 comparison microscope may also be used. All measuring devices must be calibrated annually. Refer to [FA/PM Appendix A](#) for calibration standards.

The land or groove impression at the base of the fired bullet is placed perpendicular to the dividing line of the scope image. The distance between both anchor points are measured utilizing measure tool of the software and record it to the nearest hundredth of an inch.

## 2.6.5 FBI and AFTE General Rifling Characteristics File (GRC)

The FBI's General Rifling Characteristics File (GRC) or the AFTE GRC database can be utilized when attempting to determine a list of possible firearms that could have fired an evidence bullet when no firearm is submitted. The GRC specifications can be accessed using various software utilities or the printed reference file. The GRC File is an investigative aid and should not be construed as an all-inclusive list of firearms available with those class characteristics. When an examiner conducts a search using the FBI GRC or the AFTE GRC database and includes part or all of the results in the report, a copy of the original search results shall be retained in the case file.

## 2.6.6 AFTE Table 8

[AFTE Table 8](#) shall be used when the land and groove widths, or a combined interval of conventional rifling is used to determine the caliber of a bullet or the possible total number of lands and grooves. In some instances, the Examiner will be able to determine the total number of lands and grooves from a combined land and groove measurement when not all are measurable or able to be visually observed. Lastly, when the diameter of a bullet is not measurable, and the total number of lands and grooves is visible with at least one of each measurable, or combined interval of conventional rifling, using AFTE Table 8 will enable the Examiner to determine the caliber. If the total number of lands and grooves is not visible, a base measurement must be used in conjunction with the land and groove measurements to be able to accurately calculate the total land and grooves. There may be limited situations where no base measurement is available but there is other supporting documentation that will enable the examiner to report a complete classification. Instances where it is not necessary to complete an AFTE Table 8 are as follows:

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- When a bullet or multiple bullets are identified as having been fired from a submitted firearm.
- When a bullet has an intact measurable base. If the lands and grooves are not measurable but can be determined this should be clearly communicated in the notes. For bullets where the lands and grooves are measurable, at least one of each shall be recorded in the worksheet.

If more than one bullet of a group is identified as having been fired in the same firearm, only one of the group needs to be classified using Table 8.

## 2.6.7 Interpretation of Results

- Caliber is written as a numerical term and shall be consistent with the manufacturer specification.
- May determine caliber/gauge, brand, type, style, and general rifling characteristics of the fired bullet.
- May determine if there are suitable markings for identification with a firearm or with other fired components
- May determine list of possible firearms that could have fired the bullet
- May be able to identify the firearm in which it was fired
- Record interpretation of results in examiner's notes and worksheet in Forensic Advantage

## 2.7 Appendix

[Appendix A - Calibration Standards](#)

## 2.8 References

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