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## Technical Procedure for Serial Number Restoration

**1.0 Purpose** – To outline the procedures in the restoration of obliterated or altered serial numbers or other manufacturer's markings on firearms and other items.

**2.0 Scope** – This procedure applies to any metallic evidence submitted to the Firearms Unit on which markings have been completely or partially obliterated or altered.

### 3.0 Definitions

- **Characters** – Symbols, numbers, letters, etc. that constitute a serial number.
- **Etchant** – A chemical that produces a corrosive action on material such as metal.
- **Magnaflux** – A commercial manufacturer of magnetic particle inspection products.
- **Solvent** – Usually a liquid used to dissolve or disperse another substance.

### 4.0 Equipment, Materials, and Reagents

- Stereomicroscope
- Rotary grinding tool
- Magnet
- Horseshoe magnet or electro-magnetic yoke
- Magnaflux baths (9CM and/or 7HF)
- Fry's Reagent
- Turner's Reagent
- Davis Reagent
- 25 % Nitric acid
- 10 % Sodium hydroxide
- Ferric chloride
- Acidic ferric chloride
- Cotton-tipped swabs
- Disposable pipettes
- Distilled water
- Deionized water
- Polishing compound
- Sandpaper
- Fume hood
- Personal protective equipment

### 5.0 Procedure

#### 5.1 Serial Number Restoration

##### 5.1.1 Item Preparation

- **5.1.1.1** Prior to examination, ensure that any additional service requests (e.g., Forensic Biology, Trace, Latent) that shall be completed before analysis by the Firearms Unit have been completed. This may be verified by examining one, or a combination of, the following:

- ### 5.1.2 Visual Examination

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**5.1.2.3** Note the method of obliteration (e.g., scratched, gouged, ground, drilled, peened, punched, chemically etched).

**5.1.2.4** Record the “as received” condition observed during the initial examination including any discernible or partial characters and their position prior to any processing.

### **5.1.3 Preparing the Surface**

**5.1.3.1** Polishing the surface may be used to remove obliteration scratches that obscure the serial number. Polishing may be effective independently, but is more often used in conjunction with various chemical procedures.

**5.1.3.2** Polish the area of obliteration using a rotary grinding tool with a soft polishing stone attached, or other appropriate method.

**5.1.3.3** Depending on the extent of obliteration, continue polishing until the surface is mirror-like, removing all scratches. If the obliteration is severe, it may not be possible or desirable to remove all the scratches.

**5.1.3.4** Note any discernible characters and the position of these characters after polishing/smoothing.

### **5.1.4 Magnetic Particle Inspection Method**

**5.1.4.1** The Magnetic Particle Inspection Method is a non-destructive technique and shall be utilized prior to chemical processing, if appropriate.

**5.1.4.2** Using a plastic pipette, apply magnetic particle solution (Magnaflux bath) to the serial number area while applying a magnetic field through the use of either the horseshoe magnet or electro-magnetic yoke.

**5.1.4.3** It may be necessary to use the magnetic particle method in conjunction with chemical processing to restore the serial number.

**5.1.4.4** Note the method(s) used, any characters that become discernible, and the position of these characters.

### **5.1.5 Chemical Processing Method**

**5.1.5.1** Select a chemical etchant appropriate for the material in question.

**5.1.5.1.1** **For use on magnetic material**, such as steel (listed in order of strength from strongest to weakest):

- Fry’s Reagent
- Turner’s Reagent (may be used as a highlighter)
- Davis Reagent

**5.1.5.1.2 For use on non-magnetic material** (listed in order of strength from strongest to weakest):

- Acidic ferric chloride
- Ferric chloride

**5.1.5.1.3 For use on non-magnetic aluminum media:**

- 10 % Sodium hydroxide

**5.1.5.1.4** 25 % Nitric acid may be used as a highlighter for the above chemicals.

## **5.1.5.2 Etchant Quality Control (Reactivity) Check**

**5.1.5.2.1** Test the strength of the chemical solution in an area adjacent to the polished serial number area. Ideally, the solution should not bubble or fizz when it comes in contact with the metal, but the area should slowly darken due to oxidation. Dilute the chemical solution with distilled water as necessary. **Always add acid to water, never add water to acid.**

**5.1.5.3** Apply the solution slowly by pipette, cotton-tipped swab, or other appropriate method. Gently rub across the area in one direction with a cotton-tipped swab as necessary.

**5.1.5.4** More than one etchant may be used. Improved clarity is often achieved by wiping off the etchant and lightly rubbing prior to etchant reapplication.

**5.1.5.5** If characters appear, distilled water may be applied to the area to slow and/or stop the oxidation process and allow for examination.

**5.1.5.6** Note the method(s) used, any characters that become discernible, and the position of these characters.

**5.1.5.7** Continue processing until the complete serial number is restored or the Forensic Scientist concludes that no serial number or no complete serial number can be restored.

