**Raleigh/Wake City-County**

**Bureau of Identification**

**Crime Laboratory Division**

**FIREARMS UNIT
TECHNICAL PROCEDURES**



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# **1: Technical Procedure for Firearm Safety**

1. **Purpose**
	1. This procedure establishes the general guidelines for safe handling of firearms and firearm related evidence.
2. **Equipment, Materials**
	1. Personal Protection Equipment
3. **Procedure**
	1. **General Firearm Safety**
		1. All firearms will be handled as if they are loaded.
		2. All firearms will be checked to ensure they are unloaded and will be rendered safe prior to any other action.
		3. The muzzle of the firearm will always be pointed in a safe direction.
		4. A firearm containing live ammunition will only be unloaded in a Designated Test Firing Area.
		5. Live ammunition will only be loaded into a firearm in a Designated Test Firing Area.
		6. Firearm PPE must be worn during the firing of a firearm.
		7. Discharging of all firearms will only be performed in Designated Test Firing Areas using the available bullet recovery methods.
		8. Prior to discharging a firearm in a Designated Test Firing Area, Firearm Examiners will ensure the Test Fire Warning System is deployed and active.
		9. Prior to discharging a firearm in a Designated Test Firing Area, Firearm Examiners will ensure the downrange area is clear.
		10. Firearms must be pointed down range and, when available, inserted into the port of a Bullet Recovery System before being charged for firing.
		11. Firearms Examiners must be visible to another person during the firing of a firearm.
		12. Live ammunition will be stored in a Designated Storage Area.
	2. **Pre-Firing Safety Examination**
		1. A visual examination of the firearm will be conducted prior to the test firing to determine:

			* Possibility of bore obstruction.
			* Signs of cracks or weaknesses in major parts of the frame, slide, cylinder and/or barrel.
			* Soundness of the chamber/barrel.
			* The overall mechanism functionality.
			* Type of ammunition appropriate for use with the firearm.
		2. If the firearm is deemed unsafe and cannot be easily repaired by the Firearm Examiner, the firearm will not be fired.
		3. All autoloading firearms suspected of having been altered to function in a fully automatic capacity will be tested to determine if they function as intended or if they have been altered or otherwise damaged.
			1. If a firearm is found to be altered to fire as a fully automatic firearm, the firearm will be fired by loading one cartridge at a time.
	3. **Chemical and Biological Material Safety**
		1. Fired cartridge cases, shotshells, projectiles, and firearms that are contaminated with potentially biohazardous material will be cleaned.
4. **Limitations**
	1. N/A
5. **References**
	1. SDS
6. **Records**
	1. N/A

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# **2: Technical Procedure for Firearm Test Fires**

1. **Purpose**
	1. This procedure establishes the general guidelines for test firing firearms.
2. **Equipment, Materials**
	1. Ammunition
	2. Bullet Recovery System (Water Tank)
	3. Ballistic Box
	4. Firearms PPE
3. **Procedure**
	1. **General Test Firing**
		1. The ammunition designed for the firearm will be used when possible.

			1. If ammunition has been fired in a firearm that it was not designed to be fired in, ammunition of the appropriate caliber will be fired in the firearm first.
				1. If the exemplars display insufficient characteristics, approval will be obtained by the Technical Leader(s) to use the same caliber(s) of ammunition that was submitted with the firearm.
				2. Before ammunition of an improper caliber is used, the SAAMI Technical Data Sheet will be reviewed to ensure compatibility between the ammunition and the firearm.
		2. Cartridges loaded with an FPE of up to 13,000 (approximately that of a 50 BMG) excluding steel core and ceramic tipped ammunition may be fired into the Bullet Recovery System or at an approved Wake County Firing Range appropriate for this type of cartridge load.
		3. Cartridges loaded with an FPE of up to 3,900 (approximately that of a .308 Win Mag) may be fired into the Ballistic Box, Bullet Recovery System, or at an approved Wake County Firing Range appropriate for this type of cartridge load.
		4. Cartridges loaded with an FPE exceeding 13,000 and those with a steel core or ceramic tip will be test fired at a firing range appropriate for this type of cartridge load.
		5. Activate the Test Fire Warning System.
		6. Ensure the firearm is appropriately angled into the shooting port of the Bullet Recovery System or Ballistic Box.
		7. Once firing is complete, render the firearm safe.
		8. Once test firing is complete, ensure the Test Firing Warning System is deactivated.
		9. Test fires created by the Firearms Unit will be returned to the submitting agency in a CCBI Firearms Test Fire Envelope.
			1. The Firearm Examiner’s initials and date of the test fire will be placed on the Test Fire Envelope.
	2. **Test Firing into the Bullet Recovery System**
		1. Ensure the walkway and platform are adjusted to the proper height to ensure safe test firing through the shooting port.
		2. Remove the moisture migration plug prior to operating the blower.
		3. Close the lid and turn on the blower prior to firing the firearm.
		4. Ensure the Remote Firing Arm is positioned properly.
		5. Once firing is complete, turn off the blower, switch the pump to circulate, open the lid, and recover the projectile(s).
		6. Replace the moisture migration plug.
	3. **Test Firing into the Ballistic Box**
		1. Ensure the Ballistic Box is sufficiently packed down, the lids are properly closed and secured, the box is positioned in a safe direction, and the wheels are locked prior to firing the firearm.
		2. Ensure the Portable Remote Firing Cart is positioned properly and the wheels are locked.
		3. Once firing is complete, open the lids and recover the projectiles(s).
		4. Ensure the Ballistic Box is sufficiently packed and test fire ready after firing.
	4. **Test Firing at a Range**
		1. The Firearm Examiner will ensure that the firearm is unloaded prior to transport.
		2. The firearm will be transported in an appropriate case or in the evidence box in which it was received.
		3. The Firearm Examiner will abide by all rules and regulations set forth by the firing range.
4. **Limitations**
	1. N/A
5. **References**
	1. CyberNational User Manual for Bullet Recovery System
	2. CyberNational User Manual for Ballistic Box
	3. SAAMI Technical Data Sheet <https://saami.org/technical-information/unsafe-firearm-ammunition-combinations/>
6. **Records**
	1. Test Fire Envelope (CCBI-300)

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# **3: Technical Procedure for** **Evidence Handling, Equipment, References, and Photomicrography**

1. **Purpose**
	1. This procedure establishes guidelines for evidence handling, equipment, references, and photomicrography within the Firearms Unit.
2. **Equipment, Materials**
	1. Comparison microscope
	2. Stereomicroscope
	3. Caliper
	4. Micrometer
	5. Mettler PB3002 Balance
	6. DMD-48
	7. Leica Application Suite Software (LAS)
	8. NIST-traceable calibrated stage micrometer
	9. 24” Calibration Rod
	10. Static weights
	11. 10g reference standard weight
	12. NIST-traceable ruler 36”
	13. Gage block (0.500”)
	14. Gage block (1.000”)
	15. Forceps
	16. Cloth glove
	17. NIST Standard Cartridge Case
3. **Procedure**
	1. **Evidence Handling**

		1. Test fires created by the Firearms Unit or those submitted by an outside Agency for NIBIN entry only will not be considered evidence.
		2. Test fired ammunition components created by the Firearms Unit for examination purposes will be considered evidence.

			1. Evidence test fires may be entered into NIBIN.
		3. Test fires may be made from evidence ammunition.

			1. The Laboratory Report will reflect when evidence ammunition is used as test fires and the state of the returned ammunition.
		4. All evidence cartridge casings will be triaged and entered into NIBIN.
		5. All evidence firearms will be test fired and entered in to NIBIN.

			1. Any additional firearm examination will be completed upon request.
		6. Firearms found submerged in water must be maintained in a sample of that same water until examination.

			1. The firearm’s breechface and barrel condition, as well as the overall functionality, will be examined to determine the extent of the examination to be performed.
			2. Upon completion of examination the firearm will be dried and oiled to prevent any further loss of evidentiary value.

* + 1. Comparison of Multiple Cases

			1. Comparison of evidence from multiple cases require completion of a CCBI Laboratory Request form (CCBI-002) for each case.

				1. Item numbers in Multiple Case Comparisons must reference both the CCBI case number and the CCBI item number.
			2. Conclusions for Multiple Case Comparisons will be documented in laboratory reports, which will be issued for each case.

				1. Conclusions will be identically reported in laboratory reports generated for all corresponding cases.
				2. The CCBI case number for each case will be cross referenced in the header of all corresponding cases using the following format:

*Cross Referenced to CCBI case(s)* <insert CCBI case #(s)>

* + 1. Evidence Marking

			1. Ammunition components must be marked in an area devoid of tool marks.
			2. If the evidence is a pellet, fragment, or excessively damaged, an alternative method will be used to label the evidence based upon the Firearm Examiner’s discretion.
			3. Evidence firearms will be marked on the frame or receiver.
	1. **Equipment and Instrumentation Maintenance, Calibration, and Performance**
		1. The maintenance of all equipment and instrumentation will be documented in the Equipment Maintenance Log.
		2. If a Firearm Examiner is concerned about any aspect of the performance of an instrument a Quality Control Check will be performed.
		3. The balance, micrometers, calipers, gage blocks, the traceable stage micrometer, the DMD calibration rod, and NIST-traceable ruler will be calibrated annually by an approved vendor.
		4. The LAS measurement modules of the comparison microscopes will be calibrated annually by the CCBI Firearms Unit using a calibrated stage micrometer. The Quality Control Check procedure will be utilized for annual calibration.
		5. The LAS measurement module of the comparison microscope, the balance, the micrometers, the calipers, trigger pull weights, the DMD-48, and the NIST traceable ruler will be quality control checked daily before use in a forensic examination and the resulting measurement will be recorded in the Performance Log.
		6. If the Quality Control Check for any instrument fails, the instrument will be checked again. If the instrument fails a second time, it will be taken out of service and the Technical Leader(s) will be notified.
		7. The Quality Control Check steps for each instrument are listed as follows:
			1. Comparison Microscope LAS Measurement Module

				1. Place the stage micrometer on the stage.
				2. Using the LAS measurement module, measure a length of 0.200 inches on the stage micrometer scale.
				3. The acceptable range for this measurement must be +/- 0.001 inches.
			2. Balance

				1. Ensure the balance is level.
				2. Turn on the balance and zero or tare the balance.
				3. Ensure the balance is reading in grains.
				4. Using forceps, place the 10-gram reference standard weight on the balance. Do not touch the standard weight with bare hands.
				5. The acceptable range for this measurement must be 154.3 +/- 0.5 grains.

The range is based on the repeatability of the balance (+/- 0.01g) multiplied by three, converted into grains, and rounded to one digit after the decimal place.

When the 10-gram reference standard weight is unavailable due to annual calibration, the 20-gram reference standard weight utilized by the Drug Chemistry Unit shall be used. The acceptable range for this measurement must be 308.6 +/- 0.5 grains.

* + - 1. Caliper

				1. Close the jaws of the caliper and verify that the caliper reads zero.
				2. Open the jaws of the caliper and measure the widths of the 0.500 inch and 1.000 inch gage blocks.
				3. Use the entire surface of the jaws, being careful to hold the caliper level.
				4. The acceptable ranges for these measurements must be 0.500 +/- 0.001 inches and 1.000 +/- 0.001 inches, respectively.
			2. Micrometer

				1. Close the jaws of the micrometer and verify that the micrometer reads zero.
				2. Open the jaws of the micrometer and measure the widths of the 0.500 inch and 1.000 inch gage blocks.
				3. Use the entire surface of the jaws, being careful to hold the micrometer level.
				4. The acceptable ranges for these measurements must be 0.500 +/- 0.001 inches and 1.000 +/- 0.001 inches, respectively.
			3. Trigger Pull Weights

				1. All individual trigger pull weights must be checked daily before use.
				2. Ensure the balance is level.
				3. Turn on the balance and tare the balance.
				4. Ensure the balance is reading in pounds.
				5. Place each weight on the balance and record the resulting weight in the Performance Log. The tolerance for each weight will +/- 1% of the expected value.
			4. Digital Measuring Device (DMD-48)

				1. Quality Control Checks will be conducted using the calibration rod.
				2. Power on the DMD.
				3. Make the rear moveable plate flush with the front plate and zero the DMD.
				4. Remove the end caps of the 24-inch Rod and place it in the center of the unit, with one end against the front plate.
				5. Slide the rear moveable plate until it contacts the end of the 24-inch Rod.
				6. The acceptable range for measurement of the 24-inch Rod (actual measurement of 24.107 inches as stated on the Certificate of Calibration) must be 24.11 +/- 0.01 inches.
			5. Ruler

				1. Remove the end caps and place one end of the 24-inch Rod parallel to and at the beginning of the NIST certified 36” ruler.
				2. The acceptable range for measurement of the 24-inch Rod (actual measurement of 24.107 inches as stated on the Certificate of Calibration) reads 24.11 +/- 1/16 inch on the NIST ruler.
			6. Stereomicroscope

				1. Stereomicroscope(s) will be serviced as needed and do not require calibration or quality control checks.
			7. NIBIN

				1. Calibrations are completed automatically by the BrassTrax system and are logged on the BrassTrax system.
				2. Only Firearm Examiners may perform manual calibrations of the BrassTrax system at their discretion.
				3. Follow the BrassTrax prompts to manually calibrate the instrument.
				4. Manual calibrations that are performed by the user are automatically logged by the system.
	1. **Reference Standards**
		1. All reference standards will be stored in the Designated Reference Material Storage area.
		2. The 10-gram reference weight will be calibrated annually by an approved vendor.
		3. The NIST QC cartridge case will be maintained with the reference standards but does not require calibration.
	2. **Firearm Reference Library**
		1. Numbering of Firearm Reference Collection (FRC) Firearms.

