ASB Standard 163, First Edition
202X

Standard for the Restoration of Obliterated Serial Numbers and Other Manufacturer Applied Markings

DRAFT



This document is copyrighted © by the AAFS Standards Board, LLC. 202X All rights are reserved.
410 North 21st Street, Colorado Springs, CO 80904, www.aafs.org/academy-standards-board.

Standard for the Restoration of Obliterated Serial Numbers and Other Manufacturer Applied Markings

ASB Approved Xxxxx 202X

ANSI Approved Xxxxx 202X

410 North 21st Street
Colorado Springs, CO 80904

This document may be downloaded from: www.aafs.org/academy-standards-board

This document is provided by the AAFS Standards Board (ASB). Users are permitted to print and download the document and extracts from the document for personal use, however the following actions are prohibited under copyright:

- *modifying this document or its related graphics in any way;*
- *using any illustrations or any graphics separately from any accompanying text; and,*
- *failing to include an acknowledgment alongside the copied material noting the AAFS Standards Board as the copyright holder and publisher.*

Users may not reproduce, duplicate, copy, sell, resell, or exploit for any commercial purposes this document or any portion of it. Users may create a hyperlink to www.aafs.org/academy-standards-board to allow persons to download their individual free copy of this document. The hyperlink must not portray AAFS, the AAFS Standards Board, this document, our agents, associates and affiliates in an offensive manner, or be misleading or false. ASB trademarks may not be used as part of a link without written permission from ASB.

The AAFS Standards Board retains the sole right to submit this document to any other forum for any purpose.

Certain commercial entities, equipment or materials may be identified in this document to describe a procedure or concept adequately. Such identification is not intended to imply recommendations or endorsement by the AAFS or the AAFS Standards Board, nor is it intended to imply that the entities, materials, or equipment are necessarily the best available for the purpose.

Proper citation of ASB documents includes the designation, title, edition, and year of publication.

This document is copyrighted © by the AAFS Standards Board, LLC. 202X All rights are reserved.
410 North 21st Street, Colorado Springs, CO 80904, www.aafs.org/academy-standards-board.

DRAFT

Foreword

This standard provides test methods used in the restoration of obliterated serial numbers and other manufacturer markings. Depending on the material composition of the item being examined for restoration, different techniques in this test method may be used. The policies of the Forensic Science Service Provider (FSSP) may inform the practitioner as to which techniques in the method will be used.

The American Academy of Forensic Sciences established the Academy Standards Board (ASB) in 2015 with a vision of safeguarding Justice, Integrity and Fairness through Consensus Based American National Standards. To that end, the ASB develops consensus based forensic standards within a framework accredited by the American National Standards Institute (ANSI) and provides training to support those standards. ASB values integrity, scientific rigor, openness, due process, collaboration, excellence, diversity and inclusion. ASB is dedicated to developing and making freely accessible the highest quality documentary forensic science consensus Standards, Guidelines, Best Practices, and Technical Reports in a wide range of forensic science disciplines as a service to forensic practitioners and the legal system.

This document was revised, prepared, and finalized as a standard by the Firearms and Toolmarks Consensus Body of the AAFS Standards Board. The draft of this standard was developed by the Firearms and Toolmarks Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science.

Questions, comments, and suggestions for the improvement of this document can be sent to AAFS-ASB Secretariat, asb@aafs.org or 410 N 21st Street, Colorado Springs, CO 80904.

All hyperlinks and web addresses shown in this document are current as of the publication date of this standard.

ASB procedures are publicly available, free of cost, at www.aafs.org/academy-standards-board.

