



Examination of Fired Cartridge Cases

PART 1 – FIRE-FORMED MARKS

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Objectives

- Defining class and individual characteristics
- Introduce various types of marks that may be encountered on cartridge cases
- Discuss marks related to the firing of a cartridge case

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Class characteristics

Measurable features of a specimen which indicate a restricted group source. They result from design factors and are determined prior to manufacture.

Association of Firearm and Toolmark Examiners, 2013. AFTE Glossary, 6th edition, Version 6.030317.

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Class characteristics

Caliber

Firing pin

- Location
- Shape
- Size
- Toolmark style

Breechface

- Toolmark style

Ejector

- Location
- Shape
- Toolmark style

Extractor

- Location

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Class characteristics

When documenting class characteristics and location, use a clock designation as you are looking down at the head of the cartridge case. By convention:

- Centerfire
 - If a drag mark is present, that drag mark is considered at 12 o'clock
 - If no drag mark is present, extractor is at three o'clock
- Rimfire
 - Firing pin is at 12 o'clock



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Individual characteristics

Marks produced by the random imperfections or irregularities of tool surfaces. These random imperfections or irregularities are produced incidental to manufacture and/or caused by use, corrosion, or damage. They are unique to that tool to the practical exclusion of all other tools.

Association of Firearm and Toolmark Examiners, 2013. AFTE Glossary, 6th edition, Version 6.030317.

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Firearm produced marks

Generally, three processes will leave marks from various parts of the firearm on cartridge cases

- Loading
- Firing
- Extraction and ejection

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Firearm produced marks

Firing	Loading	Extraction/Ejection
• Firing pin • Firing pin drag • Breechface marks • Aperture outline • Aperture shear • Chamber marks	• Slide marks • Magazine lip marks • Extractor override marks • Feed ramp marks	• Extractor • Ejector • Ejection port

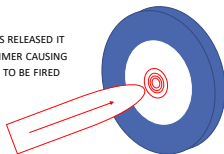
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Firing pin

AS FIRING PIN IS RELEASED IT STRIKES THE PRIMER CAUSING THE CARTRIDGE TO BE FIRED



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Firing pin

Two general types

- Rimfire – firing pin on edge of cartridge case head
- Centerfire – firing pin strikes a center primer

Shapes of firing pins can be different and are considered class characteristics – if they have different shapes, then they were not made by the same firing pin

Toolmark type – the surface of the firing pin may have distinctive tool marks depending on how the firing pin was manufactured

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Firing pin



Rectangular



Circular

RIMFIRE FIRING PIN SHAPES

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Firing pin



Round Hemispherical



Round Flat



Round Faceted



Oval



Rectangular

CENTERFIRE FIRING PIN SHAPES

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Firing pin



D-Shape
S&W SW40VE
S&W SW9VE



Rectangular
Springfield Armory
XDS 45

CENTERFIRE FIRING PIN SHAPES - MISCELLANEOUS

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Firing pin



Smooth



Concentric
Circular



Metal
Injection
Molding



Irregular

TOOLMARK TYPES

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Firing pin drag

AFTER THE CARTRIDGE IS FIRED, THE FIRING PIN REMAINS IN THE PRIMER AS THE SLIDE IS MOVING BACK AND THE FIRED CARTRIDGE CASE IS BEING EXTRACTED FROM THE CHAMBER.

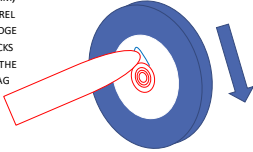


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Firing pin drag

IN A RECOIL OPERATED FIREARM, THE BREECH END OF THE BARREL WHICH STILL HAS THE CARTRIDGE CASE IN THE CHAMBER UNLOCKS BY DROPPING A BIT CAUSING THE TIP OF THE FIRING PIN TO DRAG THROUGH THE PRIMER.



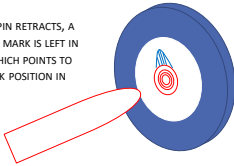
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Firing pin drag

WHEN FIRING PIN RETRACTS, A STRIATED DRAG MARK IS LEFT IN THE PRIMER WHICH POINTS TO THE 12 O'CLOCK POSITION IN THE FIREARM.

