

TENNESSEE BUREAU OF INVESTIGATION
Forensic Services Division

Firearms/Toolmarks Standard Operating Procedures Manual
Ejection Pattern Testing Procedure



8.0 EJECTION PATTERN TESTING PROCEDURE

8.1 Scope: One of the routine procedures conducted in a firearm examination is determining the ejection pattern of the firearm.

On occasion, the submitting agency may request the firearms examiner to determine the ejection pattern of a firearm given a set of specific and/or unusual circumstances. In this instance, a non-standard ejection pattern test will be conducted. Every attempt should be made to duplicate these circumstances unless doing so may pose a risk to the examiner.

8.2 Precautions/Limitations: The measurements taken are estimates and the firearm examiner should give a range of distances and direction when reporting the results of the ejection pattern test.

8.3 Related Information:

- 8.3.1** Section 6 Test Firing Procedure
- 8.3.2** Section 5 Firearm Examination and Classification Procedure
- 8.3.3** Section 4 Safe Firearm Handling Procedure
- 8.3.4** Appendix 1 Worksheets
- 8.3.5** Appendix 3 Firearm Safety
- 8.3.6** Appendix 4 Range of Conclusions

8.4 Instruments:

- 8.4.1** Tape measure
- 8.4.2** Protractor

8.5 Reagents/Materials: None

8.6 Hazards/Safety:

8.6.1 It is the responsibility of the firearm examiner to employ appropriate safety and health practices. Safe firearm handling procedures shall be strictly followed at all times.

8.7 Reference Materials/Controls/Calibration Checks: None.

8.8 Procedures/Instructions:

Ejection Pattern Tests are performed upon request of the submitting agency to determine the pattern produced (distance and relative direction) when a cartridge case/shotshell case is ejected from a firearm during the firing process.

8.8.1 Standard Ejection Pattern Test

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- Use the suspect firearm and the same manufacturer and type of ammunition received from the requesting agency or determined by the examiner from the fired ammunition components received.
- Fire all ejection pattern tests in the indoor range, or at a designated outdoor range.
- Shoot the tests at shoulder height. With pistols, use a supported strong hand grip with the shooting arm extended. A measurement should be made from the ejection port to a point of the ground directly below the ejection port.
- A minimum of four (4) rounds should be fired. When feasible, firing a full magazine is recommended to observe any differences that might result from magazine spring pressure.
- A technician or second examiner (the spotter) may be needed to mark the points on the floor/ground where the fired cartridge cases first land, or the examiner may elect to use a large drop cloth to determine where the fired cartridge cases first land.
- Measurements should be taken from the point on the ground directly below the ejection port to the ejected cartridge cases and the general direction (right/left of shooter, front/rear of shooter) of the ejected cartridge cases should be noted.
- The examiner may draw a sketch to illustrate the results.

8.8.2 Non-Standard Ejection Pattern Test

When information is provided to the examiner about the conditions/situations of a shooting incident and the requesting agency asks that an ejection pattern test be conducted simulating those conditions/situations, then the following protocol will be followed.

- First, conduct a standard ejection pattern test.
- Next, using the information provided about the conditions of the shooting incident (E.g., shooter was 6'6" tall, using a two handed grip with the gun canted to the right, or shooter was aiming gun down at a 45 degree angle), the examiner will devise a method to best simulate those conditions. It will be up to the individual examiner to best determine the methodology to be used.
- A minimum of four (4) additional rounds should be fired for the non-standard ejection pattern test. When feasible, firing a full magazine is recommended to observe any differences that might result from magazine spring pressure.
- A technician or second examiner (the spotter) may be needed to mark the points on the ground where the fired cartridge cases first land, or the examiner may elect to use a large drop cloth to determine where the fired cartridge cases first land.

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- Measurements should be taken from the point on the ground directly below the ejection port to the ejected cartridge cases and the general direction (right/left of shooter, front/rear of shooter) of the ejected cartridge cases should be noted.
- The examiner may draw a sketch to illustrate the results.
- If safety becomes an issue for recreating a situation for a non-standard ejection pattern test, it is at the examiner's discretion to not perform the test with the suggested conditions/situations. If the examiner deems those conditions unsafe, only a standard ejection pattern test will be conducted.

8.9 Records: The firearm examiner shall document their findings in the form of handwritten notes, computer generated notes, photography, diagramming, or by utilizing an FTIU worksheet.

8.10 Interpretations of Results: The ejection pattern will be defined as the location(s) that the cartridge cases/shotshell cases first land. The ejection pattern shall be reported as a range of distances and relative direction of ejected cartridge cases or shotshell cases.

8.11 Report Writing: Firearm report writing can be found in the Range of Conclusions Appendix 4. If a non-standard ejection pattern test is conducted, all variables shall be included in the report.

8.12 References:

Hueske, E. E., Practical Analysis and Reconstruction of Shooting Incidents, CRC Press, 2006, Chapter 5.

Haag, L.C., Shooting Incident Reconstruction; Second Edition, Academic Press, 2011, Chapter 12.

Pepper, I. K., and Bloomer, S. T., "Cartridge Casing Ejection Patterns from Two Types of 9mm Self-loading Pistols Can be Distinguished from Each Other", Journal of Forensic Identification, 2006, Vol. 56(5), pgs. 721-725.

Sims, E., and Barksdale, L., "The Importance of Careful Interpretation of Shell Casing Ejection Patterns", Journal of Forensic Identification, 2005, Vol. 55, No. 6, pgs. 726-740.

Haag, L.C., "Cartridge Case Ejection Patterns", AFTE Journal, 1998, Vol. 30, No. 2, pgs. 300-302.

Haag, M., Stuart, J. and Haag, K., "Ejection Patterning – Standard Testing and the Effects of Non-Standard Angles, Orientations, and Maneuvers", AFTE Journal, 2009, Vol. 41, No. 2, pgs. 111-129.

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McCombs, N, and J. Hamman, "Cartridge Case Ejection Patterns from .25 Auto Pistols Positioned Sideways", AFTE Journal, 1998, Vol. 30, No. 4, pgs. 644-648.