DRAFT

Keywords: *obliteration, serial number, serial number restoration.*

Table of Contents *(to be updated when the document is finalized)*

1 Scope

2 Normative References

3 Terms and Definitions

4 Requirements
4.1 General
4.2 Equipment and Materials
4.3 Test preparations
4.4 Documentation
4.5 Evidence Handling
4.6 Preliminary examination
4.7 Surface Preparation
4.8 Magnetic Particle Inspection
4.9 Chemical Restoration
4.10 Electrochemical Restoration
4.11 Heat Restoration in Plastic Surfaces
4.12 Report Wording

Annex A (normative) Reagent Formulas

Annex B (informative) Bibliography

DRAFT

Standard for the Restoration of Obliterated Serial Numbers and Other Manufacturer Applied Markings

1 Scope

This document provides procedures for commonly used serial number restoration techniques. These procedures provide the requirements to conduct, document, and report on any results of the restoration of obliterated serial numbers and other manufacturer-applied markings.

Other restoration techniques may be available and appropriate but are beyond the scope of this document.

2 Normative References

The following references are indispensable for the application of the standard. For dated references, only the edition cited applies. See Annex B, Bibliography, for informative references.

ANSI/ASB Best Practice Recommendation 068, *Safe Handling of Firearms and Ammunition*, First Edition, 2020.

ANSI/ASB Standard 093, *Standard Test Method for the Forensic Examination and Testing of Firearms*, First Edition, 2020.

3 Terms and Definitions

3.1
serial number
The numbers or letters applied to a surface as a unique identifier for an item in conjunction with other manufacturer markings.

3.2
manufacturer markings
The words, numbers, or symbols that are applied by a manufacturer that convey information about that item.

3.3
serial number restoration
The application of methods used for the retrieval, recovery, or revisualization of the manufacturer-applied markings.

3.4
barcode
The broad, generic term that includes various types of machine-readable markings used to store data, including 1D, 2D, and QR codes, among others.

4 Background

4.1 Many manufactured items have markings for identification. Only serial number restoration in the context of firearms will be referred to in the remainder of this document. However, these

DRAFT

procedures may be applicable to the restoration of serial numbers or other markings on both firearms and non-firearm items.

4.2 The process of applying identifying markings often deforms the metal or plastic in the immediate area and for a short distance below the visible character.

4.3 Serial numbers can be removed and/or obliterated in a variety of ways. The serial number may be restored if the removal or obliteration does not extend below the deformed area of the metal or plastic.

5 Equipment and Materials

The following is a non-exhaustive list of equipment and materials that may be used to perform serial number restoration techniques.

- Various light sources.
- Personal protective equipment.
- Engraver or scribe.
- Microscope(s).
- Tools necessary for the disassembly of firearms.
- Fume/exhaust hood.
- Chemicals and reagents for chemical/electrochemical restoration techniques. (Annex A provides formulas required for reagent preparation.)
- Magnetic particle suspension (e.g., Magnaflux™[a]).
- Magnets.
- Cleaners and/or solvents.
- Sanding/polishing equipment.
- Cotton-tipped swabs or other applicators.
- Power source (for electrochemical restoration).

6 Requirements

6.1 Evidence Handling

6.1.1 The evidence shall be marked for identification in accordance with laboratory protocols.

[a] This term is used as an example only and does not constitute an endorsement of this product by the AAFS Standards Board.

DRAFT

6.1.2 Care shall be taken to ensure no identification markings interfere with or damage areas of interest.

6.2 Documentation

6.2.1 The practitioner shall photograph the area of obliteration before beginning the restoration process, at the conclusion of the process, and during the processing as characters are visualized.

6.2.2 When characters cannot be photographed, the reasons shall be documented.

6.2.3 The examiner shall document in the technical record which of the methods in sections 6.4 through 6.8 are used in the serial number restoration.

NOTE 1 Acceptable forms of documentation include, but are not limited to, worksheets, laboratory notes, sketches, photographs, or a combination thereof for the general documentation of the entire restoration process.

NOTE 2 Additional documentation requirements are included in each Section.

6.3 Preliminary Examination

6.3.1 The practitioner shall:

a) wear gloves suitable for protection against chemicals and biological hazards when present on the items being examined;

b) wear eye protection when working with chemical reagents or operating power tools;

c) work within a fume hood or wear respiratory protection when working with volatile chemical reagents or polishing equipment;

d) minimize exposure to skin when an ultraviolet light source is used;

NOTE This could include wearing protective clothing and using eye protection.

e) ensure that the firearm is unloaded prior to examination and follow all applicable safe handling requirements found in ANSI/ASB Best Practice Recommendation 068, *Safe Handling of Firearms and Ammunition;*

f) perform function testing and test firing prior to serial number restoration, unless specifics of the case dictate otherwise, following standard methods for function testing found in ANSI/ASB Standard 093, *Standard Test Method for the Examination and Testing of Firearms*.

