OSAC 2023-S-0018
Test Method for the Restoration of Obliterated Serial Numbers and Other Markings

Firearms & Toolmarks Subcommittee
Physics/Pattern Interpretation Scientific Area Committee (SAC)
Organization of Scientific Area Committees (OSAC) for Forensic Science

OSAC Proposed Standard

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This document provides procedures for the restoration of obliterated serial numbers and other markings by forensic examiners or technicians.

Foreword

This standard test method document was proposed by the Firearms and Toolmarks Subcommittee of the Organization of Scientific Area Committees (OSAC) by submitting a request to the American Academy of Forensic Sciences (AAFS) Academy Standards Board (ASB). This document is intended to provide procedures for the restoration of obliterated serial numbers and other markings by forensic firearm and toolmark examiners or technicians.

Laboratory policy may inform examiners/technicians as to which steps in the process are appropriate.

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

Table of Contents

Standard Test Method for the Restoration of Obliterated Serial Numbers and Other Markings

1 Scope

These procedures include the most commonly-used techniques. Other techniques may be available and appropriate but are beyond the scope of this document. Following these procedures, an examiner or technician will be able to conduct, document, and report on any results of the restoration of obliterated serial numbers and other markings.

Only serial number restoration in the context of firearms will be referred to in the remainder of this document. However, these procedures may be applicable to the restoration of serial numbers or other markings on firearms and non-firearm items, as well as other markings.

2 Normative References

Best Practice Recommendations for the Safe Handling of Firearms and Ammunition.

Standard Test Method for the Examination and Testing of Firearms.

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

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.

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3 Terms and Definitions

None.

4 Requirements

4.1 Background

Many manufactured items have serial numbers for identification. The process of applying the numbers often deforms the metal or plastic in the immediate area and for a short distance below the visible number.

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. Many methods to obliterate serial numbers may, themselves, produce toolmarks identifiable to a suspect tool. If preservation is desired, these toolmarks shall be cast prior to serial number restoration processes.

4.2 Equipment and Materials

- Various light sources
- Personal protective equipment
- Engraver or scribe
- Microscope (various types)
- Various tools necessary for the disassembly of firearms
- Fume/exhaust hood
- Chemicals/reagents necessary for restoration (See Appendix A for reagent preparation instructions)
- Magnetic particle suspension (e.g. Magnaflux™)
- Magnets (various types)
- Cleaners and/or solvents
- Sanding/polishing equipment
- Cotton-tipped swabs or other applicators
- Power source (e.g., electrochemical restoration)

4.3 Test Preparations

4.3.1 Use appropriate personal protective equipment.

4.3.1.1 Wear appropriate gloves when using chemical reagents or when handling evidence contaminated with chemical and/or biological hazards.

4.3.1.2 Wear eye protection when working with chemical reagents or operating power tools.

4.3.1.3 Work within a fume hood or wear an appropriate respiratory protection when working with volatile chemical reagents and/or polishing equipment.

4.3.1.4 If an ultraviolet light source is used, minimize exposure to skin by wearing appropriate protective clothing and using appropriate eye protection.

4.3.2 Ensure that the firearm is unloaded prior to examination and follow all appropriate measures for safe handling. Refer to *ANSI/ASB Best Practice Recommendation 068 for the Safe Handling of Firearms and Ammunition*.

4.3.3 Perform function testing and test firing prior to serial number restoration unless specifics of the case dictate otherwise. Refer to *ANSI/ASB Standard 093, Standard Test Method for the Examination and Testing of Firearms*.

4.4 Documentation

4.4.1 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.

4.4.2 Specifically, use photography to document the area of obliteration before beginning the restoration process and at the conclusion of the process, to include any characters restored. If restored characters cannot be photographed, note the reason(s).

4.4.3 Document contemporaneously as restored characters appear, given they may be transient.

4.4.4 Document the following, as appropriate:

- Restoration procedures used
- Chemical reagents used and their order of use
- Result of reagent check(s)

4.5 Evidence Handling

4.5.1 Document the condition of the evidence packaging as received and mark the packaging in accordance with laboratory protocols.

4.5.2 Mark the evidence for identification in accordance with laboratory protocols.

4.6 Initial Examination

4.6.1 Determine and document the following, as appropriate:

- Location of obliterated serial number
- Any coatings or trace material present
- Suspected method of obliteration
- Characters and character remnants visible prior to restoration
- Composition of substrate (e.g., ferrous metal, aluminum alloy)
- Possible serial number structure (e.g., firearm reference collection and serial number structure guides).

4.6.2 Determine if the firearm contains a barcode or hidden serial number. The presence of either may obviate the need for a restoration, depending on laboratory policy.

4.6.3 Determine the restoration technique(s) that will be utilized. Non-destructive methods such as magnetic particle inspection should be used before destructive methods, where appropriate, and may be used at subsequent stages of the examination (e.g., before and after polishing).

4.7 Surface Preparation

It is desirable to remove dirt, debris, paint or other obscuring substances and to smooth scratches and burrs introduced during obliteration. The surface preparation procedure can be effective independently but is more often performed prior to various chemical or physical restoration procedures.