			1. FRC firearms will be engraved with “FR” and a sequential number on the frame or receiver and will be recorded in the Reference Logbook.
			2. Each FRC firearm will receive a unique number and no two firearms will have the same number.
			3. Firearms received as Uncertainty Study firearms will be labeled with “UFR”. These firearms are only for use in Uncertainty Studies.
		2. Procedure for Receiving Firearms for the Firearm Reference Collection

			1. No FRC firearm will be received by the Firearms Unit without a court order or appropriate paperwork from the proper authority allowing for the use of the FRC firearm(s) being received.
			2. When receiving an FRC firearm, the Firearm Examiner will create a Firearms Reference Collection Receipt that will reflect the assigned FRC number and a description of the submitted firearm, which will include: make, model, caliber/gauge, type, and the manufacturer serial number. The receipt will be signed and dated by the contributor and receiving Firearm Examiner. The receipt and the court order or appropriate paperwork from the authority authorizing receipt of the firearm(s) will be filed in a Traceability Binder in the Firearms Unit and a copy of the receipt will be given to the contributor.
			3. After receiving an FRC firearm, the Firearm Examiner will check the firearm for safety and then engrave the assigned FR number on the firearm.
		3. Authorized Use of FR Firearms

			1. Only a Firearm Examiner from the CCBI Firearms Unit is authorized to utilize an FRC firearm unless otherwise approved by the Deputy Director of the Crime Laboratory.
			2. Firearm Examiners are authorized to use an FRC Firearm for the following reasons: training, familiarization, case related work, or research.
			3. The Firearm Examiner will complete the “FR Collection Sign-Out Sheet” when an FRC firearm is removed from the FR collection.
	3. **Reference Ammunition Library**
		1. Collection and Indexing of Reference Ammunition

			1. Reference Ammunition will consist of only new commercially purchased ammunition which is labeled with the caliber or gauge, bullet or shot weight, projectile design, and manufacturer.
			2. At least two reference samples will be collected for each library entry.
			3. All collected ammunition samples will be indexed in the Reference Logbook and denoted with the caliber or gauge, bullet or shot weight, projectile design, and manufacturer.
			4. Ammunition samples will be stored in the Firearms Unit.
	4. **Photomicrography**
		1. Use of Photomicrography in Firearm Examinations
			1. Photomicrographs are used to document the microscopic characteristics which are used to make an identification and/or to document a Firearm Examiner’s notes. Photomicrographs alone are not used for comparison, verification, or conclusions.
			2. Due to inherent limitations in the use of photomicrographs, the following disclaimer will be placed on each photomicrograph produced for casework at the City-County Bureau of Investigation:
				1. **“This photomicrograph was created for documentation purposes only. It is a two-dimensional representation of a three-dimensional object and does not fully represent the object as viewed through the comparison microscope. This photomicrograph alone cannot be used to draw any conclusion relating to this item.”.**
				2. The laboratory case number(s), the item number(s) in the photomicrograph, and the initials of the Firearm Examiner producing the photomicrograph.
		2. Production of Photomicrographs

			1. A minimum of two (2) photomicrographs will be produced for each area of identification which depict:
				1. An image representative of the overall area of identification.
				2. An image representative of the close-up area of identification.
			2. Side by side photomicrographs

				1. At least one (1) side-by-side photomicrograph will be taken.
				2. A dividing line separating each image must be maintained for photomicrographs situated side-by-side.
				3. Images must not overlap in such a way as to obscure an area of detail from appearing on either photomicrograph.
			3. All photomicrographs must be annotated with the software provided with the comparison microscope.
		3. Preservation of Photomicrographs

			1. All digital raw data files associated with photomicrographs produced from the comparison microscope will be saved electronically.
1. **Limitations**
	1. Photomicrographs are two-dimensional representations of three-dimensional objects and do not fully represent the object as viewed through the comparison microscope.
2. **References**
	1. LAS Manual
	2. DMD-48 Manual
	3. Micrometer Manual
	4. Caliper Manual
	5. Leica FS-C Manual
	6. IBIS Manual
	7. Hatcher, Jury, and Weller. Firearms Investigation, Identification, and Evidence. Harrisburg, Pennsylvania: Stackpole Books, 1957.
	8. Heard, Brian J. Handbook of Firearms and Ballistics: Examining and Interpreting Forensic Evidence. Chichester, West Sussex, England: John Wiley & Sons Ltd., 1997.
	9. Leica Microsystems. Leica MC190 HD Microscope Camera with software.
	10. Leica Microsystems. LAS Software.
	11. Roberts, J. L. “Photography of Identifications: Professionalism or Personal Preference?” AFTE Journal Spring 1991: 694 - 697.
3. **Records**
	1. Firearm Reference Collection Receipt (CCBI-302)
	2. Firearm Reference Collection Sign-Out Sheet (CCBI-301)
	3. Equipment Maintenance Log
	4. Performance Log
	5. Reference Log

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| 4/1/2019 | 1 | Original Document |
| 6/7/2019 | 2 | Added section addressing water guns; added statements addressing NIBIN evidence; added section addressing comparison of multiple cases; updated LAS Quality Check; Added tolerances for instrument checks; updated trigger pull check schedule and process; revised photomicrograph statement |
| 7/29/2019 | 3 | Added 3.2.7.2.5.2 allowing Drug Chemistry 20g weight to be used when 10g weight is unavailable due to calibration. Changed 3.6.2.2.1 to at least 1 side-by-side photomicrograph will be taken |

# **4: Technical Procedure for** **the National Integrated Ballistic Information Network**

1. **Purpose**
	1. This procedure provides the general guidelines and procedures for the use of the National Integrated Ballistic Information Network (NIBIN).
2. **Equipment, Materials**
	1. Forensic Technology Inc., IBIS BrassTrax System
	2. Forensic Technology Inc., MatchPoint
	3. NIST Standard Cartridge Case
	4. Stereomicroscope
3. **Procedure**
	1. **General Guidelines**
		1. IBIS is part of a computer network run and maintained by the ATF as part of NIBIN. Due to the participation in the NIBIN network, all possible precautions will be exercised in preventing any unauthorized access of the IBIS system and any damage to the system that could affect the network. These precautions include reporting any security incidents to the ATF as soon as possible.
		2. Access to the NIBIN database is limited to those who have current certification through the ATF.
		3. NIBIN users will ensure that they are performing acquisitions and correlations under their use name.

			1. Each user will log out once they have completed acquisitions and/or correlations.
		4. Firearms that are to be test fired for NIBIN acquisition must be considered a Crime Gun.

			1. For NIBIN acquisition of a firearm, at least two (2) test shots will be fired and the cartridge cases recovered.
			2. Information for firearms that do not fire will not be entered into NIBIN.
	2. **NIBIN Protocol**
		1. Test fired cartridge cases created by the submitting agency are not considered evidence but will be accompanied by the CCBI 002 form. The following information must be completed on the CCBI 002 form or the test fire cartridge cases will not be entered into NIBIN:

			* Agency case number
			* Contact Agency
			* Date of Offense
			* Offense type
			* Agency item number(s)
			* Date of firearm seizure
			* For test fire exemplars:
				+ Firearm make
				+ Firearm model
				+ Firearm type
				+ Firearm caliber
				+ Firearm serial number
		2. Police firearms will not be test fired or entered into NIBIN unless it has been approved by the CCBI Director or Crime Laboratory Deputy Director.
		3. Firearms submitted by agencies through the CCBI Evidence Control Unit for NIBIN entry only will be test fired by the CCBI Crime Laboratory upon documented approval by the CCBI Director or Crime Laboratory Deputy Director.
			1. Agencies submitting firearms to be test fired by the CCBI Crime Laboratory must make an appointment prior to arrival and must remain present until test firing is complete.
		4. A cartridge case found to have already been acquired by a different agency/laboratory will not be re-entered.
		5. All cartridge cases will be screened to determine suitability for entry into NIBIN.
			1. A cartridge case suitable for entry into NIBIN will have sufficient individual characteristics within the firing pin impression, within the breechface marks on the primer, and/or the ejector mark to affect a match.
			2. The cartridge case(s) bearing the best individual characteristics will be selected for entry.
		6. For case submissions containing multiple evidence cartridge cases, the cartridge cases will be triaged by grouping them by cartridge case class characteristics to reduce redundant images being entered into the system.
		7. Multiple evidence cartridge cases may be entered if different individual characteristics are found to have reproduced better on different evidence items.
		8. If test fires and evidence cartridge case(s) are determined to have similar characteristics, either the known test fire or the evidence will be entered into NIBIN based upon which bears the clearest individual characteristics.
		9. All items of evidence entered into NIBIN will be recorded on the appropriate section of the Firearms Unit Worksheet (CCBI-303).
		10. Additional items of evidence submitted in the same case for NIBIN entry subsequent to a previous NIBIN entry will be triaged prior to entry into NIBIN.
	3. **NIBIN Acquisition**
		1. Place the cartridge case in BrassTrax.
		2. Follow the BrassTrax software prompts for Case Information:
			1. The requesting agency will be entered into the “Contact” field.
			2. The “Occurrence Date” field will be completed with the Date of Offense.
		3. Follow the BrassTrax software prompts for Cartridge Case Exhibit Information:

			1. The CCBI/Agency Item number will be entered into the “Exhibit Number” field, as applicable.
			2. The “Category” field will be completed as follows:

				1. Select “Crime Test-Fire Terminated” in when entering a test fire.
				2. Select “Crime Test-fire Returned” when a firearm is going back into circulation.
				3. Select “Crime Evidence” when entering an evidence cartridge case.
			3. The “Breechface” field will be entered as “Unknown”.
			4. The “Occurrence Date” field will be completed as follows:

				1. Enter the case date for a cartridge case.
				2. Enter the date the firearm was seized.
			5. For firearms with no firing pin

				1. Deselect “firing pin” from the region of interest.
				2. Add a note in the comment block that no firing pin image was obtained.
		4. Once the images are acquired place the breechface and firing pin rings in appropriate position.
		5. Remove the cartridge cases from BrassTrax.
		6. Ensure the acquisition is submitted.
	4. **NIBIN Correlations**
		1. Correlation reviews will be done by certified NIBIN operators on site at CCBI or at the Nation NIBIN Correlation and Training Center (NNCTC).
		2. A manual correlation may be performed to a specific location other than the Default Correlation Region.
		3. At minimum the top thirty (30) entries for class and individual characteristics on the breechface, primer, and/or ejector will be compared to determine if a NIBIN Lead exists.
		4. Firearms Unit Technical Leader(s) will ensure the NIBIN Correlation Queue is checked in the morning and afternoon during normal business hours, when possible.
		5. Primary Correlations in MatchPoint will be documented by marking the correlation as “Previously Viewed”.
		6. Primary and Secondary Correlation reviews will be documented in the appropriate section of the Firearms Unit Worksheet (CCBI-303) or the CCBI Laboratory Request Form (CCBI-002):
			1. The name of the Examiner doing the review.
			2. The date of the review.
			3. The outcome of the review.
	5. **NIBIN Leads**
		1. Test Fires submitted by an Agency that result in a NIBIN Lead will receive a new CCBI case number obtained by the Primary Examiner.
		2. A secondary correlation review will be performed for all for a NIBIN Leads.
			1. A Secondary Correlation that is in agreement with a Primary Correlation review will be reported as a NIBIN Lead.
			2. NIBIN Leads will be indicated after the Secondary Correlation review by selecting the Hit icon in MatchPoint.
			3. The Secondary Correlation must be documented in the appropriate section of the Firearms Unit Worksheet by the Secondary Reviewer.
		3. The Primary Examiner will place the NIBIN Lead Report in the Case File.

* 1. **Confirmed NIBIN Leads**
		1. The confirmation date will be entered in MatchPoint for all NIBIN leads confirmed through a microscopic examination.
	2. **Reporting**
		1. The Customer Agreement Terms and Conditions on the CCBI 002 will serve as the acquisition report NIBIN entries for test fires submitted by an Agency for NIBIN only.
		2. The General Report Format template will be used for all items of evidence entered into NIBIN and notification of all NIBIN Leads.
		3. The following additional information shall be added to the General Report Format template for NIBIN reporting, when applicable.
			1. “*Items submitted*”
				1. Test fired cartridge cases/shotshells submitted for NIBIN entry:

*Cartridge cases from Agency Item <*enter item number*>.*

* + - * 1. Firearms submitted as evidence for NIBIN entry only:

*CCBI Item <*enter item number*> (Agency Item <*enter item number*>):* <enter quantity, manufacturer, model, caliber, serial number, item type, and description of any additional objects received>.

* + - * 1. Evidence cartridge cases/shotshells submitted for NIBIN entry:

*CCBI Item <*enter item number*> (Agency Item <*enter item number*>):* <enter quantity, manufacturer, caliber, item type>.

* + - 1. The “*Type Examination Requested*” will be reported as follows:
				1. *NIBIN Entry – Cartridge case/shotshell(s) were entered into the National Integrated Ballistic Information Network for correlation.*

* + - 1. “*Results and Conclusions*”will be reported as follows, when applicable:

				1. ***THIS IS A NOTIFICATION OF AN INVESTIGATIVE LEAD FROM NIBIN ENTRY.*** *This lead has not been confirmed through microscopic comparison. If confirmation is required, a detailed microscopic examination can be requested.*
				2. “*Results*”

<A test fired cartridge case created from> *<*Agency or CCBI*> Item* <enter item number> *was entered in the National Integrated Ballistic Information Network and no NIBIN lead was developed*.

*<*Agency or CCBI*> Item(s)* <enter item number(s)> <was or were> *determined to have the same class characteristics. <*Enter number(s)> <was or were*> selected for entry in the National Integrated Ballistic Information Network and no NIBIN lead was developed*.

*<*Agency or CCBI*> Item(s)* <enter item number(s)> <was or were> *determined to have the same class characteristics. <*Enter number(s)> <was or were*> selected for entry in the National Integrated Ballistic Information Network and yielded a NIBIN Lead to* <enter applicable NIBIN Lead information>.

*All* <cartridge cases or shotshells> *in* <Agency or CCBI> *Item(s)* <enter item number(s)> <was or were> *determined to have the same class characteristics.* <Only one or item numbers> <was or were> *selected for entry in the National Integrated Ballistic Information Network and no NIBIN lead was developed.*

*All* <cartridge cases or shotshells> *in* <Agency or CCBI> *Item(s)* <enter item number(s)> <was or were> *determined to have the same class characteristics.* <Only one or item numbers> <was or were> *selected for entry in the National Integrated Ballistic Information Network and yielded a NIBIN Lead to* <enter applicable NIBIN Lead information>*.*

<A test fired cartridge case created from> *<*Agency or CCBI*> Item* <enter item number> *was entered in the National Integrated Ballistic Information Network and yielded a NIBIN Lead to* <enter applicable NIBIN Lead information>.

<A test fired cartridge case created from> *<*Agency or CCBI*> Item* <enter item number> *was not entered into the National Integrated Ballistic Information Network <*explain why*>.*

*<*Agency or CCBI*> Item* <enter item number> *was not analyzed.*

* + - * 1. “*Disposition*”

*No further action will be taken unless a request for a microscopic comparison is received.*

*All items of evidence will be returned to the* <requesting or submitting> *agency.*

*Items will be retained for further examination.*

* + - * 1. *\*\*\* NIBIN acquisition and reporting are not included in the Raleigh/Wake City-County Bureau of Identification Crime Laboratory scope of accreditation. \*\*\**
1. **Limitations**
	1. Condition and/or quality of the cartridge case or firearm may limit NIBIN entry.
	2. Firearms that are not typically test fired include revolvers, single shot or bolt-action rifles, shotguns in other gauges, weapons never fired, or firearms deemed unsafe, inoperable, or incomplete.

