

~~X~~ A TRAINING MANUAL for the
**RESTORATION of
OBLITERATED STAMPED MARKINGS**

51869

prepared by the
Colorado Auto Theft Investigators Association

AUTHORS

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ACQUISITIONS

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SCOPE

This manual will touch upon the restoration of obliterated stamped markings on metal (both ferrous and non-ferrous), leather, wood, and rubber. An attempt will be made to confine discussion to motor vehicles and associated components, however, items which may be recovered from such vehicles will be briefly touched upon. This manual will also provide information on the generally accepted procedures for the collection and preservation of physical evidence.

The information contained herein is designed for the exclusive use of law enforcement personnel and should be treated as CONFIDENTIAL information. Today's law enforcement officer should be aware that the criminal element has knowledge of many of the techniques presently used in the detection of crime, and is constantly endeavoring to develop counter-measures of his own. In his attempt to obliterate a serial number, or other stamped marking on metal, he may not understand the complete problem he faces. This lack of understanding on his part often permits a successful conclusion to the investigation, as he has not been completely successful in the counter-measures he has employed. It certainly is not incumbent on the law enforcement officer to furnish information to the criminal which may permit him to successfully avoid apprehension for a crime he has committed.

GENERAL PROCEDURES

In all cases, the first step must be to examine the item's surface. This examination should be performed by examining the item under low magnification and by lighting the surface of the item from as many different angles as possible. It may become necessary to rotate either the light or the item to provide maximum lighting across the surface of the obliterated number. All markings noted at this stage should be recorded, indicating their relative position and size as well as their shape. After this preliminary examination, the surface of the material should be smoothed, only a minimal amount of material being removed at first, and the object should be viewed again carefully. It might be wise to obtain black and white photographs of the object throughout the restoration attempt. A 35mm single lens reflex camera will be sufficient to obtain the needed photographs. (Photography will be touched on later in this manual).

Once the surface has been completely smoothed to as near a mirror finish as possible, with all scratches or gouges that have been initially visible removed, an appropriate reagent should be applied to the suspect surface. Any reagent used by the officer should always be at first diluted to produce a minimal effect, and if the diluted solution fails to give a satisfactory result, then a more concentrated solution can be applied. The officer should remember that this solution will need a sufficient amount of time to produce results. In attempting a serial number restoration, the officer should remember the old adage, "Haste makes waste." In restorations that involve hard rolled steel, several hours and often days, are necessary to produce a readable restored number.

INTRODUCTION

When a die-stamped impression is placed onto an object, there is produced a permanent zone of compressed molecules in the object and immediately surrounding the image of the die. There is also produced, for a short distance below the penetration of the die, an area of compressed molecules in the metal. Numerous articles bear serial numbers placed on them by the manufacturer to assist in establishing ownership. Such articles include, but are not limited to, the following:

- A. Vehicles — Identifying numbers are placed on trucks, automobiles, tractors, construction equipment, motorcycles, and bicycles. Such numbers may be placed on the engine, the frame, or both. In some instances an additional (hidden) number may be placed on these items. The locations of these markings are contained in the Manual for Identification of Automobiles. This booklet is printed each year by the Nation Auto Theft Bureau and is distributed through its regional office.

- B. Weapons — Most firearms manufactured or sold in the United States are required by law to bear a stamped serial number. Removal of such serial number is a federal and state offense. At the time of this writing, in the State of Colorado, it is a state offense to merely possess a weapon which has an altered or defaced serial number. Some weapons have, in addition to serial numbers in plain view, a hidden number — for example, Colt Firearms places a serial number on the inside of the sideplate of most revolvers made by that company.

- C. Watches — A watch usually has a serial number that is stamped and recorded by the manufacturer. The number is also recorded by the retailer, pawn shops and repairmen. Such numbers usually appear either on the outside or the inside of the back of the watch. Sometimes an officer may have only a portion of a watch. He should examine this watch closely for minute numbers which have been placed either on the face of the watch or on the inside rings which are used to secure the watch to the main housing. An examination of any Timex faceplate will give you the make, model number and year in which the watch was made.

- D. Cameras and Binoculars – The more expensive makes and models of cameras and binoculars bear serial numbers that have been stamped into them by the manufacturer. As a rule, the more expensive the item, the more carefully the records are kept.