**5.1.5.8** All restoration results shall be confirmed by a second qualified Forensic Scientist. The confirmation shall be documented through the use of a verification review.

## **5.2 Range of Conclusions**

**5.2.1** The suggested report wording listed below may be modified at the Forensic Scientist's discretion to reflect more accurately his/her conclusions. Any such modifications to report wording shall be reviewed and approved with the technical review.

**5.2.2** Possible results include full restoration, partial restoration, or unsuccessful restoration. Full restoration is the total recognition of all obliterated characters. Partial restoration is the

recognition of any obliterated characters but less than the total being sought. Unsuccessful restoration is the lack of recognition of any obliterated characters.

#### **5.2.2.1 Full Restoration**

- Examination and [magnetic and/or chemical] processing of the K-1 pistol restored the original obliterated serial number which was determined to be "123456". "

#### **5.2.2.2 Partial Restoration**

- Examination and [magnetic and/or chemical] processing of the K-1 pistol partially restored the original obliterated serial number which was determined to be "1234\*6". The asterisk (\*) represents a partially restored digit that was concluded to be most likely a "5"; however, a "6" could not be eliminated."

#### **5.2.2.3 Unsuccessful Restoration**

- Examination and [magnetic and/or chemical] processing of the K-1 pistol failed to restore any part of the serial number."

**5.3 Standards and Controls** – For verification procedures for serial number restoration chemicals, including Fry's reagent, Turner's reagent, Davis reagent, 25 % Nitric acid, 10 % Sodium hydroxide, Ferric chloride, and Acidic ferric chloride, see **5.1.5.2**.

**5.4 Calibration** – N/A

**5.5 Maintenance** – For stereomicroscope maintenance information, see the Firearms Unit Technical Procedure for Instrument Calibration and Maintenance.

**5.6 Sampling** – N/A

**5.7 Calculations** – N/A

**5.8 Uncertainty of Measurement** – N/A

**6.0 Limitations** – The type of material containing the serial number and the original method used to place the serial number on the evidence item (such as laser engraving) may prevent this procedure from restoring the serial number.

**7.0 Safety** – Examinations performed in the Firearms Unit are inherently dangerous. These procedures involve hazardous chemicals, firearms, and power tools. All hazardous procedures shall be performed in compliance with the State Crime Laboratory Safety Manual. If the examination involves a biohazard, the Forensic Scientist shall use proper personal protective equipment, such as eye protection, a lab coat, and/or gloves, and work within a fume hood, as appropriate.

## **8.0 References**

*The Association of Firearm and Tool Mark Examiners.* The Association of Firearm and Tool Mark Examiners. Web. 14 Dec. 2011. <[www.afte.org](http://www.afte.org)>

Association of Firearm and Tool Mark Examiners. *Procedures Manual*. 2001.

United States. Bureau of Alcohol, Tobacco, Firearms, and Explosives Laboratory. *Serial Number Restoration Handbook*. 1999.

United States. Bureau of Alcohol, Tobacco, Firearms, and Explosives. *Firearm Serial Number Structure Guide*. January 2007.

O'Reilly, W.E. "Magnetic Restoration of Serial Number." *AFTE Journal* Spring 1970: 26-27.

Polk, Donald E. and Bill C. Gaenssien. "Metallurgical Aspects of Serial Number Recovery." *AFTE Journal* Spring 1989: 174.

Schaefer, Jeffery. "Serial Number Restoration Observations." *AFTE Journal* Summer 1987: 276-278.

Treptow, Richard S. National Aeronautics and Space Administration. *Handbook of Methods for the Restoration of Obliterated Serial Numbers* 1978.

Turley, Dennis M. "Restoration of Stamp Marks on Steel Components by Etching and Magnetic Techniques." *Journal of Forensic Sciences* May 1987: 640-649.

## **9.0 Records**

- FA Worksheets

## **10.0 Attachments – N/A**

Revision History		
Effective Date	Version Number	Reason
09/17/2012	1	Original Document
12/07/2012	2	Added magnet to Equipment list
02/15/2013	3	Removed Raleigh from the header; 4.0 – added equipment; 5.1.1.6.2 – added “or K”; 5.1.2.3 – added “chemically etched”
11/15/2013	4	Added issuing authority to header
09/05/2014	5	<b>Header and various subsections</b> – corrected to reflect organizational change
09/22/2017	6	Edit header information Throughout – removed etc. from e.g. statements <b>5.1.5.8</b> – Added verification review requirement Delete old <b>5.1.5.9, 5.1.5.9.1, 5.1.5.9.2, 5.2.2.2, 5.2.2.4</b> <b>5.2</b> (and subsections) – remove all NCIC check info; change “no serial number restored” to “unsuccessful restoration”. <b>5.2.2.3</b> – Added “any part of” and removed “failed to restore a complete serial number”.