1. **References**
	1. Firearms Unit Abbreviations and Definitions
	2. NIBIN Training Guide
	3. IBIS Quick Reference Guide
	4. NIBIN Procedures Manual
	5. NIBIN Reference Guide
	6. User Guide for NIST SRM 2461 Standard Cartridge Cases
	7. Minimum Required Operating Standards for NIBIN <https://www.atf.gov/firearms/nibin-training-outline-and-guidelines>
2. **Records**
	1. Firearms Unit Worksheet (CCBI-303)

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| --- |
| **Revision History** |
| **Effective Date** | **Version Number** | **Reason** |
| 4/1/2019 | 1 | Original Document |
| 4/17/2019 | 2 | Minor formatting and grammatical corrections throughout; added 3.7.3.3.2.4 and 3.7.3.3.2.5 result statements |
| 6/7/2019 | 3 | Updated NIBIN protocol section |
| 7/8/2019 | 4 | Updated section 3.5 NIBIN Leads to change the selecting of the Hit icon in MatchPoint to occur after the Secondary Correlation review |

# **5: Technical Procedure for Firearm Examinations**

1. **Purpose**
	1. This procedure outlines the examination of firearm evidence.
2. **Equipment, Materials**
	1. Comparison microscope
	2. Stereomicroscope
	3. DMD-48
	4. NIST-traceable rulers
	5. Traceable weight set
	6. Calibration rods
	7. Bullet Recovery System (Water Tank)
	8. Ballistic Box
	9. Engraver
	10. Ultrasonic cleaner
	11. Ethanol, acetone
	12. Plastic/nylon tie
	13. Dummy rounds
	14. Kinetic Bullet Puller
	15. Firearm Reference Collection
	16. General Rifling Characteristic database
	17. Personal Protection Equipment
	18. Test Fire Envelopes
3. **Procedure**
	1. **General**
		1. Upon case completion, render the firearm safe by blocking the action with a plastic or nylon band/tie.
		2. Firearm examinations will be documented in the appropriate area of the Firearms Unit Worksheet (CCBI-303).
	2. **Physical Characteristics Examination**
		1. Features of firearms that will be examined and/or documented, if applicable, include but are not limited to:

			* Make/manufacturer
			* Model
			* Serial number
			* Firearm type
			* Action type
			* Caliber/gauge
			* Magazine/cylinder capacity
			* Cylinder direction
			* Firing pin shape
			* Bore condition
			* General Rifling Characteristics (GRCs)
				+ Number of lands and grooves
				+ Width of lands and grooves (see Technical Procedure for Fired Projectile Examination)
				+ Direction of twist
			* Safeties
			* Rust, wear, damage
		2. Capacity of magazines/revolver cylinders will only be determined by dummy rounds.
		3. If any magazine submitted with the firearm does not fit the firearm, it will be documented in the case notes.
	3. **Function Testing**
		1. All firearms will be function tested prior to any examination.
		2. At a minimum, the following will be examined:
			1. Visual Abnormalities to include, but not limited to:

				* Loose or bulged barrel
				* Bore obstruction
				* Cracked receiver or slide
				* Broken, loose, or missing parts
				* Frozen or protruding firing pin
				* Alterations or adaptations
			2. Correct assembly and function of action and safeties.
		3. An attempt may be made to render an inoperable firearm operable by performing simple repairs, such as substituting parts from the Firearm Reference Collection.

			1. All parts that were substituted will be documented in the case notes.
			2. Once test firing is complete reference parts will be removed from the firearm and returned to the Firearm Reference Collection.
		4. Test Firing
			1. The number of test shots will be determined by the Firearm Examiner on a case by case basis for firearm examinations.

				1. Either live rounds or primed cartridge cases will be used.

The Kinetic Bullet Puller will be used for all cartridges except rimfire, exploding bullets, tracers, incendiary devices.

* + - * 1. All ammunition used for test firing will be examined and documented for marks prior to use.
				2. The test fire ammunition will be of the same composition and design as the evidence ammunition.

If ammunition of the same composition is not available, ammunition of similar composition and design will be used.

Evidence ammunition may be used to create comparison specimens under the following conditions:

No ammunition of the same or similar design and composition is available.

The ammunition available is not reproducing detail well.

* + 1. Tests for accidental discharge will be conducted when requested or when appropriate and will be documented in the notes area of the Firearms Unit Worksheet (CCBI-303).

			1. Drop-tests, jar-off tests, or other tests will be performed only after test firing is complete.

				1. Dummy rounds or primed cartridge cases will be used.
				2. Testing will be performed on an approved range.
				3. A drop-test or jar-off test will be performed using SAAMI Standard ANSI/SAAMI Z299.5 as a guideline.
	1. **Trigger Pull Determinations**
		1. Dummy rounds will be used when measuring the trigger pull of a rimfire firearm.
		2. For revolvers, all chambers will be included when determining the trigger pull range.
		3. Trigger pulls will be measured using the dead weight method in ¼ pound increments.
		4. Ensure that the sear connection is reset after each attempt.
		5. Trigger pull will be reported as a range.
			1. The firearm will be measured in single and/or double action mode as applicable.
			2. Record the greatest amount of weight the trigger can carry without releasing the hammer/striker from sear engagement (i.e. lower limit).
			3. Record the least amount of weight the trigger can carry that releases the hammer/striker from sear engagement (i.e. upper limit).
			4. The weight needed for the firearm to always fire will be determined by three consecutive measurements of the same weight.
			5. A range will be reported to which includes the weight needed for the firearm to always fire (upper limit) and the maximum weight for the firearm to never fire (lower limit).
	2. **Barrel and Overall Length Determination**
		1. General Procedure
			1. Barrel and overall lengths will only be measured after any necessary microscopic examination is complete and only upon request.
			2. Any shotgun with a barrel(s) of less than 18 inches in length or an overall length of less than 26 inches, and rifle with a barrel(s) of less than 16 inches in length or an overall length of less than 26 inches is a weapon of mass death and destruction.
			3. These measurements will include compensators, flash suppressors, or any other permanently affixed attachments to the firearm.

				1. Any non-permanent attachments will be removed before measuring.
			4. The barrel and overall lengths will be measured using the DMD-48.
			5. The digital readout of the DMD-48 shows four digits after the decimal point. Rounding for the DMD-48 will be as follows:

				1. Barrel and overall length measurements will be done using Imperial Units and reported to two decimal places.
				2. If the third decimal place (thousandth place) is a “0”, the second decimal place (hundredth place) shall not change. For example, 19.2604 inches would round to 19.26 inches.
				3. If the third decimal place is any other digit, the second decimal place shall round up. For example, 19.2614 inches would round to 19.27 inches.
			6. Alternatively, the barrel length may also be measured using a rod supplied with the DMD-48 and the overall length will be measured using a NIST calibrated ruler.

				1. Read and record the NIST ruler measurements as a fraction and then convert to two decimal places using the rounding method above.
		2. Barrel Length

			1. Care will be taken when placing the measuring device down the barrel.
			2. Measure the barrel length from the face of the closed breechblock or bolt to the farthest end of the barrel.
			3. Choose an appropriate diameter measuring rod for the caliber of the firearm to be measured.
		3. Overall Length

			1. Measure the overall length of the firearm parallel to the barrel from the muzzle to a line perpendicular to the rearmost point of the firearm.
		4. Measurement of Uncertainty

			1. Estimated expanded uncertainty of measurement will be calculated using both the DMD-48 and the NIST ruler for barrel length and overall length.
			2. Uncertainty of measurement will be completed utilizing the NIST 8-Step Process for Estimating and Reporting Uncertainty to include a reproducibility study.

				1. All identified sources of uncertainty will be evaluated and significant sources will be combined to obtain a combined uncertainty of measurement, using the formula:

 CU = √ (u12 + u22 + u32….)

Where: CU = combined uncertainty

 u1, u2, etc. = individual identified sources of uncertainty

* + - * 1. The expanded uncertainty, EU, will be calculated to provide a minimum 95% coverage probability by multiplying the CU by the appropriate coverage factor, k.
				2. The expanded uncertainty will be reported for all measured lengths reported on a laboratory report in the following format:

 *y* ± *EU*

Where: y = the measured quantity value

 EU = expanded uncertainty consistent with the units of y

The coverage probability will be included in the reporting statement on the laboratory report.

* + - 1. An uncertainty of measurement budget will be completed for each calculated expanded uncertainty.

				1. All uncertainty of measurement budgets will be reviewed annually or upon a replacement of a reference standard or personnel change within the Firearms Unit.
	1. **Casting**
		1. Casting of a firearm may be done at the discretion of the Firearm Examiner.
		2. Casts will be made using appropriate casting materials designed for use in firearms, such as AccuTrans™ and silicone rubber compounds.
			1. The materials must be non-damaging and easily removed.
			2. Insert the casting compound into the barrel and/or chamber of the firearm.
			3. Wait until the casting compound has dried, then gently remove.
	2. **Reporting**

		1. The following additional information shall be added to the General Report Format template, when applicable.

			1. *“Items Submitted”* will be described as:

				1. *CCBI Item <*enter item number*> (Agency Item <*enter item number*>):* <enter manufacturer, model, caliber, serial number, type and action of firearm, and quantity and type of any additional accessory(s)>.
				2. *CCBI Sub-Item* <enter Sub-Item Number>: <enter quantity, manufacturer, caliber, item type>.
			2. The “*Type Examination Requested”* will be reported as follows:
				1. *Firearm Function Test – The examination of a firearm to determine its condition and if all safety features are operable and/or if the firearm is capable of firing.*

* + - 1. *“Results and Conclusions”* will be reported as follows, when applicable:
				1. *Firearm Function and Trigger Pull Examinations*

Firearms that properly function will be reported as:

*CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm> *functions properly.*

Firearms that have a malfunctioning safety will be reported as:

*CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm> *will* <fire or not fire>*.* <enter explanation of malfunctioning safety>.

Firearms with broken or missing parts will be reported as:

*CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm> *does not function properly.* <Explain what was broken or missing and if the firearm was able to be made functional for testing>*.*

Trigger Pull results, if requested, will be reported as:

*CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm> *has a* <single and/or double> *action trigger pull of greater than* <enter lower limit> *and less than or equal to* <enter upper limit>*.*

* + - * 1. *Barrel and Overall Length Measurements*

Barrel and Overall Lengths will be reported as:

*CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm> *has a length that been altered from the manufacturer’s original specifications. The* <barrel or overall> *length is* <enter barrel or overall length> *+/-* <enter Measurement of Uncertainty> *at a 95% coverage probability*.

* + - * 1. “*Disposition*”

*No further action will be taken unless an additional request is received. All items of evidence were returned to the <*requesting or submitting*> agency.*

1. **Limitations**
	1. The limits of the measuring devices.
2. **References**
	1. American National Standards Institute. Voluntary Industry Performance Standards Criteria for Evaluation of New Firearms Designs Under Conditions of Abusive Mishandling for the Use of Commercial Manufacturers”. Voluntary Industry Performance Standards ANSI/SAAMI Z299.5. Newtown, CT: Sporting Arms and Ammunition Manufacturers’ Institute Inc. <https://saami.org/technical-information/ansi-saami-standards/>
	2. Association of Firearm and Tool Mark Examiners. Glossary.
	3. Association of Firearm and Tool Mark Examiners. Procedures Manual.
	4. “Guidelines for Trigger Pull Analysis.” swggun.org. SWGGUN, n.d. Web. 14 Dec. 2011.
	5. National Rifle Association of America. NRA Firearms Fact Book.
	6. N.C. G.S. 14-288.8(c)(3)
	7. Poole, Robert A. “Mikrosil Casting Material Information.” AFTE Journal Spring 1983: 80. Precision Forensic Testing.
	8. DMD-48 Digital Measuring Device Instruction Manual.
	9. “The Proper Method for Measuring Weapons.” AFTE Journal Summer 1982: 10.
	10. United States. Title 18, United States Code, Chapter 44. Section 923, paragraph I (Gun Control Act of 1968).
3. **Records**
	1. Test Fire Envelope (CCBI-300)
	2. Firearms Unit Worksheet (CCBI-303)

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| --- |
| **Revision History** |
| **Effective Date** | **Version Number** | **Reason** |
| 6/7/2019 | 1 | Original Document |
| 6/25/19 | 2 | Modified wording in reporting statements |
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# **6: Technical Procedure for Fired Projectile Examinations**

1. **Purpose**
	1. This procedure outlines the procedures for examination of fired projectile evidence.
2. **Equipment, Materials**
	1. Comparison microscope
	2. Stereomicroscope
	3. Caliper
	4. Micrometer
	5. Balance/Scale
	6. Ammunition Reference Collection
	7. FBI General Rifling Characteristic File
	8. Engraver
	9. Cotton-tipped swabs
	10. Cleaning solutions
	11. Magnet
	12. Personal protective equipment
	13. Soft bristle brush
3. **Procedure**
	1. **Fired Projectile Examination**
		1. Physical Characteristics Examination

			1. Fired projectiles will be documented in the appropriate area of the Firearms Unit Worksheet (CCBI-303).
			2. The following features of fired projectiles will be documented in the case notes, when applicable:
				1. Design characteristics of fired projectiles:

Caliber/gauge

Weight (measured in grains)

Composition

Base design

Manufacturer/marketer (if possible to determine)

Cannelure(s)

Damage or deformation

* + - * 1. Class characteristics on the fired projectiles:

Number of land and groove impressions present

Type of rifling

Direction of twist

Width of land and groove impressions

Markings that indicate a particular type or condition of firearm (i.e. skid marks, slippage marks, shave marks, flared base)

* + - * 1. Individual characteristics used for areas of comparison:

Striations within the land and groove impressions

Striations on wadding

* + 1. Determination of Caliber or Gauge

			1. Design, diameter, and weight will be used to determine the caliber, gauge, and/or shot size; the results will be recorded in the appropriate area of the Firearms Unit Worksheet (CCBI-303).

				1. The design characteristics such as projectile shape, total number of pellets, composition, nose configuration, and the number and placement of cannelures, must be considered in caliber determination.
				2. The diameter of a bullet will be determined by one of the following methods:

Measurement of the base diameter of the evidence item using a calibrated measuring device.

Comparison of the number and widths of the land and groove impressions to the appropriate table in the Appendices section of the AFTE Glossary to determine nominal caliber.

Nominal caliber may be calculated using the following formula:

 d = N(L+G)/𝝅

 Where: d = diameter of base of bullet

 N = total number of lands and grooves

 L = width of one land impression

 G = width of one groove impression

 𝝅 = pi = 3.1416

* + - * 1. The diameter of a pellet will be determined by the following method:

Choose the most intact pellet and measure the diameter using a calibrated measuring device.

Consult known shot sizes in the appropriate tables in the Appendices section of the AFTE Glossary.

* + - * 1. Weights of projectiles will be reported in grains.
				2. Weight measurements will be performed using a calibrated balance.

