

SUBJECT	COMPARISON MICROSCOPE EXAMINATION PROTOCOL
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9.0 Comparison Microscope Examination Protocol

9.1 The following is an illustration of one way to perform a comparison microscope examination of test and evidence bullets. Examiners may develop their own routine for this type of examination although they should incorporate the general points mentioned here in bold letters.

9.2 Compare test bullets first.

9.2.1 Place one of the test fired bullets on the right stage of the microscope with the nose of the bullet toward the right.

9.2.2 Adjust the light to provide oblique or grazing illumination over the bearing surface of the bullet.

9.2.2 Using low magnification (10X - 20X) examine the entire bearing surface of this test bullet looking for areas with the most obvious individual characteristics. Higher magnifications should be used to verify the correspondence of finer striations. When such an area is located, leave the right stage in that position.

9.2.3 Next, place a second test bullet on the left stage with the nose in the same direction as the bullet on the right stage.

9.2.4 Rotate the bullet on the left stage looking for the area of individual characteristics present on the bullet on the right stage

9.2.5 When and if this area is found, align the corresponding land or groove impression and then rotate both bullets simultaneously, examining and comparing each land impression area and each groove impression area from base to nose until the examiner can conclude there is sufficient agreement to match or there is not sufficient agreement to match.

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- **These examinations should be made with the bullets in phase. This means that the edges of the land or groove impressions of both bullets align with each other and the relationship of the other land and grooves visible in the viewing area is the same. Also the lighting (whether incandescent, fiber optic or fluorescent) should be the same for both bullets.**

 - *Agreement is sufficient when it exceeds the best agreement demonstrated between tool marks (bullet striae) known to have been produced by different tools (different firearms or different barrels) and is consistent with the agreement demonstrated by tool marks (bullet striae) known to have been produced by the same tool (firearm).*

 - **If these test bullets cannot be matched to each other, (there is not sufficient agreement) then more test bullets should be fired and inter-compared. If a match still cannot be determined, the examiner may reach the conclusion that the firearm barrel in question does not reproduce very well the individual marks present or that the firearm barrel does not produce sufficient individual marks to reach a positive conclusion.**
- 9.2.6 If the test bullets can be matched to each other, the area of best agreement or the area with the most obvious striae should be indexed with an indelible marker on both the base and nose, if possible.

9.3 Compare evidence bullet(s) to test bullets.

- 9.3.1 Place the evidence bullet on the right stage with the nose toward the right.
- 9.3.2 Place the best test bullet on the left stage with the nose in the same direction as the bullet on the right stage.

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- 9.3.3 Rotate the test bullet so that the indexed area is in the center of the viewing area.
- 9.3.4 Align the driving edge of the test bullet with a driving edge on the evidence bullet.
- The examiner can ascertain at this point if the class characteristics agree by noting whether or not the twist is same and whether or not the widths of both land and groove impressions are the same on both bullets.
 - If the width of the land or groove impressions are *markedly different between test and evidence* and this difference cannot be contributed to deformity or deformation due to a damaged evidence bullet or to damage to the barrel since the firing of the evidence bullet then the examiner can conclude at this point that the evidence bullet was not fired from the evidence firearm.
- 9.3.5 If the class characteristics of the test and evidence bullets agree, rotate the evidence bullet in a search for similar individual characteristics as those found on the indexed area of the test bullet. If these are found then phase the bullets and compare all the- undamaged bearing surface of the evidence bullet with the corresponding area on the test bullet(s).
- The evidence bullet may be damaged or deformed in the area of the indexed test bullet. It may be necessary to use other areas of the test bullet to compare to the undamaged areas of the evidence bullet.
- 9.3.6 If a positive conclusion is reached (sufficient agreement) the evidence bullet should be indexed at the same area as the test bullet even if this is a damaged area.

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- **If the evidence bullet is missing the area indexed on the test bullet or if the evidence is just a portion of a bullet then the evidence must be indexed at the best area on the evidence bullet with a different color index mark. The test bullet(s) must be then be indexed again at this area of agreement with the same color index mark (different color than already on test).**

9.3.7 If the evidence bullet cannot be indexed and/or sufficient agreement is not found, further examinations must be made to determine what conditions or circumstances might have caused this inconclusive result.