4.7.1 Use an appropriate cleaner or solvent to remove obscuring material.

4.7.2 Polish the area of the obliteration using a fine grit abrasive. Depending on the extent of the obliteration, continue polishing until the surface is smooth, removing as many scratches as possible without destroying the area of deformation. If the obliteration is deep, it may not be possible or desirable to remove all the scratches.

4.7.3 Document any characters that become visible. If a barcode becomes clear enough for decryption, then consider the use of one of the methods outlined by Klees or Malikowski (see references).

If all the characters do not become visible or legible, proceed to the appropriate restoration procedure.

4.8 Magnetic Particle Inspection Restoration

The magnetic particle inspection 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 procedure can be an effective, non-destructive method to restore obliterated characters. The magnetic particle inspection technique may be applied at various stages during the restoration procedure, even after chemical restoration is attempted.

4.8.1 Determine whether the specimen is suitable for magnetic particle inspection by ensuring the magnetic field can be adjacent to the area of obliteration. The specimen is suitable if it is magnetic.

4.8.2 Prepare magnetic particle suspension.

4.8.3 Apply selected magnetic particle suspension to the area of obliteration.

4.8.4 Place a magnet, with the poles on either side of the area of obliteration. This placement may be adjusted to reveal more or different areas of the obliteration.

4.8.5 If a fluorescent magnetic particle suspension is used, observe the characters under an ultraviolet light.

4.8.6 Document any characters that become visible during the process.

4.8.7 If no characters become visible, proceed to the appropriate chemical restoration procedure.

4.9 Chemical Restoration

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

4.9.1 Determine the magnetic properties of the serial number substrate and use appropriate chemical reagent(s), as listed below in order of increasing reactivity; this is not an exhaustive list. Depending on the alloy encountered, examiners may find additional reagents that perform equally well or better.

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% Sodium Hydroxide
25% Nitric Acid

Test the chosen reagent in an area away from the serial number location in order to determine if the reagent is reacting appropriately for the substrate. Document the result(s) of this test. Do not proceed with a reagent that does not react appropriately. Any additional reagents used later in the process should also be tested for reactivity.

4.9.2 Apply the reagent to the area of obliteration utilizing cotton tipped applicators or swabs that have been moistened with the chemical solution. Alternating between (particularly the reagents for zinc alloys) or changing reagents may assist in the recovery process.

4.9.3 Document any characters that become visible.

4.9.4 At the conclusion of the chemical restoration process, rinse the area that was in contact with the reagent with water and apply a preservative such as oil, a clear lacquer, etc. to inhibit corrosion.

4.10 Electrochemical Restoration

The electrochemical technique using the standard chemical etchants is an enhanced form of chemical restoration, in which the application of a voltage potential assists with the oxidation of the specimen. This procedure, in conjunction with the surface preparation procedure, may be an effective way to restore an obliterated serial number in ferrous metal.

4.10.1 Attach the specimen to the positive terminal of the power supply via an alligator clip. Turn on the power supply and adjust the voltage. Three to six volts is typically sufficient.

4.10.2 Thoroughly soak the cotton tip of an applicator with the appropriate chemical etchant and attach the negative terminal of the power supply to a moistened area at the base of the cotton tip.

4.10.3 Wipe the area of obliteration with the moistened tip of the cotton swab.

4.10.4 Document any characters as they become visible.

4.10.5 At the conclusion of the electrochemical restoration process, rinse the area that was in contact with the reagent with water and apply a preservative such as oil, a clear lacquer, etc. to inhibit corrosion.

4.11 Heat Restoration in Plastic Surfaces

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.

4.11.1 Carefully apply heat to the area of obliteration using a high intensity lamp, heat gun, or other suitable heat source, using caution so as not to melt the surrounding area.

4.11.2 Continue the application of heat until the plastic in the obliterated area starts to soften.

4.11.3 Document any characters as they become visible.

4.12 Test Reports

4.12.1 The test report shall include a description of the firearm or other item that is examined. At a minimum, the description of a firearm shall include, if known, the make/manufacturer, firearm type, model, caliber/gauge, and any legible serial number characters.

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

Annex A
(normative)

Reagent Formulas

A.1 Reagent Formulas

A.1.1 10% Sodium Hydroxide

10 g sodium hydroxide
90 mL distilled water

A.1.2 25% Nitric Acid

25 mL nitric acid
75 mL distilled water

A.1.3 Acidic Ferric Chloride

25 g ferric chloride
25 mL hydrochloric acid
100 mL distilled water

A.1.4 Davis' Reagent

5 g cupric chloride
50 mL hydrochloric acid
50 mL distilled water

A.1.5 Ferric Chloride

25 g ferric chloride
100 mL distilled water

A.1.6 Fry's Reagent

90 g cupric chloride
120 mL hydrochloric acid
100 mL distilled water

A.1.7 Phosphoric Acid/Nitric Acid

98 mL 85% phosphoric acid
2 mL concentrated nitric acid

A.1.8 Turner's Reagent

2.5 g cupric chloride
40 mL hydrochloric acid
25 mL ethyl alcohol
30 mL distilled water

Annex B

(informative)

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