Shot pellets will be weighed using the following additional steps:

Determine the total number of pellets to be weighed.

Weigh all the pellets and record the value in the notes.

Divide the weight of all pellets by the total number of pellets.

Round the calculated value to the corresponding number of significant figures in the AFTE table used to determine the shot size.

Consult the appropriate table(s) in the Appendices section of the AFTE Glossary.

* + 1. Rifling Characteristics

			1. All conventionally rifled land and groove impressions will be measured when possible.
			2. Each land and groove impression will be measured to the nearest thousandth of an inch and recorded in the notes.
			3. The measurements of the land and groove impressions will be averaged and recorded in the notes to the nearest thousandth of an inch.
			4. Width measurements of land and groove impressions must be performed utilizing the anchor points shown in the table below:



* + - 1. The widths of the land and groove impressions will be measured using one of the following methods:
				1. Comparison Microscope Application Software

Mount the fired bullet on the calibrated stage of the comparison microscope.

Utilize the LAS Measurement Module to measure the widths of the land and groove impressions.

* + - * 1. Air Gap Method

Mount the fired bullet on one stage of the comparison microscope and a micrometer on the other stage.

Align the image of the land or groove impression with one of the anchor points corresponding with the anvil of the micrometer.

 Rotate the micrometer’s spindle to the next anchor point of the land or groove impression.

* + - 1. The following calculation may be used to determine the total number of land and groove impressions if the number cannot be visually determined:

 N = d𝝅/(L+G)

 Where: N = total number of lands and grooves

 d = diameter of base of bullet

𝝅 = pi = 3.1416

 L = width of one land impression

 G = width of one groove impression

* 1. **General Rifling Characteristics (GRC) File Search**
		1. GRC File searches will not be performed unless accompanied by a written request from the submitting agency.
		2. The GRC File Database will be accessed online through the AFTE Member’s Area.
		3. A combination list generated using class characteristics of both fired bullets and cartridge cases will NOT be produced.
		4. Only one list will be generated when multiple evidence projectiles have been identified to each other.
		5. The GRC search parameters and results will be documented in the notes area on the Firearms Unit Worksheet (CCBI-303) and the results will be placed in the case file.
	2. **Comparison Microscope Protocol**
		1. All fired projectiles submitted in a case will be compared to each other and/or to test fired projectiles.
		2. Test fired projectiles will be compared to each other to determine which microscopic characteristics are being reproduced prior to being compared to other projectiles.
			1. The test fire(s) used for examination will be documented in the appropriate area of the Firearms Unit Worksheet (CCBI-303).
			2. The Firearm Examiner may produce any number of test fires necessary for the examination.
		3. Evaluate the class characteristics to ascertain if they are in agreement.
		4. The indexed land/groove impressions will be used to indicate the position in which the agreement is most clearly viewed.
		5. Further examination of individual characteristics will be done when class characteristics are in agreement.
			1. If they are not in agreement, the elimination result statement will be used.
		6. Examination of Individual Characteristics of fired projectiles:

			1. A Firearm Examiner must consider all detail in an area of comparison.
	3. **Reporting**
		1. The following additional information shall be added to the General Report Format template, when applicable.

			1. *“Items Submitted”* will be described as:
				1. *CCBI Item <*enter item number*> (Agency Item <*enter item number*>):* <enter quantity, manufacturer, caliber, item type>.
			2. The “*Type Examination Requested”* will be reported as follows:

*Fired Projectile Examination – A microscopic comparison of two or more fired projectiles to determine the possible association(s) to each other or a firearm.*

* + - 1. *“Results and Conclusions”* will be reported as follows, when applicable:
				1. Examinations that result in an identification to a firearm or projectile will be reported as:

*CCBI Item(s) <*enter item number(s)*> <*(enter CCBI case number, when applicable)><was or were> *fired by CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>.

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *fired by the same firearm.*

* + - * 1. Examinations that are inconclusive to a firearm or projectile will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *could not be identified or eliminated as having been fired by CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>*.*

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *could not be identified or eliminated as having been fired by the same firearm* <as CCBI Item(s)> <enter item number(s)> <(enter CCBI case number, when applicable)>.

* + - * 1. Examinations that result in an elimination to a firearm or projectile will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not fired by CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>.

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not fired by the same firearm* <as CCBI Item(s)> <enter item number(s)> <(enter CCBI case number, when applicable)>.

* + - * 1. Items that are unsuitable for comparison will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *contain(s) no marks of comparison value for forensic firearms identification.*

* + - * 1. Items that are not microscopically compared for reasons other than unsuitability will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not microscopically compared* <explain the reason>.

* + - * 1. GRC search results will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *GRC results are attached. This list may not be all inclusive and should not be used to eliminate any suspect firearm.*

* + - * 1. “*Disposition*”

*No further action will be taken unless an additional request is received. All items of evidence will be returned to the <*requesting or submitting*> agency.*

1. **Limitations**
	1. N/A
2. **References**
	1. Crime Laboratory Administrative Procedural Manual
	2. FBI General Rifling Characteristic File <https://afte.org/members/databases/grc-search>
	3. Technical Procedure for Firearm Safety and Test Fires
	4. Association of Firearm and Tool Mark Examiners. Glossary. 6th ed. 2013.
	5. Association of Firearm and Tool Mark Examiners. Procedures Manual. 2001.
	6. Barnes, Frank C. Cartridges of the World. 7th ed. Northbrook, IL: DBI Books, Inc., 1993.
	7. Mathews, J. Howard. Firearms Identification. Vol. I. Madison, WI: The University of Wisconsin Press, 1962.
	8. Molnar, S. “A Simplified Technique for L&G Measurements.” AFTE Newsletter, No. 4 December 1969: 28.
	9. Parian, R. W. “Land and Groove Tabulation.” AFTE Journal Winter 1976: 15-17.
	10. National Rifle Association of America. NRA Firearms Fact Book. 3rd ed. 1989.
	11. Walsh, J. F. “Accuracy, Speed and Conversion in Rifling Measurements.” AFTE Journal Winter 1977: 50.
3. **Records**
	1. Firearms Unit Worksheet (CCBI-303)

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| **Revision History** |
| **Effective Date** | **Version Number** | **Reason** |
| 6/7/2019 | 1 | Original Document |
| 6/25/2019 | 2 | Modified wording in reporting statements |
| 7/8/2019 | 3 | Added GRC search parameters to be in included in notes in 3.2.5 |
| 7/29/2019 | 4 | Added 3.3.5.1 “If they are not in agreement, the elimination result statement will be used.” Removed “Microscopic” from 3.4.1.3.1, 3.4.1.3.2, and 3.4.1.3.3 |

# **7: Technical Procedure for Fired Cartridge Case and Shotshell Examinations**

1. **Purpose**
	1. This procedure outlines the examination of fired cartridge case and shotshell evidence.
2. **Equipment, Materials**
	1. Comparison microscope
	2. Stereomicroscope
	3. Caliper
	4. Micrometer
	5. Ammunition Reference Collection
	6. Engraver
	7. Cotton-tipped swabs
	8. Cleaning solutions
	9. Magnet
	10. Personal protective equipment
	11. Soft bristle brush
3. **Procedure**
	1. **Fired Cartridge Case/Shotshell Examination**
		1. No microscopic comparisons will be performed on cartridge cases/shotshells that are removed from the chamber, action, or magazine of a firearm unless specifically requested by the District Attorney’s Office.
		2. Physical Characteristics Examination

			1. Fired cartridge cases/shotshells will be documented in the appropriate area of the Firearms Unit Worksheet (CCBI-303).
			2. The following features of fired cartridge cases/shotshells will be documented in the case notes, when applicable:
				1. Design characteristics of fired cartridge cases/shotshells:

Manufacturer

Caliber/gauge

Headstamp

Ignition system (centerfire or rimfire)

Composition of the case, primer, and/or hull

Hull markings (load information)

* + - * 1. Class characteristics on the cartridge cases/shotshells:

Firing pin impression shape (may also note drag, flow, aperture shear)

Breechface impression detail type

Extractor mark(s)

Ejector marks(s)

Chamber detail type

Magazine lip marks

Shell latch marks

Ejection port markings

Anvil marks

Resizing marks or any other indications of reloading

* + - * 1. Individual Characteristics used for areas of comparison:

Firing pin impression

Breechface impression

Extractor mark(s)

Ejector marks(s)

Chamber detail

Ejection port markings

Anvil marks

* 1. **General Rifling Characteristics (GRC) File Search**
		1. GRC File searches will not be performed unless accompanied by a written request from the submitting agency.
		2. The GRC File Database will be accessed online through the AFTE Member’s Area.
		3. A combination list generated using class characteristics of both fired bullets and cartridge cases will NOT be produced.
		4. Only one list will be generated when multiple evidence cartridge cases have been identified to each other.
		5. The GRC search results will be documented in the notes area on the Firearms Unit Worksheet (CCBI-303) and the results will be placed in the case file.
	2. **Comparison Microscope Protocol**
		1. All fired cartridge cases/shotshells submitted in a case will be compared to each other and/or to test fired cartridge cases/shotshells.
		2. Test fired cartridge cases/shotshells will be compared to each other to determine which microscopic characteristics are being reproduced prior to being compared to other cartridge cases/shotshells.
			1. The test fire(s) used for examination will be documented in the appropriate area of the Firearms Unit Worksheet (CCBI-303).
			2. The Firearm Examiner may produce any number of test fires necessary for the examination.
		3. Evaluate the class characteristics to determine if they are in agreement.
		4. The indexed extractor, ejector, and/or chamber marks will be used to indicate the position in which the agreement is most clearly viewed.
		5. Further examinationof individual characteristics will be done when class characteristics are in agreement.
			1. If they are not in agreement, the elimination result statement will be used.
		6. Examination of Individual Characteristics of fired cartridge cases/shotshells:

			1. A Firearm Examiner must consider all detail in an area of comparison.
			2. Distinguishing chamber detail as fired-in or cycling:

				1. Cartridges/shotshells will be cycled through the action of the firearm.
				2. Microscopically compare the chamber detail on the test cycled cartridges/shotshells.

Matching chamber detail that appears on the test cycled cartridges/shotshells, indicate that the detail was from cycling.

Matching chamber detail that does not appear on the test cycled cartridges/shotshells but is present on the evidence cartridges/shotshells indicates that the detail is fired-in detail.

* + - * 1. Chamber marks on three (3) or more fired cartridge cases/shotshells must be documented in order for an identification or elimination conclusion to be rendered.
				2. An examination will still be conducted if less than three (3) cartridge cases/shotshells are present; however, the result will be reported as inconclusive.
				3. All chamber marks must be examined in relation to the observed class characteristics.
	1. **Reporting**

		1. The following additional information shall be added to the General Report Format template, when applicable.

			1. *“Items Submitted”* will be described as:
				1. *CCBI Item <*enter item number*> (Agency Item <*enter item number*>):* <enter quantity, manufacturer, caliber, item type>.
			2. The *“Type Examination Requested”* will be reported as follows:

*Fired Cartridge Case and Shotshell Examination – A microscopic comparison of two or more fired cartridge cases/shotshells* *to determine the possible association(s) to each other or a firearm.*

* + - 1. *“Results and Conclusions”* will be reported as follows, when applicable:
				1. Examinations that result in an identification to a firearm or cartridge case/shotshell will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were><fired in or cycled through> *CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>*.*

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> <fired in or cycled through> *the same firearm*.

* + - * 1. Examinations that are inconclusive to a firearm or cartridge case/shotshell will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *could not be identified or eliminated as having been* <fired in or cycled through> *CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>*.*

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *could not be identified or eliminated as having been* <fired in or cycled through> *the same firearm* <as CCBI Item(s)> <enter item number(s)> <(enter CCBI case number, when applicable)>.

* + - * 1. Examinations that result in an elimination to a firearm or cartridge case/shotshell will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not* <fired in or cycled through> *CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>*.*

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not* <fired in or cycled through> *the same firearm* <as CCBI Item(s)> <enter item number(s)> <(enter CCBI case number, when applicable)>.

* + - * 1. Items that are unsuitable for comparison will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *contain(s) no marks of comparison value for forensic firearms identification.*

* + - * 1. Items that are not microscopically compared for reasons other than unsuitability will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not microscopically compared* <explain the reason>.

* + - * 1. GRC search results will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *GRC results are attached. This list may not be all inclusive and should not be used to eliminate any suspect firearm.*

* + - * 1. “*Disposition*”

*No further action will be taken unless an additional request is received. All items of evidence will be returned to the <*requesting or submitting*> agency.*

1. **Limitations**
	1. N/A
2. **References**
	1. Crime Laboratory Administrative Procedural Manual
	2. FBI General Rifling Characteristic File <https://afte.org/members/databases/grc-search>
	3. Technical Procedure for Firearm Safety and Test Fires
	4. Association of Firearm and Tool Mark Examiners. Glossary. 6th ed. 2013.
	5. Association of Firearm and Tool Mark Examiners. Procedures Manual. 2001.
	6. Barnes, Frank C. Cartridges of the World. 7th ed. Northbrook, IL: DBI Books, Inc., 1993.
	7. Hatcher, J.S. Hatcher’s Notebook. 3rd ed. Harrisburg, PA: The Stackpole Company, 1966.
	8. Mathews, J. Howard. Firearms Identification. Vol. I. Madison, WI: The University of Wisconsin Press, 1962.
	9. National Rifle Association of America. NRA Firearms Fact Book. 3rd ed. 1989.
	10. White, H.P. and B.D. Munhall. Cartridge Case Headstamp Guide. Bel Air, MD: H. P. White Laboratory, 1963.
3. **Records**
	1. Firearms Unit Worksheet (CCBI-303)

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| **Revision History** |
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| 6/7/2019 | 1 | Original Document |
| 6/25/2019 | 2 | Modified wording in reporting statements |
| 7/29/2019 | 3 | Added 3.3.5.1 “If they are not in agreement, the elimination result statement will be used.” Removed “Microscopic” from 3.4.1.3.1, 3.4.1.3.2, and 3.4.1.3.3 |

#  **8: Technical Procedure for Cartridge and Shotshell Examinations**

1. **Purpose**
	1. This procedure outlines the examination of cartridge and shotshell evidence.
2. **Equipment, Materials**
	1. Comparison microscope
	2. Stereomicroscope
	3. Caliper
	4. Balance
	5. Ammunition Reference Collection
	6. Engraver
	7. Cotton-tipped swabs
	8. Cleaning solutions
	9. Magnet
	10. Personal protective equipment
	11. Soft bristle brush
3. **Procedure**
	1. **Cartridge/Shotshell Examination**
		1. No microscopic comparisons will be performed on cartridges/shotshells that are removed from the chamber, action, or magazine of a firearm unless specifically requested by the District Attorney’s Office.
		2. No further examination for cycling detail will be completed once one (1) item in a group is identified to a firearm or to a group of cartridges/shotshells.
		3. Physical Characteristics Examination