6.3.2 The examiner shall document the following, as applicable:

a) location of obliterated serial number;

b) any coatings or trace material present;

c) suspected method of obliteration;

d) characters and character remnants visible prior to restoration;

DRAFT

e) composition of the substrate (e.g., ferrous metal, aluminum alloy);

f) potential serial number structure (refer to the firearm reference collection or serial number structure guides); and

g) any barcodes or hidden serial number.

NOTE The presence of either may negate the need for restoration, depending on laboratory policy.

6.3.3 The examiner shall determine the restoration technique(s) that will be utilized.

6.3.4 The practitioner should cast toolmarks according to the casting material manufacturer instructions prior to serial number restoration processes if the obliteration of the serial number itself produced toolmarks that may be identifiable to a specific tool.

6.4 Surface Preparation

6.4.1 The examiner shall prepare the obliterated area for restoration, as applicable, by:

a) removing dirt, debris, paint or other obscuring substances, using a cleaner or solvent to remove obscuring material;

b) smoothing scratches and burrs introduced during obliteration by polishing the area of the obliteration using a fine grit abrasive until the surface is smooth, removing as many scratches as possible without destroying the area of deformation.

NOTE 1 If the obliteration is deep, it may not be possible or desirable to remove all the scratches.

NOTE 2 The surface preparation procedure may reveal some or all of the characters.

6.4.2 The examiner shall document any characters that become visible.

6.4.3 If a barcode becomes clearly visible, then the practitioner shall photograph the barcode for additional examination.

6.4.4 If all expected characters do not become legible after surface preparation, the practitioner shall continue the restoration process.

6.5 Magnetic Particle Inspection (MPI)

NOTE 1 The magnetic particle inspection (MPI) technique is used to detect surface or subsurface irregularities in ferrous materials such as steel and iron. In conjunction with surface preparation, use of this technique can be an effective, non-destructive way to restore obliterated characters. The MPI technique may be applied at various stages during the restoration method, even after chemical restoration is attempted.

NOTE 2 An item is suitable for MPI if a magnetic field can be generated in the obliterated area. The examiner can test this using a magnet. Weak magnetic fields may not be immediately detectable but still may be suitable for MPI.

DRAFT

6.5.1 The examiner shall follow this procedure for magnetic particle inspection:

a) obtain or prepare magnetic particle suspension according to FSSP procedure or manufacturer specification;

b) place a magnet, with the poles on either side of the area of obliteration;

NOTE This placement may be adjusted to reveal more or different areas of the obliteration.

c) apply the magnetic particle suspension to the area of obliteration;

NOTE An ultraviolet light is necessary to reveal characters when a fluorescent magnetic particle suspension is used.

d) document any characters, or parts of characters, as they appear;

e) document the type of magnet, the type of magnetic particle suspension, and the type of lighting used.

6.5.2 If all expected characters do not become legible after MPI, the practitioner shall continue the restoration process.

6.6 Chemical Restoration

NOTE The chemical restoration technique, sometimes referred to as the chemical etching technique, is suitable for restoration of serial numbers in metal. This technique, in conjunction with the surface preparation technique, is an effective way to restore an obliterated serial number in metal.

6.6.1 The practitioner shall follow this procedure for chemical restoration:

a) determine the magnetic properties of the serial number substrate and use appropriate chemical reagent(s);

NOTE Common reagents are listed below in order of increasing reactivity and formulas for each reagent may be found in Annex A.