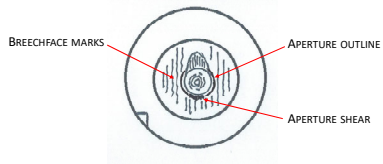


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Breechface related marks



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Breechface marks

Breechface marks – force of discharge presses head of cartridge case back against breechface of firearm and toolmarks on surface of breechface may be impressed onto surface of cartridge case, especially the primer

Different machining processes leave different classes of toolmarks on the breechface

- Similar class means possibly same firearm
- Different class means different firearms

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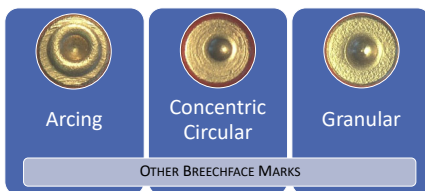
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Breechface marks


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Breechface marks


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Aperture related marks

Aperture outline – when cartridge case is fired, pressure may cause primer material to flow into firing pin channel causing an outline of the hole in the breechface to be outlined on the primer

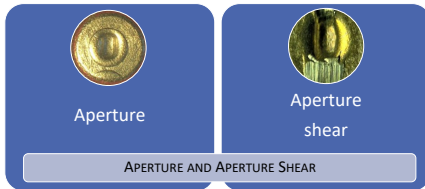
Aperture shear – when cartridge case is fired, pressure may cause primer material to flow into firing pin channel; in a recoil operated firearm, this primer material will be sheared as the breech end of the barrel unlocks and drops against the breechface

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Aperture related marks



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Aperture outline

BERETTA PISTOLS AND DONUT SHAPED BULGE



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Aperture outline

BRYCO 380 AUTO



22 CALIBER RIMFIRE



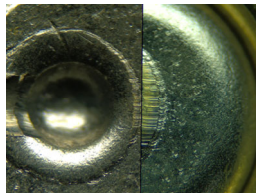
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Aperture shear

AMMUNITION DIFFERENCES
CAN CAUSE APERTURE
SHEAR TO APPEAR
DIFFERENT WHEN IN FACT
ONE IS SIMPLY BETTER
MARKED THAN THE OTHER.



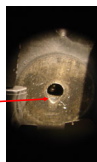
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Aperture shear

SMITH & WESSON M&P SERIES PISTOLS



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Other marks on breechface



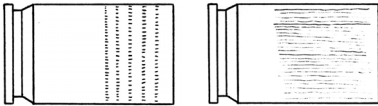
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Chamber marks

WHEN CARTRIDGE CASE IS FIRED IT SWELLS AND SEALS AGAINST THE INNER WALLS OF THE CHAMBER (OBTURATION). MACHINING MARKS FROM THE FINISHING OF THE CHAMBER CAN BE IMPRESSED ON THE SIDES OF THE CARTRIDGE CASE OR CAN BE SCRATCHED INTO SURFACE AS CARTRIDGE CASE IS EXTRACTED FROM CHAMBER.



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Firing marks summary

Firing pin – have two class characteristic features

- Firing pin shape
- Manufacturing marks on the surface of the firing pin

Breechface marks are manufacturing marks left behind the tooling process and these manufacturing toolmarks are considered class characteristics

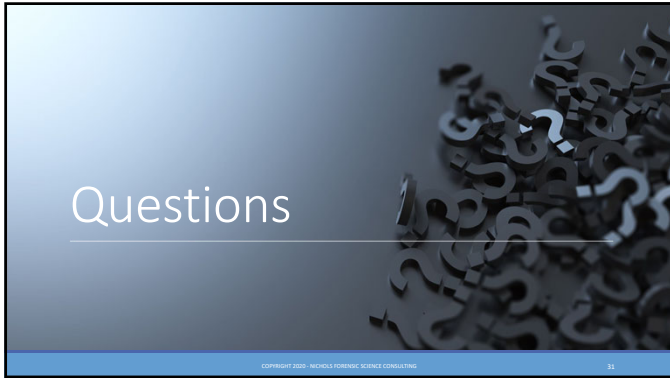
Aperture related marks may be useful provided they are consistently marked

Chamber marks are valuable because it is one mark that is not impacted by subclass; ammunition differences can impact their presence

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