			1. Cartridge/shotshells will be documented in the appropriate area of the Firearms Unit Worksheet (CCBI-303).
			2. The following features of cartridges/shotshells will be documented in the case notes, when applicable:

				1. Design characteristics of the cartridges/shotshells:

Manufacturer

Caliber/gauge

Headstamp

Ignition system (centerfire or rimfire)

Composition of the case, primer, and/or hull

Hull markings (load information)

* + - * 1. Class characteristics on the cartridges/shotshells:

Extractor mark(s)

Ejector marks(s)

Chamber detail type

Magazine lip marks

Shell latch marks

Ejection port markings

Resizing marks or any other indications of reloading

* + - * 1. Individual Characteristics used for areas of comparison:

Extractor mark(s)

Ejector marks(s)

Chamber detail type

Magazine lip marks

Shell latch marks

Ejection port markings

Resizing marks or any other indications of reloading

* 1. **Comparison Microscope Protocol**
		1. All cartridges/shotshells with cycling marks will be compared to each other and/or to test cycled cartridge cases/shotshells.
		2. Test cartridges/shotshells cycled through a firearm will be compared to each other to determine which microscopic characteristics are being reproduced prior to being compared to other cartridges/shotshells.
			1. The test cycle(s) used for examination will be documented in the appropriate area of the Firearms Unit Worksheet (CCBI-303).
			2. The Firearm Examiner may produce any number of test cartridges/shotshells necessary for the examination.
		3. Evaluate the class characteristics to determine if they are in agreement.
		4. The indexed extractor, ejector, and/or chamber marks will be used to indicate the position in which the agreement is most clearly viewed.
		5. Further examination of individual characteristics will be done when class characteristics agree.
			1. If they are not in agreement, the elimination result statement will be used.
		6. Examination of Individual Characteristics of cartridges/shotshells:

			1. A Firearm Examiner must consider all detail in an area of comparison.
			2. Cartridges/shotshells will be cycled through the action of the firearm.
			3. Chamber marks on three (3) or more cartridges/shotshells must be documented in order for an identification or elimination conclusion to be rendered.
			4. An examination will still be conducted if less than three (3) cartridges/shotshells are present; however, the result will be reported as inconclusive.
			5. All chamber marks must be examined in relation to the observed class characteristics.
	2. **Reporting**

		1. The following additional information shall be added to the General Report Format template, when applicable.

			1. *“Items Submitted”* will be described as:
				1. *CCBI Item <*enter item number*> (Agency Item <*enter item number*>):* <enter quantity, manufacturer, caliber, item type>.
			2. The “*Type Examination Requested”* will be reported as follows:

*Cartridge and Shotshell Examination – A microscopic comparison of two or more cartridges/shotshells to determine the possible association(s) to each other or a firearm.*

* + - 1. *“Results and Conclusions”* will be reported as follows, when applicable:
				1. Examinations that result in an identification to a firearm or cartridge/shotshell will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *cycled through CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>*.*

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *cycled through the same firearm.*

* + - * 1. Examinations that are inconclusive to a firearm or cartridge/shotshell will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *could not be identified or eliminated as having been cycled through CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>*.*

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *could not be identified or eliminated as having been cycled through* *the same firearm* <as CCBI Item(s)> <enter item number(s)> <(enter CCBI case number, when applicable)>.

* + - * 1. Examinations that result in an elimination to a firearm or cartridge/shotshell will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not cycled through CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)><type of firearm>*.*

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not cycled through the same firearm* <as CCBI Item(s)> <enter item number(s)> <(enter CCBI case number, when applicable)>.

* + - * 1. Items that are unsuitable for comparison will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)> *contain(s) no marks of comparison value for forensic firearms identification.*

* + - * 1. Item that are not microscopically compared for reasons other than unsuitability will be reported as:

*CCBI Item(s)* <enter item number(s)> *<*(enter CCBI case number, when applicable)><was or were> *not microscopically compared* <explain the reason>.

* + - * 1. “*Disposition*”

*No further action will be taken unless an additional request is received. All items of evidence will be returned to the <*requesting or submitting*> agency.*

1. **Limitations**
	1. N/A
2. **References**
	1. Crime Laboratory Administrative Procedural Manual.
	2. Association of Firearm and Tool Mark Examiners. Glossary. 6th ed. 2013.
	3. Association of Firearm and Tool Mark Examiners. Procedures Manual. 2001.
	4. Barnes, Frank C. Cartridges of the World. 7th ed. Northbrook, IL: DBI Books, Inc., 1993.
	5. Mathews, J. Howard. Firearms Identification. Vol. I. Madison, WI: The University of Wisconsin Press, 1962.
	6. National Rifle Association of America. NRA Firearms Fact Book. 3rd ed. 1989.
	7. White, H.P. and B.D Munhall. Cartridge Case Headstamp Guide. Bel Air, MD: H.P. White Laboratory, 1963.
3. **Records**
	1. Firearms Unit Worksheet (CCBI-303)

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| **Revision History** |
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| 6/7/2019 | 1 | Original Document |
| 6/25/2019 | 2 | Modified wording in reporting statements |
| 7/29/2019 | 3 | Added 3.2.5.1 “If they are not in agreement, the elimination result statement will be used.” Removed “Microscopic” from 3.3.1.3.1, 3.3.1.3.2, and 3.3.1.3.3 |

# **9: Technical Procedure for Serial Number Restoration**

1. **Purpose**
	1. This procedure outlines the procedures in the restoration of obliterated or altered serial numbers or other manufacturer’s markings on firearms and other metallic items.
2. **Equipment, Materials, Reagents**
	1. Stereomicroscope
	2. Rotary grinding tool
	3. Horseshoe magnet or electromagnetic yoke
	4. Magnaflux baths
	5. Fry’s Reagent
	6. Turner’s Reagent
	7. Davis Reagent
	8. Sodium hydroxide
	9. Ferric chloride
	10. Acidic ferric chloride
	11. Nitric acid
	12. Cleaning solution
	13. Acid neutralizer powder
	14. Phosphoric nitric acid
	15. Oil
	16. Cotton-tipped swabs
	17. Disposable pipettes
	18. Purified water
	19. Polishing compound
	20. Sandpaper
	21. Fume hood
	22. Millipore System
	23. Digital Camera
	24. Personal protective equipment
3. **Procedure**
	1. **Preparation**
		1. Serial Number restorations are potentially destructive and will be performed after all other examinations have been completed.
		2. Firearms that are contaminated with potentially biohazardous material will be cleaned.
	2. **Examination**
		1. All observations and actions will be recorded in the appropriate section of the Firearms Unit Worksheet (CCBI-303).
		2. Determine the following properties of the serial number area:

			* Position
			* Location
			* Size
			* Style
			* Hidden numbers
			* Number of characters typically found in the serial number
		3. Take photographs of the item prior to any examinations and document the original condition of the item.
		4. The Firearm Examiner may take any action to reveal a hidden serial number.
		5. A description of the obliteration will be recorded in the notes.
	3. **Methods**
		1. The following methods may be used at the Firearm Examiner’s discretion to restore a serial number:

			1. Surface Enhancement
				1. Remove any scratches that obscure the serial number by polishing the area using an appropriate method.

Do not over polish, this can worsen the obliteration.

* + - 1. Magnetic Particle Inspection Method

				1. Utilize the non-destructive Magnetic Particle Inspection Method prior to chemical processing, when appropriate.
				2. Apply Magnaflux to the serial number area.
				3. Apply a magnetic field to the serial number area to visualize the serial number.
			2. Chemical Processing Method

				1. Select a chemical reagent appropriate for the material to be examined.
				2. Test the strength of the chemical solution in an area adjacent to the polished serial number area.

The area may slowly darken due to oxidation and should not bubble or fizz.

* + - * 1. Chemicals will be applied and are listed from weakest to strongest.

The following reagents are for use on ferrous material:

Davis Reagent

Turner’s Reagent

Fry’s Reagent

The following reagents are for use on non-ferrous material:

Nitric Acid

Ferric chloride

Acidic ferric chloride

The following reagent is for use on non-magnetic or aluminum material:

10% Sodium hydroxide

* + - * 1. More than one reagent may be used to improve clarity.
				2. 25% Nitric acid may be used as an enhancer for any of the above chemical reagents.
				3. Any chemical reagent may be diluted with water from the Millipore System at the Firearm Examiner’s discretion.

Always add acid to water, never add water to acid.

* + - * 1. Apply the solution slowly with a pipette, cotton-tipped swab, or other appropriate applicator.
				2. Gently rub a cotton-tipped swab across the area in one direction.
				3. The process may be repeated by wiping off the reagent with water and reapplying a chemical reagent.
				4. The oxidation process may be slowed and/or stopped to allow for examination by adding purified water to the area.
		1. The method(s) used, any characters that become discernible, and the position of these characters will be recorded in the notes. Photographs will be used to document characters that become discernible and the position of these characters at the Firearm Examiner’s discretion.
	1. **Reporting**
		1. The General Report Format template will be used for all Serial Number Restoration reports.
		2. The following additional information shall be added to the General Report Format template, when applicable.

			1. *“Items Submitted”* will be described as:

				1. *CCBI Item <*enter item number*> (Agency Item <*enter item number*>):* <enter quantity, manufacturer, model, caliber, serial number, item type>.
			2. The “*Type Examination Requested”* will be reported as follows:
				1. *Serial Number Restoration: The application of scientific techniques used for the retrieval, recovery, and/or revisualization of the serial number.*
			3. *“Results and Conclusions”* will be reported as follows, when applicable:
				1. Full Restoration: the total recognition of all obliterated characters.

*Examination and* <magnetic and/or chemical> *processing of CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)> *restored the original obliterated serial number which was determined to be* <enter restored serial number>*.*

* + - * 1. Partial Restoration: the recognition of obliterated characters less than the total being sought.

*Examination and* <magnetic and/or chemical> *processing of CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)> *partially restored the serial number. The serial number was determined to be* <enter restored characters and an asterisk (\*) to represent unknown characters followed by a list ofthe potential characters in parenthesis>.

* + - * 1. No Serial Number Restored: the lack of recognition of any obliterated characters or the failure to conclusively identify a sufficient number of characters for a NCIC based on references listed in 5.1 and 5.2.

*Examination and* <magnetic and/or chemical> *processing of CCBI Item* <enter item number> *<*(enter CCBI case number, when applicable)> *failed to restore a serial number that could be used to complete a NCIC search.*

* + - * 1. “*Disposition*”

*No further action will be taken unless an additional request is received. All items of evidence will be returned to the <*requesting or submitting*> agency.*

*The requesting agency will be responsible for entering the serial number into the National Crime Information Center (NCIC) Stolen Gun Files.*

1. **Limitations**
	1. The type of material containing the serial number and the original method used to place the serial number on the evidence item (i.e., laser engraving) may prevent this procedure from restoring the serial number.
2. **References**
	1. Serial Number Restoration Guide, US ATF
	2. “Firearms Reference Table”, Royal Mounted Canadian Police
3. **Records**
	1. Firearms Unit Worksheet (CCBI-303)

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| **Revision History** |
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| 6/7/2019 | 1 | Original Document |
| 6/25/19 | 2 | Modified wording in reporting statements |
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# **10: Technical Procedure for Reviews**

1. **Purpose**
	1. This procedure provides the general explanations for casework conclusions and guidelines for the review of casework involving microscopic comparisons of evidence in the Firearms Unit.
2. **Equipment, Materials**
	1. N/A
3. **Procedure**

	1. **Review Process**
		1. All firearm examination cases will undergo 100% technical review.
		2. In addition to the CCBI Crime Laboratory requirements for technical reviews, the Firearms Unit technical review will include:
			1. Verification of microscopic comparison conclusions.
				1. Verification is an independent review by another qualified Firearm Examiner in which the Verifying Examiner confirms all conclusions reached by the Primary Examiner.
4. **Limitations**
	1. N/A
5. **References**

5.1 N/A

1. **Records**
	1. Firearms Unit Worksheet (CCBI-303)
	2. Case Record

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| **Revision History** |
| **Effective Date** | **Version Number** | **Reason** |
| 4/1/2019 | 1 | Original Document |
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# **11: Technical Procedure for Water Tank Maintenance**

1. **Purpose**
	1. This procedure establishes the general guidelines for the maintenance of the Firearms Unit water tank.
2. **Equipment, Materials**
	1. Algaecide Treatment
	2. Non-Chlorine Shock Treatment
	3. Alkalinity Increaser
	4. PH Increaser
	5. Water Test Strips
	6. HEPA Filter
	7. Pre-Filter
	8. Cartridge Filter
3. **Procedure**
	1. **Water Treatment**
		1. The tank water condition will be checked every two weeks and water treatments performed as needed.
		2. Use a water treatment strip to test the water tank water for total hardness, pH, and total alkalinity. Apply pool chemicals according to the water strip indicators.
			1. Test results will be recorded in the Equipment Maintenance Log.
		3. To prevent algae formation, apply 1.5 to 3 ounces of NON-CHLORINE swimming pool shock and 1 to 2 ounces of pool/spa algaecide treatment once a week to one month as needed.
			1. **Do not use chlorine, bromine, or bleach in the water tank.**
		4. Hardness
			1. Water should have a total hardness range of 250 to 500 ppm.
		5. pH
			1. pH refers to the intensity of acid or alkaline materials in the water. The right pH range for the tank’s water is 7.2 to 7.8, with an ideal range of 7.4 to 7.6. Corrosion can be caused when pH levels are less than 7.2.