- Magnetic (Ferrous) Substrate:
  - Davis Reagent
  - Turner's Reagent
  - Fry's Reagent
- Non-magnetic (Non-Ferrous) Substrate - Zinc
  - Ferric Chloride
  - Phosphoric Acid/Nitric Acid (Knowles Reagent)
  - 25% Nitric Acid
- Non-magnetic (Non-Ferrous) Substrate - Aluminum
  - Ferric Chloride
  - Acidic Ferric Chloride 10%

DRAFT

— Sodium Hydroxide

— 25% Nitric Acid

NOTE Examiners may consider other reagents or etchant formulas from literature as appropriate for the alloy encountered.

b) document the reference information for reagents used from sources not listed in the bibliography of this standard;

c) test the chosen reagent in an area away from the serial number location to determine if the reagent reacts with the substrate;

1) document the results of this test;

2) do not proceed with a reagent that does not show a reaction; and

3) repeat the test for each reagent used;

d) apply the selected reagents to the area of obliteration;

NOTE The examiner may choose to alternate between or change reagents as needed based on the appearance of the obliterated area.

e) document any characters, or parts of characters, as they appear;

f) document the reagents used and the order in which they are applied; and

g) rinse the area that was in contact with the reagents with a neutralizing solution and apply a preservative such as oil, a clear lacquer, etc., to inhibit corrosion at the conclusion of the chemical restoration procedure.

6.7 Electrochemical Restoration

NOTE The electrochemical restoration technique is an enhanced form of chemical restoration in which the application of a voltage potential assists with the oxidation of the specimen. This technique, in conjunction with the surface preparation technique, can be used to restore an obliterated serial number in ferrous metal.

6.7.1 The practitioner shall follow this procedure for electrochemical restoration:

a) attach the specimen to the positive terminal of the power supply via an alligator clip;

b) turn on the power supply and adjust the voltage;

NOTE Three to six volts is typically sufficient.

c) thoroughly soak the cotton tip of an applicator with the selected chemical etchant and attach the negative terminal of the power supply to a moistened area at the base of the cotton tip;

d) wipe the area of obliteration with the moistened tip of the cotton swab;

e) document any characters, or parts of characters, as they appear;

DRAFT

f) document the reagents used and the order in which they are applied; and

g) rinse the area that was in contact with the reagents with a neutralizing solution and apply a preservative such as oil, a clear lacquer, etc., to inhibit corrosion at the conclusion of the electrochemical restoration procedure.

6.8 Heat Restoration in Plastic Surfaces

NOTE The application of heat can be a suitable restoration method for serial numbers in plastic. The die stamping or embossing process is a form of cold-working plastic. A side effect of cold-working is the decrease of that item's ability to resist heat.

6.8.1 The examiner shall follow this procedure for heat restoration in plastic surfaces:

a) carefully apply heat to the area of obliteration using a high-intensity lamp, heat gun, or other heat source, using caution so as not to melt the surrounding area;

b) continue the application of heat until the plastic in the obliterated area starts to soften;

c) document any characters, or parts of characters, as they appear; and

d) document the heat source used and time of application.

6.9 Serial Number Character Verification

6.9.1 A second authorized examiner shall provide visual verification of any restored characters and document their observations in the technical record.

NOTE Photographic documentation from the original examiner that completely captures the restored characters, or parts of characters, is acceptable for visual verification.

6.9.2 The documentation of verification shall include the characters, or parts of characters, visualized, any additional restoration processes used by the verifier, the name of the verifier, and the date of the verification.

7 Report Wording

7.1 The report shall include a description of the firearm or other item that is examined.

7.2 For firearms, the description shall include, when known, the make or manufacturer, firearm type, model, and caliber or gauge.

7.3 The report shall document any characters that were legible prior to the restoration.

7.4 The entire structure of the serial number, if known, shall be represented in the report, to include fully and partially restored characters and locations of characters that could not be restored.

DRAFT

Annex A
(informative)

Reagent Formulas

Annex A contains formulas for common chemical reagents used in chemical restoration procedures. FSSP procedures may provide additional reagents or formulas for use by practitioners.