- Possible reasons for insufficient agreement may be:
- The evidence bullet(s) and test bullet(s) were fired from different firearms.
- The firearm was damaged between firing the evidence bullet and the test bullet.
- The test ammunition available is significantly different from the evidence causing a difference in the way the bullet was marked.
- Misalignment between chamber and barrel causing marks to differ on bullets fired from different chambers.
- Extreme leading in the barrel, either prior to firing the evidence bullet or occurring since the evidence bullet was fired.
- Damage that occurred to the evidence bullet causing distortion, deformation or the elimination of microscopic detail.

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- Other reasons that may exist and should be considered and tested if appropriate.
- 9.4 The following is an illustration of one way to perform a comparison microscope examination of evidence bullets to evidence bullets. Examiners may develop their own routine for this type of examination although they should incorporate the general points mentioned here in bold letters.
- 9.4.1 Examine each bullet separately and select the one with the least damage and/or the most individual characteristics.
- 9.4.2 Place that evidence bullet on the right stage of the microscope with the nose of the bullet toward the right.
- 9.4.3 Adjust the light to provide oblique or grazing illumination over the bearing surface of the bullet.
- 9.4.4 Using low magnification (10X - 20X) examine the entire bearing surface of this evidence bullet looking for areas with the most obvious individual characteristics. Higher magnifications should be used to verify the correspondence of finer striations. When such an area is located, leave the right stage in that position.
- 9.4.5 Next, place another evidence bullet on the left stage with the nose in the same direction as the bullet on the right stage.
- 9.4.6 Rotate the bullet on the left stage looking for the area of individual characteristics present on the bullet on the right stage
- 9.4.7 Align the driving edge of the test bullet with a driving edge on the evidence bullet.**
- **The examiner can ascertain at this point if the class characteristics agree by noting whether or not the widths of both**

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land and groove impressions are the same on both bullets.

- If the width of the land or groove impressions are *markedly different between evidence and evidence* and this difference cannot be contributed to deformity or deformation then the examiner can conclude at this point that these evidence bullets were not fired from the same firearm.

9.4.8 When and if this area is found, align the corresponding land or groove impression and then rotate both bullets simultaneously, examining and comparing each land impression area and each groove impression area from base to nose until the examiner can conclude there is sufficient agreement to match or there is not sufficient agreement to match.

- These examinations should be made with the bullets in phase. This means that the edges of the land or groove impressions of both bullets align with each other and the relationship of the other land and grooves visible in the viewing area is the same. Also the lighting (whether incandescent, fiber optic or fluorescent) should be the same for both bullets.
- *Agreement is sufficient when it exceeds the best agreement demonstrated between tool marks (bullet striae) known to have been produced by different tools (different firearms or different barrels) and is consistent with the agreement demonstrated by tool marks (bullet striae) known to have been produced by the same tool (firearm).*
- If these evidence bullets cannot be matched to each other (there is not sufficient agreement), the examiner may reach the conclusion that it cannot be determined if these evidence bullets were or were not fired from the same firearm.

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- 9.4.9 If these evidence bullets can be matched to each other, the area of best agreement or the area with the most obvious striae should be indexed with an indelible marker on both the base and nose of both bullets.
- 9.5 Repeat the entire process with each evidence bullet.
- 9.5.1 **With several evidence bullets of the same caliber and class characteristics and with varying degrees of damage, it may necessary to utilize more than one of these evidence bullets to inter-compare with the other bullets.**
- 9.6 The following is an illustration on one way to perform a comparison microscope examination of test and evidence cartridge cases and/or shotgun shells. Examiners may develop their own routine for this type of examination although they should incorporate the general points mentioned here in during bold letters.
- 9.6.1 Compare test cartridge cases and/or shotgun shells first.**
- 9.6.2 Place one of the test cartridge cases or shotgun shells on the right stage base up.
- 9.6.3 Adjust the light to provide oblique or grazing illumination over the bearing surface of the test and evidence cartridge case/shotgun shell.
- 9.6.4 **Using low magnification (10X - 20X) examine the base and primer area of the test cartridge case or shotgun shell, slowly turning the cartridge case or shotgun shell looking for the position that best highlights the individual characteristics on the primer and/or the base. Higher magnifications should be used to verify the correspondence of finer impressions or striae. When such an area is located, leave the cartridge case or shotgun shell in during that position.**