				1. When pH is under 7.2, add the amount of pH Increaser indicated below.
		6. Alkalinity
			1. Alkalinity should be in the range of 80 to 100 ppm (parts per million).
			2. To increase alkalinity, add 1 ounce of Alkalinity Increaser to increase by 10ppm. Circulate water in the tank for at least 2 hours then retest. Always test, adjust and retest the total alkalinity range.
	2. **Monthly Maintenance**
		1. The following items will be checked at least once per month to ensure continued operation of the bullet recovery system. Checks and any maintenance activity will be recorded in the Equipment Maintenance Log.
		2. Compressor Pressure – must read 85 psi.
		3. Compressor Tank – drain any water build-up from the compressor tank.
			1. Turn the lever to the compressor. If air comes out turn off the lever; if water comes out, leave open until no water comes out.
		4. Cartridge Water Filter Pressure – pressure should read between 24 and 34 psi when the tank is in circulation.
			1. If over 34 psi, the filter is clogged and needs to be replaced. If the psi is constantly between 30 and 32 psi, it needs to be cleaned or replaced.
			2. If the psi reads 0, there is an air leak and all connecting hoses need to be checked.
			3. To clean the filter, turn pump off, close all open ball valves, and follow the maintenance manual on the Hayward StarClear Cartridge Filter.
		5. Blower Pre-Filter – the pre-filter will be replaced when it is 75% soiled by particulates. The soiled area must not reach the edges of the pre-filter.
		6. Tank water level – water must be ¼ inch above skimmer while flowing.
			1. If under ¼ inch, add water by opening the ball valve and turning on the hose. Once the appropriate water level is reached, close the ball valve and turn off the hose.
	3. **Yearly Maintenance**
		1. The following items will be checked at least once per year to ensure continued operation of the Bullet Recovery System. Checks will be recorded in the Equipment Maintenance Log.
		2. Tank feet psi – The psi should be around 65 psi.
		3. Blower/HEPA Filter
			1. The pre-filter will be replaced when it is 75% blackened by particulates. The blackened area must not reach the edges of the pre-filter.
			2. The HEPA filter will be replaced when the filter is 75% blackened by particulates.
			3. These filters will require replacement within four to five years of use.
4. **Limitations**
	1. N/A
5. **References**
	1. Bullet Recovery Operating Guide
6. **Records**
	1. Equipment Maintenance Log

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| **Revision History** |
| **Effective Date** | **Version Number** | **Reason** |
| 4/1/2019 | 1 | Original Document |
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# **12: Glossary**

 **Purpose:** To provide abbreviations and definitions used in the examinations of firearms and toolmarks.

Below is not an inclusive list of abbreviations; however, it does include the majority of abbreviations typically used during forensic firearm examinations.

1. AP– Armor Piercing
2. API– Armor Piercing Incendiary
3. BATFE– Bureau of Alcohol, Tobacco, Firearms and Explosives
4. BMG– Browning Machine Gun
5. FMJ – Full Metal Jacket
6. FPE– Foot Pounds of Energy
7. FPI – Firing Pin Impression
8. GRC– General Rifling Characteristics
9. GSR – Gun Shot Residue
10. IBIS– Integrated Ballistics Identification System
11. JHP – Jacketed Hollow Point
12. JSP – Jacketed Soft Point
13. LRN – Lead Round Nose
14. NIBIN– National Integrated Ballistic Information Network
15. NIST– National Institute of Standards and Technology
16. PPE– Personal Protection Equipment
17. SNR – Serial Number Restoration
18. LIMP – Land Impression
19. GIMP – Groove Impression

**Types of firearms**

1. **Derringer** – The generic term applied to many variations of small one-, two- or even four-shot pistols, using both percussion caps and cartridges.
2. **Pistol** – A handgun in which the chamber is integral with the barrel.
3. **Revolver** – A firearm, usually a handgun, with a cylinder having several chambers so arranged as to rotate around an axis. The firearm is discharged successively by the same firing mechanism.
4. **Rifle** – A firearm with a rifled bore designed to be fired from the shoulder.
5. **Shotgun** – A long gun designed to shoot from the shoulder, typically having a smooth bore and designed to fire shotshells.

**Actions of firearms**

**Action** – The working mechanism of a firearm. The combination of the receiver or frame, the breech bolt, and the other parts of the mechanism by which a firearm is loaded, fired, and unloaded. May be broken down into action types as follows:

* + **Automatic Action** – A firearm design that feeds cartridges, fires, extracts, and ejects cartridge cases as long as the trigger is fully depressed and there are cartridges in the feed system. Actuation of the mechanism may be from an internal power source such as gas pressure or recoil, or external power source, such as electricity. Also known as fully automatic, full auto or machine gun.
	+ **Bolt Action** – A firearm in which the breech closure is in line with the bore at all times, manually reciprocates to load, unload, and cock, and is locked in place by breech bolt lugs and engaging abutments, usually in the receiver. There are two principal types of bolt actions: the turn bolt and the straight pull.
	+ **Double Action** – A handgun mechanism in which a single pull of the trigger first cocks and then releases the hammer or striker.
	+ **Hybrid Action** – A design that incorporates aspects of both single action and double action systems. For example, a pistol action which requires the slide to retract and set or partially cock the action, and the trigger to further cock and release the hammer or striker.
	+ **Lever Action** – A design wherein the breech mechanism is cycled by an external lever generally below the receiver.
	+ **Semiautomatic Action** – A repeating firearm that requires a separate pull of the trigger for each shot fired, and which uses the energy of discharge to perform a portion of the operating or firing cycle. Also known as an autoloader or self-loader.
	+ **Single Action** – An action requiring the manual cocking of the hammer or striker. Sufficient pressure on the trigger then releases the firing mechanism.
	+ **Single Shot Action** – A firearm with no means in the mechanism for storing or loading more than a single cartridge housed in the chamber of the barrel.
	+ **Slide Action** – An action which features a movable forearm that is manually actuated in a motion parallel to the barrel by the shooter. Forearm motion is transmitted to a breech bolt assembly which performs all the functions of the firing cycle assigned to it by the design. Also known as pump action.

The definitions provided below were pulled from the AFTE Glossary 6th Edition and any additional terminology can be found there or in the current AFTE Glossary.

1. **Ammunition** – One or more loaded cartridges consisting of a primed cartridge case, propellant, and with or without one or more projectiles. Also referred to as fixed ammunition or live ammunition (slang term).
2. **Ammunition Standards**
	* A collection and cataloging of both cartridges and ammunition components utilized by the firearm examiner; may include both unfired and fired ammunition components. Also known as reference ammunition, fired standards, or known standards.
	* Ammunition used by test ranges to evaluate test barrels, ranges, and other velocity and pressure measuring equipment. May also be used as a control sample by which other characteristics are compared, such as accuracy, patterns, etc. Also known as reference ammunition.
3. **Axial Engraving** – Striations or contours on a fired bullet that run parallel or approximately parallel to the axis of the bullet. There are several possible types of axial engravings, including, but not limited to marks left by or due to: 1) the mouth of the cartridge case; 2) the chamber throat; 3) irregularities or burrs along the forward edge of a chamber in a revolver cylinder; 4) inconsistent rotation of a bullet as it moves down the bore; 5) misalignment of a revolver chamber with the axis of the bore (also known as forcing cone marks, misalignment marks, or out-of-time marks); and 6) the rifling, prior to engagement with and rotation of the bullet (also known as slippage marks, skid marks, or jump marks).
4. **Ballistics** – The science of projectiles in motion. Usually divided into three parts: 1) Interior Ballistics, which studies the projectile’s movement inside the firearm; 2) Exterior Ballistics, which studies the projectile’s movement between the muzzle and the target; and 3) Terminal Ballistics, which studies the effect of a projectile’s impact at the target. A term often confused with Forensic Firearms Identification.
5. **Barrel** – That part of a firearm through which a projectile or shot charge travels under the impetus of powder gasses, compressed air, or other like means. A barrel may be rifled or smooth.
6. **Barrel Length** – The distance between the muzzle end of the barrel and the face of the closed breechblock or bolt. On revolvers, it is the overall length of the barrel including the threaded portion within the frame. Barrel length normally should include compensators, flash hiders, etc., if permanently affixed.
7. **Base** – The rear portion of a bullet that is opposite the nose. Also known as the heel. That portion of a cartridge case which contains the primer (more commonly known as the head) or the filler material which constitutes the lowest or base wad in a shotshell.
8. **Bearing Surface** – That portion of a bullet’s outer surface that comes into direct contact with the interior surface of the barrel. Also known as the band.
9. **Best Known Non-Matching Agreement in Toolmarks** – The greatest individual corresponding agreement between two toolmarks known to have been created by different tools that has either been personally observed by trained examiners or has been observed by others in the profession by rigorous studies.
10. **Body (Case)**

	* The metallic portion of the cartridge case that contains the propellant, primer and projectile(s).
	* The tubular section of a shotshell that contains the propellant, wads, and projectile(s).
11. **Bolt** – The locking and cartridge head support mechanism of a firearm that operates in line with the axis of the bore. Also known as the breech bolt. In revolvers, bolt is sometimes used to refer to the cylinder stop.
12. **Bore** – The interior of a barrel forward of the chamber.
13. **Bore Diameter**

	* In rifled barrels, it is the distance across the center of the barrel from the top of one land to the top of the opposite land.
	* In shotguns or muskets, it is the distance across the center of the barrel forward of the chamber but before any restrictive choke or expanded muzzle.
14. **Breech** – The part of a firearm at the rear of the bore into which ammunition components are inserted.
15. **Breechblock** – The block in breech-loading firearms that locks the rear of the barrel against the force of the charge and prevents gases from escaping; also provides support for the head of the cartridge case during firing.
16. **Breech Face** – That part of the breechblock or breech bolt which locks against the rear of the chamber and is against the head of the cartridge case or shotshell during firing.
17. **Breech Face Markings** – A negative impression of the breech face of the firearm found on the head of the cartridge case and/or primer after firing. These impressed marks are caused by the pressures produced during firing.
18. **Bullet** – A non-spherical projectile for use in a rifled barrel. The following are various bullet types and styles:

	* **Armor Piercing Bullet** – (1) A projectile consisting of a hardened core or wholly composed of a substance other than lead or lead alloy. (2) Any projectile manufactured, represented, or designed to be metal or armor piercing.
	* **Boattail Bullet** – A specific design of projectile having a tapered or a truncated conical base.
	* **Brass Washed Bullet** – A term used for lead projectiles with a thin brass colored coating. Sometimes referred to as golden bullets. This coating has been used on 22 caliber bullets.
	* **Coated Bullet** – Lead alloy projectile having a thin metal alloy coating. Examples include Remington® Golden™ Bullet and Winchester Lubaloy®. Refer to Copper Washed Bullet and Brass Washed Bullet.
	* **Copper Washed Bullet** – A term used for lead projectiles with a thin copper colored coating. This finish is found extensively on 22 caliber bullets.
	* **Flat-nosed Bullet** – A projectile with a flattened tip at right angles to its axis.
	* **Frangible Bullet** – A projectile designed to disintegrate upon impact with a hard surface in order to minimize ricochet. Sometimes referred to as a disintegrating bullet or gallery bullet.
	* **Full Metal Jacket Bullet** – A projectile in which the bullet jacket encloses the entire bullet, with the usual exception of the base. Also called full jacketed, full patch, full metal case, metal cased, metal patched, and ball ammunition.
	* **Hollow Point Bullet** – A projectile with a cavity in the nose to facilitate expansion.
	* **Jacketed Bullet** – A projectile having an inner core typically enveloped by a metallic substance.
	* **Jacketed Hollow Point Bullet** – A bullet having a metal jacket enclosing a lead alloy core. The entire bullet is enclosed except for the nose, which has a cavity.
	* **Lead Bullet** – A projectile formed from a lead alloy.
	* **Round Nose Bullet** – A projectile with a hemispherical nose.
	* **Saboted Bullet** – A sub-caliber projectile centered in a lightweight carrier to permit firing the subcaliber projectile in a larger bore firearm.
	* **Semi-jacketed Bullet** – A projectile with a partial jacket and exposed lead nose.
	* **Semi-jacketed Hollow Point Bullet** – A projectile with a partial jacket and exposed lead nose with a cavity.
	* **Semi-wadcutter Bullet** – A projectile with a distinct, short truncated cone on a cylindrical body with sharp shoulders. Like the wadcutter bullet, it is intended to cut target paper cleanly but does not have the feeding issues that may be experienced with a wadcutter bullet.
	* **Soft Point Bullet** – A design providing for exposure of a portion of the core at the nose of a jacketed projectile.
	* **Spire Point Bullet** – A projectile with a conical nose profile.
	* **Spitzer Bullet** – A projectile design having a sharp pointed nose, a long ogive, and sometimes a boattail base.
	* **Steel Core Bullet** – A jacketed projectile containing a core that is usually composed of mild steel. The steel core is frequently centered or secured inside the jacket with lead.
	* **Steel Jacketed Bullet** – A bullet with a jacket made of steel.
	* **Swaged Bullet** – A projectile that has been shaped by compressing and forming the bullet material in a die.
	* **Total Metal Jacket Bullet** – A projectile made by copper plating a lead core to create a jacket that encloses the entire bullet. The jacket is much thicker than cosmetic copper plating.
	* **Tracer Bullet** – A projectile that has a burning compound in its base which permits observation of its flight.
	* **Truncated Cone Bullet** – A design of flat-nosed projectile having a conical rather than rounded profile.
	* **Wadcutter Bullet** – A generally cylindrical projectile design having a sharp, shouldered nose intended to cut target paper cleanly to facilitate easy and accurate scoring.
	* **Wax Bullet** – A projectile made from paraffin and/or other wax preparations, usually used for short range indoor target shooting.
	* **Wooden Bullet –** A projectile made of hollow wood which will disintegrate in the bore or a short distance from the muzzle. Many European blanks are loaded with wooden bullets to facilitate feeding.
19. **Bullet Core** – The inner portion of a jacketed bullet often made of lead.
20. **Bullet Diameter** – The maximum dimension across the largest cylindrical section of a bullet.
21. **Bullet Jacket** – The envelope enclosing the core of a projectile that is typically of metallic construction.
22. **Bullet Recovery System** – Any method that will allow the recovery of a fired, undamaged bullet. Different systems are needed for various cartridges depending on bullet composition, jacket thickness, and velocity. Water tanks and cotton boxes are most commonly used.
23. **Caliber**