A.1 Reagent Preparation

10% Sodium Hydroxide

10 g sodium hydroxide 90 mL distilled water

25% Nitric Acid

25 mL nitric acid

75 mL distilled water

Acidic Ferric Chloride

25 g ferric chloride

25 mL hydrochloric acid

100 mL distilled water

Davis' Reagent

5g cupric chloride

50 mL hydrochloric acid

50 mL distilled water

Ferric Chloride

25 g ferric chloride

100 mL distilled water

Fry's Reagent

90 g cupric chloride

120 mL hydrochloric acid

100 mL distilled water

Phosphoric Acid/Nitric Acid

98 mL 85% phosphoric acid

2 mL concentrated nitric acid

DRAFT

Turner's Reagent

2.5 g cupric chloride

40 mL hydrochloric acid 25 mL ethyl alcohol

30 mL distilled water

DRAFT

Annex B
(informative)

Bibliography

The following bibliography is not intended to be an all-inclusive list, review, or endorsement of literature on this topic. The goal of the bibliography is to provide publications cited informationally, and publications relevant to the standard.

1] Deats, Marcellus. "Serial Number Restoration Information." AFTE Journal 12.3 (1980): 82-83.

2] Desrochers, C., et al. "Serial Number Restoration in Plastic Using a Heat Gun." AFTE Journal 32.4 (2000): 367.

3] Gicale, Dana B., "Methods for the Reconstruction and Decoding of 2D Matrix Bar Codes", AFTE Journal 51.1 (2019): 3-8.

4] James, Stuart H. and Jon J. Nordby, eds. Forensic Science: An Introduction to Scientific and Investigative Techniques. 2nd ed. Boca Raton: CRC Press, 2005.

5] Klees, Gregory S. "The Restoration of Obliterated Laser-Etched Firearm Identifiers by Conventional and Alternative Decryption Methods." AFTE Journal 34.3 (2002): 264-267.

6] Knowles, M, "Instant Recovery of Obliterated Serial Numbers", AFTE Journal 17. 3 (1985), p. 65.

7] Malikowski, Shawn G. "The Restoration of an Obliterated Serial Number and Barcode Using Digital Photography and Adobe® PhotoShop®." AFTE Journal 36.2 (2004): 237-238.

8] Mathews, J. Howard. Firearms Identification. Vol. 1. Madison, Wis.: Univ. of Wisconsin Press, 1962.

9] Miller, Ken E. "Current Assist for Die Stamp Impression Restoration." AFTE Journal 4.3 (1972): 38.

10] O'Reilly, W.E. "Magnetic Restoration of Serial Number." AFTE Journal 2.NL07 (1970): 26-27.

11] Roberts, Van. "Restoration of Serial Numbers in Plastic." AFTE Journal 13.4 (1981): 40-47. 11]

12] Schaefer, Jeffrey. "Serial Number Restoration Observations." AFTE Journal 19.3 (1987): 276-278.

13] Serial Number Restoration Reagents for Plastics. Sirchie Finger Print Laboratories, n.d. Web. 18 Nov. 2014.

14] Polk, Donald E. and Bill C. Giessen. "Metallurgical Aspects of Serial Number Recovery." AFTE Journal 7.2 (1975): 38-52. Rpt. in AFTE Journal 21.2 (1989): 174-181.

15] Treptow, Richard. National Aeronautics and Space Administration. Handbook of Methods for the Restoration of Obliterated Serial Numbers. Chicago: Chicago State University, 1977.

DRAFT

16] Turley, Dennis M. "Restoration of Stamp Marks on Steel Components by Etching and Magnetic Techniques." Journal of Forensic Sciences 32.3 (1987): 640-649.

17] United States Department of Justice, Bureau of Alcohol, Tobacco, Firearms, and Explosives Laboratory. Serial Number Restoration Handbook. 1999.

18] United States Department of Justice, Bureau of Alcohol, Tobacco, Firearms, and Explosives Laboratory. Firearm Serial Number Structure Guide, 2024.

DRAFT

DRAFT



Academy Standards Board
410 North 21st Street
Colorado Springs, CO 80904

www.aafs.org/academy-standards-board