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- 9.6.5 Next, place another test cartridge case or shotgun shell on the left stage and turn it until the primer position is the same as the right staged cartridge case or shotgun shell is attained.
- 9.6.6 Manipulate the stages to move the left and right cartridge cases or shotgun shells and attempt to align any impressions that are present on the primer and/or the base. The examiner can conclude there is sufficient agreement to match or there is not sufficient agreement to match based on the quality and quantity of the individual characteristics present on the primer and or the base. (breach face marks or striations)
- 9.6.7 The examiner should also examine and compare the firing pin impressions of test cartridge cases or shotgun shells. Cartridge cases or shotgun shells may have to be tilted toward the light source to better illuminate the firing pin impression.
- Rotate the cartridge case or shotgun shells looking for individual characteristics within the firing pin area that correspond to individual characteristics in the other cartridge case or shotgun shell firing pin impression.
- 9.6.8 The examiner can conclude there is sufficient agreement to match or there is not sufficient agreement to match based on the quality and quantity of the individual characteristics present within the firing pin impression.
- 9.6.9 The examiner should also examine and compare any extractor, ejector, chamber marks, magazine marks and/or any other marks that may be present on the test cartridge cases and shotgun shells.
- Position the cartridge case or shotgun shell on the stages in during the position that best highlights the area(s) of concern (extractor, ejector, chamber marks, magazine marks or other marks).

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9.6.10 The examiner can conclude there is sufficient agreement to match or there is not sufficient agreement to match based on the quality and quantity of the individual characteristics present in during the extractor, ejector, chamber magazine marks or other marks present.

9.7 The following is an illustration on one way to perform a comparison microscope examination of evidence to evidence cartridge cases and/or shotgun shells. Examiners may develop their own routine for this type of examination although they should incorporate the general points mentioned here in during bold letters.

9.7.1 Place one of the evidence cartridge cases or shotgun shells on the right stage base up.

9.7.2 Place another evidence cartridge case or shotgun shell on the right stage base up.

9.7.3 Adjust the light to provide oblique or grazing illumination over the bearing surface of the cartridge cases/shotgun shells base

9.7.4 **Using low magnification (10X - 20X) examine the base and primer area of one of the cartridge cases or shotgun shells, slowly turning the cartridge case or shotgun shell looking for the position that best highlights the individual characteristics on the primer and/or the base. Higher magnifications should be used to verify the correspondence of finer impressions or striae. When such an area is located, leave the cartridge case or shotgun shell in during that position.**

9.7.5 Next, turn the other evidence cartridge case of shotgun shell until the same primer position of the right staged cartridge case or shotgun shell is attained.

9.7.6 Manipulate the stages to move the left and right cartridge cases or shogun shells and attempt to align any impressions that are present on

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the primer and/or the base. The examiner can conclude there is sufficient agreement to match or there is not sufficient agreement to match based on the quality and quantity of the individual characteristics present on the primer and or the base. (breach face marks or striations)

- 9.7.7 The examiner should also examine and compare the firing pin impressions of evidence cartridge cases or shotgun shells. Cartridge cases or shotgun shells may have to be tilted toward the light source to better illuminate the firing pin impression.
- Rotate the cartridge case or shotgun shells looking for individual characteristics within the firing pin area that correspond to individual characteristics in the other cartridge case or shotgun shell firing pin impression.
- 9.7.8 The examiner can conclude there is sufficient agreement to match or there is not sufficient agreement to match based on the quality and quantity of the individual characteristics present within the firing pin impression.
- 9.7.9 The examiner should also examine and compare any extractor, ejector, chamber marks, magazine marks and/or any other marks that may be present on the evidence cartridge cases and shotgun shells.
- Position the cartridge case or shotgun shell on the stages in the position that best highlights the area(s) of concern (extractor, ejector, chamber marks, magazine marks or other marks).
- 9.7.10 The examiner can conclude there is sufficient agreement to match or there is not sufficient agreement to match based on the quality and quantity of the individual characteristics present in the extractor, ejector, chamber magazine marks or other marks present.