	* A term used to designate the specific cartridge for which a firearm is chambered.
	* In firearms, caliber is the approximate diameter of the circle formed by the tops of the lands of a rifled barrel, typically expressed in hundredths of an inch (38 caliber) or millimeters (9mm caliber).
	* In ammunition, caliber is a numerical term, without the decimal point, included in a cartridge name to indicate the nominal bullet diameter.
24. **Calipers** – A device consisting of two moveable legs or jaws used to measure diameter, thickness, or distance between two surfaces.
25. **Cannelure** – A circumferential groove generally of a knurled or plain appearance on a bullet or cartridge case. Three uses of cannelures include crimping, lubrication, and identification.
26. **Carbine** – A rifle of short length and light weight originally designed for mounted troops.
27. **Cartridge** – A single unit of ammunition consisting of the cartridge case, primer, propellant, and with or without one or more projectile(s). Also applies to a shotshell.
28. **Cartridge Case** – The container for all the other components which comprise a cartridge. Serves as a gas seal during the firing of a cartridge.
29. **Cartridge Case Extractor Groove** – An annular groove cut in rimless, semi-rimmed, or belted cartridge cases forward of the head for the purpose of providing a surface that the extractor may grip to remove the case from the chamber.
30. **Cartridge Case Head** – The base of the cartridge case which contains the primer.
31. **Cartridge Case Mouth** – The opening in the cartridge case into which the projectile(s) is seated.
32. **Cartridge Case Shoulder** – The section of a bottleneck cartridge case connecting the main body of the cartridge case and the smaller diameter neck.
33. **Chamber** – The rear part of the barrel bore that has been formed to accept a specific cartridge or shotshell. In a revolver, the holes in the cylinder represent multiple chambers.
34. **Chamber Casting** – The process of making a cast of the chamber of a firearm to determine the cartridge for which the firearm is designed, or to better observe imperfections within that chamber.
35. **Chamber Marks** – Individual microscopic marks placed upon a cartridge case by the chamber wall as a result of any or all of the following: (1) chambering, (2) expansion during firing, and/or (3) extraction.
36. **Class Characteristics** – Measurable features of a specimen which indicate a restricted group source. They result from design factors and are determined prior to manufacture.
37. **Cock** – To place a firing mechanism (hammer, firing pin, or striker) in a position for firing. A firearm part that holds pyrite or flint; the predecessor of the hammer.
38. **Comparison Microscope** – Essentially two microscopes connected to an optical bridge which allows the viewer to observe two objects simultaneously with the same degree of magnification. This instrument can have a monocular or binocular eyepiece. May also be referred to as a comparison macroscope.
39. **Contour Variation** – Variations in the elevations of the ridges and valleys in striated marks and of forms and shapes or depressions in impression marks.
40. **Cycling Marks** – A general term for those toolmarks imparted onto a cartridge, cartridge case, or shotshell that has been cycled through the action of a firearm. Examples include ejector marks, extractor marks, feed ramp marks, magazine lip marks, and ejection port marks. Also known as feed marks or mechanism marks.
41. **Cylinder** – The rotating component of a firearm that contains the chambers.
42. **Disconnector** – A device intended to disengage the sear from the trigger. In a semiautomatic firearm it is intended to prevent full automatic firing. In a manually operated firearm, it is intended to prevent firing without pulling the trigger.
43. **Distance Determination** – The process of determining the distance from the firearm, usually the muzzle, to the target based upon patterns of gunpowder or gunshot residues deposited upon that target. Where multiple projectiles, such as shot, have been fired, the spread of those projectiles is also indicative of distance.
44. **Driving Edge** – The driving edge of a bullet fired from a gun with a right twist is the right edge of the land impression, or the left edge of the groove impression. The driving edge of a bullet fired from a gun with left twist is the left edge of the land impression or the right edge of the groove impression. Also known as leading edge when used in conjunction with the term following edge. Refer to Trailing Edge.
45. **Drop Fire** – The discharge of a loaded firearm as a result of an impact after being dropped. This may be the consequence of a design shortcoming, a compromised safety system, or the failure of the handler to engage the appropriate safety device. Also refer to Jar Off.
46. **Dry Firing** – The releasing of the firing pin on an unloaded chamber of a firearm.
47. **Ejection Port** – An opening in the receiver or slide to allow for ejection of a cartridge, cartridge case, or shotshell.
48. **Ejection Port Marks** – An indentation or striated mark at one or more locations on a cartridge case (typically found on the sidewall) produced as the result of striking the ejection port during the ejection process. Such marks may be reproducible.
49. **Ejector** – A mechanical device of a firearm which expels a cartridge, cartridge case, or shotshell.
50. **Ejector Marks** – Toolmarks produced by the ejector on the head of a cartridge case or shotshell.
51. **Ejector Rod** – A rod found on revolvers which is pushed rearward to facilitate extraction/ejection
52. **Extractor** – A component of a firearm which is designed to remove the cartridge, cartridge case, or shotshell from the chamber of the firearm.
53. **Extractor Groove** – An annular groove cut in rimless, semi-rimmed, or belted cartridge cases forward of the head for the purpose of providing a surface that the extractor may grip to remove the case from the chamber.
54. **Extractor Mark** – Impressed or striated toolmarks produced on a cartridge, cartridge case, or shotshell as a result of contact with the extractor. These marks are usually found on the outer edge or just ahead of the rim, the underside of the rim, or in the extractor groove.
55. **Feed Ramp** – A sloped surface located at the mouth of the chamber that serves to guide the cartridge as it is fed from the magazine into the chamber. Also known as cartridge ramp or feed throat cartridge guide.
56. **Feet Per Second** – A unit of both speed and velocity of a projectile (abbreviated fps). The metric equivalent is meters per second (m/s).
57. **Firearm** – An assembly of a barrel and action from which a projectile(s) is propelled by products of combustion. The legal definition of a firearm may vary by jurisdiction.
58. **Firearms Identification** – A discipline of forensic science which has as its primary concern to determine if a bullet, cartridge case, or other ammunition component was fired by a particular firearm.
59. **Firearms Reference Library** – A collection of firearms maintained by a laboratory for the following reasons:

	* To identify the make, model, and source of evidence firearms.
	* To provide exemplar firearms for various testing purposes which otherwise compromise evidence firearms.
	* To provide an exemplar resource for training new examiners or in developing new technology for the examination of firearms.
	* To provide a source of firearms parts for the repair of evidence firearms for test firing purposes.
	* To provide a resource for the identification of firearms parts recovered at crime scenes.
	* To provide a resource for the location and style of firearms serial numbers.
60. **Firing Pin** – That part of a firearm mechanism which strikes the primer or rim of a cartridge to initiate ignition in order to fire a cartridge or shotshell. Refer to Hammer Nose and Striker.
61. **Firing Pin Aperture** – The hole in the breech face of a firearm through which the firing pin protrudes.
62. **Firing Pin Aperture Shear** – Striated marks caused by the rough edges of the firing pin aperture scraping the primer metal during unlocking of the breech. Refer to Primer Flow-Back.
63. **Firing Pin Drag Mark** – The toolmark produced when a projecting firing pin comes into contact with a cartridge case or shotshell during the extraction/ejection cycle.
64. **Firing Pin Impression** – The indentation of the primer of a centerfire cartridge case or in the rim of a rimfire cartridge case caused when it is struck by the firing pin. May also be referred to as a firing pin indent.
65. **Following Edge** – Refer to Trailing Edge.
66. **Forcing Cone**
	* The tapered section at the front end of a shotgun chamber by which the diameter of the front end of the chamber is reduced to bore diameter.
	* The tapered section towards the muzzle end of a shotgun barrel that gradually reduces in size from bore diameter to choke diameter.
	* The tapered entrance to the bore at the breech end of a revolver barrel.
67. **Frame** – In revolvers, pistols, and break-open guns, the basic unit of a firearm which houses the firing and breech mechanism and to which the barrel and grips are attached. Refer to Receiver.
68. **Function Testing** – The examination of a firearm concerning its mechanical condition and operation. It is usually performed to determine if all safety features are operable and/or if the firearm is capable of firing a cartridge. Refer to Accidental Discharge Test, Jar Off, Drop Fire, and Safety Testing.
69. **Gauge**

	* A term used in the identification of a shotgun bore. The gauge is equal to the number of round lead balls of bore diameter that equal one pound. Thus 12 gauge is the diameter of a round lead ball weighing 1/12 pound.
	* An instrument or device for measuring or testing a parameter such as a headspace gauge or trigger pull gauge.
70. **General Rifling Characteristics** – The number, width, and direction of twist of the lands and grooves in a barrel of a given caliber firearm.
71. **Grain**

	* A unit of weight (avoirdupois). The grain unit is commonly used in American and English ammunition practice to measure the weight of components. There are 7,000 grains in a pound and 437.5 grains in one ounce.
	* An individual kernel of black powder.
72. **Grooves** – Depressed or cut channels in the bore of a firearm barrel to impart rotary motion to a projectile.
73. **Gunshot Residue** – The total residues resulting from the discharge of a firearm. It includes both propellant and primer residues, carbonaceous material plus metallic residues from projectiles, fouling, and any lubricant associated with the bullets.
74. **Hyper-Obturation** – Excessive swelling or upset of a bullet or cartridge case beyond the obturation required to make a seal for a normal firing event. Examples include expansion within an oversized barrel or chamber of a firearm (e.g., 9mm Luger cartridge fired in a 40 S&W chamber) or a high-pressure event causing a bulged or flared bullet or cartridge case either inside or upon exit from the firearm's barrel or chamber (e.g., mushrooming of a hollow bullet base from a short barrel). Also refer to Obturation.
75. **Indexing**

	* In firearms, the rotation and stopping of a revolver cylinder and the quality of alignment- between the axis of the chamber and the axis of the bore.
	* In Firearms Identification, the marking of specimens (bullets or cartridge cases) which were fired by the same firearm, orienting the features which show the alignment of corresponding detail (match). Also known as orienting or phasing.
	* A method for marking cartridges and bullets to orient the position of test cartridges in a firearm. Also known as orienting or phasing.
76. **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.
77. **Jar Off** – A condition in which a firearm may fire if dropped or jarred when the safety is off. This phenomenon occurs without the trigger being pulled. Testing for this condition involves placing the safety in the “off” position and dropping the firearm from approximately waist height onto a hard surface to see if it will fire. Testing for this condition may also be referred to as drop testing. Also refer to Drop Fire.
78. **Knurling**

	* A series of ridges or diamonds impressed or cut into a surface to help prevent slipping.
	* May be used to refer to cannelures on cartridge cases or bullets.
79. **Land** – The raised portion between the grooves in a rifled barrel.
80. **Land and Groove Impressions** – Impressed areas on the bearing surface of a bullet caused by a bullet engaging with the rifling in the barrel of a firearm.
81. **Leading Edge** – Refer to Driving Edge.
82. **Magazine Safety** – A safety device on some semiautomatic handguns that prevents firing unless the magazine is fully inserted into the firearm.
83. **Micrometer** – An instrument for making precise measurements that has a spindle moved by a finely threaded screw. It may be used in conjunction with a comparison microscope.
84. **Micrometer, Stage** – A glass microscope slide bearing a scale in the center of the slide that is 1 or 2 mm long, subdivided into tenths and hundredths of a millimeter or tenths, hundredths, and thousandths of an inch.
85. **Microscope** – An optical instrument consisting of a combination of lenses which allows the operator to view a magnified image of a small object(s).
86. **Microscopic Comparison** – A general term for the comparison of two or more items under a microscope. Also refer to Comparison Microscope.
87. **Microscopic Marks** – Striae, patterns of minute lines or grooves, or impressions in an object which are generally smaller than the unaided eye can distinguish. In firearm and toolmark identification, these marks are characteristic of the object which produced them and are the basis for identification.
88. **Misfire** – The failure of a cartridge to fire after the primer has been struck by a sufficient blow by a firing pin, or the failure of the initiated primer to ignite the powder. A misfire is considered to be an ammunition malfunction.
89. **Obturation** – The sealing of a bore and chamber by pressure. During the firing process, pressure swells the cartridge case against the chamber walls which minimizes the rearward flow of gases between the case and the chamber wall. The same pressure, applied to the base of the projectile, causes it to swell or upset, filling and sealing the bore. Also refer to Hyper-obturation.
90. **Orienting** – The aligning of two bullets, which were fired from the same barrel, on the comparison microscope so that the land and groove impressions on those bullets which were produced by the same lands and grooves in the barrel are opposite each other. The term can also refer to the alignment of cartridge cases or other toolmark-bearing surfaces, so that directionality of marks made by the same tool are consistent on both stage of the comparison microscope. Sometimes called phasing or indexing.
91. **Overall Length**
	* For a firearm, it is the dimension measured parallel to the axis of the bore from the muzzle to a line at a right angle to the axis and tangent to the rearmost point of the butt plate or grip.
	* For ammunition, it is the greatest dimension of a loaded cartridge. For centerfire and rimfire cartridges, it is the measurement from the face of the head to the tip of the bullet. For shotshells or blanks, it is the measurement from the face of the head to the crimp. Overall length does not refer to the uncrimped length of a shotshell.
92. **Pattern** – The distribution of shot fired from a shotgun. Among firearms manufacturers, pattern is generally measured as a percentage of pellets striking a 30-inch circle at 40 yards. Some 410 bore or skeet guns are measured with a 30-inch circle at 25 yards. In Firearm Identification, the term is used to describe the distribution of either shotshell pellets or gunpowder particulate.
93. **Phasing**
	* In Firearm and Toolmark Identification, the marking of specimens (bullets, cartridge cases, or toolmarks) which were fired by the same firearm or created by the same tool, orienting the features which show the alignment of corresponding detail (match). Also known as orienting or indexing.
	* A method for marking cartridges and bullets to orient the position of test cartridges in a firearm. Also known as orienting or indexing.
94. **Photomicrograph** – A photograph taken through a microscope.
95. **Primer** – The ignition component of a cartridge.
96. **Projectile** – An object propelled by external force and continuing in motion by its own inertia (e.g., a bullet propelled from a firearm by the force of rapidly burning gases or other means). Refer to Bullet for various types of projectiles.
97. **Range of Conclusions Possible When Comparing Toolmarks** – The examiner is encouraged to report the objective observations that support the findings of toolmark examinations. The examiner should be conservative when reporting the significance of these observations.
* **Identification**: Agreement of all discernible class characteristics and sufficient agreement of a combination of individual characteristics where the extent of agreement exceeds that which can occur in the comparison of toolmarks made by different tools and is consistent with the agreement demonstrated by toolmarks known to have been produced by the same tool.
* **Inconclusive**: Agreement of all discernible class characteristics and some agreement of individual characteristics, but insufficient for an identification.

	+ Agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility.
	+ Agreement of all discernable class characteristics and disagreement of individual characteristics, but insufficient for an elimination.
* **Elimination**: Significant disagreement of discernible class characteristics and/or individual characteristics.
* **Unsuitable**: Unsuitable for examination.
1. **Reference Ammunition**
	* A collection and cataloging of both cartridges and ammunition components utilized by the firearm examiner; may include both unfired and fired ammunition components. Also known as ammunition standards, known standards, or fired standards.
	* Ammunition used in test ranges to evaluate test barrels, ranges, and other velocity and pressure measuring equipment. May also be used as a control sample by which other characteristics are compared, such as accuracy, patterns, etc.
2. **Rifling Twist** – The direction (right or left) and rate at which the rifling of the firearm turns within the bore. This is normally expressed as the distance required for the rifling (and projectile) to make one complete revolution. Depending on the origin of the firearm, this may be written in inches or in millimeters (e.g., 1 turn in 12 inches or 1 turn in 305 mm).
3. **Safety, Automatic** – A locking device on some firearms designed to return to the “on” (safe) position when the action of the firearm is opened.
4. **Safety, Manually Operated**

	* **Cross Bolt** – A type of firearm safety operated by lateral force on a button usually located in the trigger guard. Also known as a push button safety.
	* **Grip** – An auxiliary locking device in the grip of some handguns which prevents firing until it is depressed (e.g., US 1911 pistol).
	* **Half Cock** – This so-called safety is a sear engagement which holds the hammer back away from the firing pin.
	* **Lever** – A type of firearm safety operated by the movement of a pivoted lever (e.g., Luger pistol).
	* **Sliding Safety** – A safety mechanism on a firearm that is operated by a sliding motion.
	* **Tang** – A safety mounted on the upper receiver tang of a firearm.
	* **Thumb** – A safety on a firearm located as to be operated conveniently by the thumb of the trigger hand.
	* **Trigger Lock** – A form of firearm safety which blocks trigger movement. The trigger lock is designed to be engaged while the firearm is in storage and it should not be applied to a loaded firearm. A trigger lock is not a typical part of a firearm.
	* **Wing** – A safety found on bolt action rifles which is usually mounted at the rear of the bolt assembly. The safety pivots up and down at right angles to the bore line in a manner of a bird’s wing.
5. **Safety, Passive** – A safety that is in place (or “on”) until the trigger is pulled.
6. **Safety Testing** – The examination of a firearm to determine if it is capable of accidental fire (i.e., if it will fire without the trigger being pulled) and if the safety features of the firearm are operational. Also known as an Accidental Discharge Test. Refer to Function Testing, Jar Off, and Drop Fire.
7. **Serial Number** – A number applied to a firearm for identification purposes. The Gun Control Act of 1968 requires all firearms manufactured after 1968 to bear a unique serial number.
8. **Shell Stop** – A mechanical device often seen in pump action and autoloading shotguns that prevent more than one shell from feeding into the carrier, or lifter, with each cycle of the breech mechanism. Also known as cartridge stop, cut-off, or shell latch.
9. **Shot** – Generally, spherical pellets used in loading shotshells or cartridges. Shot can be found in many compositions such as lead, steel, bismuth, tungsten-polymer, tin, zinc, etc.
10. **Shotshell** – A unit of ammunition that may contain a single projectile or multiple projectiles/pellets. Generally, shotshells are designed to be fired from shotguns.
11. **Shot Size** – A numerical or letter(s) designation indicating the average diameter of a pellet.
12. **Slam Fire** – The accidental discharge of a firearm upon closing of the action which may be due to one of the following:

	* A firing pin that has stuck and failed to retract.
	* A primer that is either inadequately seated or overly sensitive.
	* A weak or broken firing pin retaining spring which fails to overcome the inertia of motion imparted to the firing pin during closure, thereby allowing the firing pin to strike the primer with sufficient force to cause discharge.
	* A firearm with inadequate headspace.
13. **Slippage Marks** – Slippage marks are typically produced by revolvers and have the appearance of widening of the land impressions at their beginning point. Also known as skid marks or jump marks. Refer to Axial Engraving.
14. **Slug, Rifled** – A single projectile with spiral grooves and a hollow base that is intended for use in shotguns. The theory behind this design is that after leaving the muzzle of the gun, the slug will rotate and thus reach its target much more accurately.
15. **Smooth Bore** – A firearm with an unrifled bore.
16. **Stereomicroscope** – An optical instrument which provides three-dimensional viewing of an object through paired objectives and eyepieces. Some models share a common, main objective.
17. **Striker** – A rod-like firing pin or a separate component which impinges on the firing pin.
18. **Striker Fire** – A method of firing which involves the striker being held by a spring until released by the sear.
19. **Subclass Characteristics** – Features that may be produced during manufacture that are consistent among items fabricated by the same tool in the same approximate state of wear. These features are not determined prior to manufacture and are more restrictive than class characteristics.
20. **Test Bullet** – A bullet fired into a bullet recovery system in a laboratory for comparison or analysis.
21. **Test Cartridge Case** – A cartridge case obtained while test firing a firearm in a laboratory to be used for comparison or analysis.
22. **Test Fire** – To discharge a firearm in a laboratory or controlled setting in order to obtain representative bullets and cartridge cases for comparison or analysis, to determine functionality of the firearm, or to produce gunshot residue or shot patterns at known distances.
23. **Theory of Identification as it Relates to Toolmarks**
	* The theory of identification as it pertains to the comparison of toolmarks enables opinions of common origin to be made when the unique surface contours of two toolmarks are in “sufficient agreement”.
	* This “sufficient agreement” is related to the significant duplication of random toolmarks as evidence by the correspondence of a pattern or combination of patterns of surface contours. Significance is determined by the comparative examination of two or more sets of surface contour patterns comprised of individual peaks, ridges and furrows. Specifically, the relative height or depth, width, curvature and spatial relationship of the individual peaks, ridges and furrows within one set of surface contours are defined and compared to the corresponding features in the second set of surface contours. Agreement is significant when the agreement in individual characteristics exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools and is consistent with agreement demonstrated by toolmarks known to have been produced by the same tool. The statement that “sufficient agreement” exists between two toolmarks means that the agreement of individual characteristics is of a quantity and quality that the likelihood another tool could have made the mark is so remote as to be considered a practical impossibility.
	* Currently the interpretation of individualization/identification is subjective in nature, founded on scientific principles and based on the examiner’s training and experience.
24. **Toolmark, Impressed** – Contour variations on the surface of an object caused by a combination of force and motion where the motion of the tool is approximately perpendicular to the plane being marked. The class characteristics (shape) can indicate the type of tool used to produce the mark. These marks may contain class, subclass, and/or individual characteristics of the tool producing the marks. Also known as compression marks.
25. **Toolmark, Striated** – Contour variations, generally microscopic, on the surface of an object caused by a combination of force and motion where the motion of the tool is approximately parallel to the plane being marked. Friction marks, abrasion marks, and scratch marks are terms commonly used when referring to striated marks. These marks may contain class, subclass, and/or individual characteristics of the tool producing the marks.
26. **Trailing Edge** – The trailing edge of a bullet fired from a gun with a right twist is the left edge of the land impression, or the right edge of the groove impression. The trailing edge of a bullet fired from a gun with left twist is the right edge of the land impression or the left edge of the groove impression. Also known as following edge when used in conjunction with the term leading edge.
27. **Vernier Caliper** – A measuring instrument having a fixed jaw, a sliding jaw, and a point that slides along an attached scale.
28. **Wad** – A felt, paper, cardboard, or plastic component used in a shotshell for various purposes.
29. **Yoke** – The part of a solid frame revolver on which the cylinder is swung out to the side to accomplish loading and ejecting. Also known as a crane.

**Additional CCBI Firearms Laboratory Definitions:**

1. **Administrative review** – A review of the case file documentation for grammatical and typographical correctness.
2. **Charging Firearm** – The act of chambering a cartridge or shotshell into a firearm.
3. **Design Characteristics –** Characteristics determined by the manufacturer.
4. **Designated Storage Area**

	* Designated Storage Areas approved for the storage of ammunition are the CCBI Firearms Laboratory and the CCBI Firearms Laboratory Test Firing Facility.
	* Designated Storage Areas approved for the storage of firearms reference standards are CCBI Firearms Laboratory and the CCBI Main Evidence Vault.
5. **Designated Test Firing Area** – An area approved for the test firing a firearm. Approved test firing areas include the CCBI Firearms Laboratory Test Firing Facility and any Wake County Firing Ranges.
6. **Foot-Pounds of Energy (FPE)** – A common unit of measurement in the United States for the

energy that a bullet carries.

1. **Loading Firearm** – The act of placing cartridges or shotshells into a magazine or cylinder of a firearm or the act of placing of a magazine containing cartridges or shotshells into a firearm.
2. **Personal Protective Equipment (PPE)** – Protective clothing, goggles, or other garments or equipment designed to protect the wearer’s body from injury or infection.

	* Firearms PPE – eye protection, hearing protection, and ballistic vest. (Optional PPE -gloves, lab coat, hat, or other equipment the examiner deems necessary for protection.)
	* Chemical PPE – safety goggles and gloves. (Optional PPE may also include lab coat, hat, or other equipment the examiner deems necessary for protection.)
3. **Reference Standards** – Gage blocks, the traceable stage micrometer, the DMD calibration rod, and NIST-traceable ruler.
4. **Rifling** – Helical grooves cut or impressed into the bore of a firearm barrel to impart rotary motion to a projectile when fired.

	* Conventional Rifling – Lands and grooves having a sharp rectangular profile.
	* Polygonal Rifling – Lands and grooves having a rounded profile instead of the traditional rectangular profile. Polygonal rifling is often seen in hammer forged barrels.
5. **Technical Review** – A technical review as outlined in CCBI Laboratory Administrative Procedures Manual Chapter 2, including a verification of conclusion(s) by a second qualified Firearms Examiner.
6. **Test Fire Warning System**

	* CCBI Test Fire Warning System – This system includes:

		+ Activating the CyberNational Bullet Recovery System blower which activates the CCBI laboratory test fire warning lights and locks access doors to the Vehicle Examine Garage (Room C1392).
		+ Thirty minutes prior to test firing an email will be sent to a list of correspondents set forth by the Director of CCBI.
		+ Ensuring the Vehicle Examine Garage (Room C1392) is clear of all persons.
	* Wake County Test Fire Warning System – All procedures, actions, and rules set forth by the range facility.

**IBIS/NIBIN Definitions:**

1. **Acquisition** – The process by which an image of a cartridge case headstamp, firing pin impression, and/or ejector mark are entered into IBIS through the BrassTrax system.
2. **BrassTrax** – A computerized system for acquiring and storing the images of cartridge cases of questioned origin and those fired from known firearms. IBIS captures digital images of the primer/firing pin area of fired cartridge cases using optical and electronic technology. The images are then stored in databases and sophisticated algorithms are used to correlate the images against each other using filters. The correlations produce lists of possible associations with the highest scoring correlations at the top of the list. The images are called up and can be viewed side by side on a monitor using MatchPoint Plus. BrassTrax is only capable of entering fired cartridge casings and not fired bullets.
3. **Correlation** – The automated comparison of an acquired digital image to other images in the databases using an algorithm that provides a list of ranked, possible matches.
4. **Correlation Review** – The on-screen comparison of digital images by a trained technician/specialist to determine the potential for two cartridge casings to have been fired from the same weapon.

	1. Primary – The initial correlation review done for all automated correlations.
	2. Secondary – The correlation review completed for primary correlation reviews that result in a NIBIN Lead.
5. **Crime Gun** – Any firearm that is illegally possessed, used in a crime, or suspected by law enforcement officials of having been used in a crime or act of terrorism. This includes firearms abandoned or otherwise taken into law enforcement custody that are either suspected to have been used in a crime or whose proper disposition can be facilitated through a firearms trace.
6. **IBIS** – Integrated Ballistics Identification System - An automated ballistics imaging and analysis systemthat populates a computerized database of digital ballistic images of bullets and casings from crime guns. Technology that enables the imaging and identification of large quantities of **firearm evidence** across a network of sites, as well as the automated identification of likely matching bullets or cartridge cases.
7. **MatchPoint Plus** – Current system developed by Ultra Electronics - Forensic Technology, Incorporated that stores the ballistic images and contains the algorithm program for correlation reviews.
8. **National Crime Gun Intelligence Governing Board** – Formally NIBIN Executive Board or “NEB”. A group consisting of members of ATF, police departments, and forensic laboratories that oversees implementation and function of NIBIN program.
9. **NIBIN** – National Integrated Ballistic Information Network (NIBIN) is a program managed by ATF that automates the imaging of the unique identifiers of cartridge cases fired from firearms and stores the digital images into a database for comparison across a national network of participating sites.
10. **NIBIN Authorized Trainer (NAT)** – A technician trained and authorized by ATF to train others in the acquisition of ballistic images.
11. **NIBIN Hit** – NIBIN Hits are the result of two or more acquisitions that have been confirmed as a match by a Firearm Examiner. NIBIN Hits are based on correlation review of digital images using MatchPoint and microscopic confirmation by a Firearm Examiner. This information/intelligence can be used for investigative purposes and is suitable for court purposes.
12. **NIBIN Lead** – A NIBIN Lead is an unconfirmed, potential association between two or more pieces of firearm ballistic evidence based on a correlation review of the digital images in the NIBIN database by either a Firearm Examiner or a trained IBIS technician. A NIBIN Lead is intended to provide a lead for investigative purposes.
13. **NIBIN Program Administrator** – An individual the NIBIN Site has designated to communicate with all parties (i.e. submitting law enforcement agencies, ATF Crime Gun Intelligence Centers, etc.), involved in the NIBIN process. The NIBIN Program Administrator must be a qualified NIBIN user and full-time employee of the NIBIN site. They should be responsible for implementing and directing policies and procedures of the NIBIN site.
14. **NIBIN Site** – Also referred to as just “Site”. Location at which NIBIN acquisition and/or correlation technology is present. NIBIN sites are located in forensic laboratories, police departments, etc.
15. **NNCTC** – National NIBIN Correlation and Training Center. ATF facility that performs timely correlation reviews for multiple NIBIN sites and provides training for Qualified NIBIN Users.
16. **Qualified NIBIN User** – Technician and/or Firearm Examiner trained by ATF, Forensic Technology, and/or a NAT program to perform acquisition and/or correlation reviews of ballistic images on the national network.
17. **Triage** – The process of assessing cartridge cases to determine the best representative sample from a group of cartridge cases having similar firearm produced markings for NIBIN entry. This is not, nor should it be interpreted as a comparative examination to determine how many firearms may have been responsible for firing the cartridge case.
18. **Ultra Electronics - Forensic Technology, Incorporated (“FT,” “FTI”)** – created the Integrated Ballistics Identification System (IBIS) in 1991; an IBIS machine incorporates technology for the acquisition and correlation of ballistic images.

**Serial Number Restoration Definitions:**

1. **Characters** – Symbols, numbers, letters, etc. that constitute a serial number.
2. **Etchant** – A chemical that produces a corrosive on material such as metal.
3. **Magnaflux** – A commercial manufacturer of magnetic particle inspection products.
4. **Solvent** – Usually a liquid used to dissolve or disperse another substance.
5. **Acidic Ferric Chloride Solution** – Ferric chloride, Hydrochloric acid (Certified A.C.S. Plus), diH2O
6. **Davis Reagent Solution** – Cupric chloride, Hydrochloric acid (Certified A.C.S. Plus), diH2O
7. **Ferric Chloride Solution** – Ferric chloride, diH2O
8. **Fry’s Reagent** – Cupric chloride, Hydrochloric acid (37% A.C.S. Reagent)
9. **Sodium Hydroxide Solution** – Sodium hydroxide, diH2O
10. **Turner’s Reagent** – Cupric chloride, Hydrochloric acid (Certified A.C.S. Plus), Ethyl alcohol, diH2O
11. **Phosphoric Nitric Acid –** Phosphoric acid, Nitric acid
12. **Cleaning Solution –** Methanol, acetone

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| **Revision History** |
| **Effective Date** | **Version Number** | **Reason** |
| 4/1/2019 | 1 | Original Document |
| 7/8/19 | 2 | Added LIMP and GIMP abbreviations |
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