- E. Miscellaneous Numbered Articles – Household equipment and appliances, professional equipment, expensive matched sets of tools, and matched sets of sports equipment often bear traceable numbers. Also, these items may have the owner's name stamped in them in a monogrammed fashion.

Any time you are asked to do a serial number restoration, you should make an attempt to check the following sources for information that may be helpful to you in your investigation:

- A. Manufacturer
- B. Retailer
- C. City and state agencies
- D. Pawn brokers and jewelers
- E. Repair shops
- F. Insurance companies

THEORY

When using a chemical reagent, the chemical (etching solution) is applied to the metal surface after it has been thoroughly cleaned and polished. The compressed area reacts more quickly to the reagent than does the surrounding area; the contrast between the disturbed area and the normal area reveals the number.

RESTORATION TECHNIQUES

ELECTROLYTIC POLISHING — This is a means whereby an electric current is used to accelerate the chemical etching method. One electrode is connected directly to the metal surface and the other to a wand containing a swab into which the etching solution has been saturated. You then swab the questioned area with the wand. This speeds up the etching process acting in just the reverse of the electroplating process. A problem which may occur is that this etching process may be too rapid and you may go past your number and lose it forever. Only a low-voltage direct current source may be used and some means should be provided to adjust current flow to the point where the current is flowing through the article being restored.

ELECTROPLATING — This works just the opposite of the previously mentioned electrolytic polishing method. By the electroplating process, the surface is built up by additional layers of metal. Again, the disturbed area reacts to the process at different rates than the surrounding metal.

MAGNETIC FLUX — This method, as is currently used, consists of immersing the object into a solution in which electro-static particles are held in suspension. By creating an electro-magnetic field around the specimen and the tank in which it is placed, the electro-static particles will migrate to the compressed areas and the original stamping can be read.

EXPOSURE TO COLD — After the area is polished (mirror finish), it is wiped over with dry ice, causing a frosting of the metal. Again, the number may become visible on the frosted surface.

HEAT — By heating the metal to a cherry red, the number may be seen in the heated area. The officer should realize that, if the metal has been completely heated to a cherry pink or white hot temperature, softening will occur and absolutely no restoration is possible. Sometimes, no metal is removed but the markings are very thoroughly punched or peined out. When this is the case, no restoration is possible. When the entire area of the markings is routed out, and either a plate of new material inserted or the spot is built up by welding, and the whole surface is refinished and possibly re-stamped, no success can be expected.

X-RAY — This theory has often been advanced, but no real success has been achieved.

RESTORATION OF WOOD

When wood is cut and the cuts later removed by shaving off a portion of the surface, no restoration is possible, since the underlying fibers are quite undamaged. Sometimes, however, when the wood has been exposed to various oils, solvents, etc., and the removal has not been proceeded too vigorously, the outlines of the removed marking may be visible as a result of the penetrations to the wood by these liquids. When markings are burned into a wooden surface, little chemical action occurs below the charred area. In such cases the original markings may be discerned on the smooth surface through careful visual examination, often with oblique lighting.

When an indented marking is placed on wood parallel to the grain and this marking is sanded or filed off, often it can be brought out by the use of steam. Steam causes the wood to swell and the marking will appear.

RESTORATIONS OF MARKINGS ON RUBBER

There are serious limitations on the restoration of obliterated markings on articles made of rubber. However, with the rising cost of tires, these items have become more susceptible to theft and the obliteration of model numbers cast into the tire. Where some outline or trace of the figure is present,

the application of a suitable solvent will sometimes result in the successful restoration. In attempting a restoration on an item made of rubber, the officer should remember that again, he needs a smooth surface to work from, but he should take painstaking care in removing only loose particles of rubber. These particles can be removed by either carbon disulfide or carbon tetrachloride saturated into a cotton swab. Carbon disulfide is volatile, flammable and poisonous, so when it is used there should be no sparks or flames nearby. Also, the officer must be in a well ventilated area, preferably an exhaust hood or fume cupboard. The carbon disulfide causes the outer layer of the rubber to swell and this mass can then be slowly rubbed off by the cotton swab. As the solvent evaporates, the rubber precipitates out, so to avoid a buildup of rubber on the swab, they should be frequently changed. With carbon tetrachloride the procedure is slightly different and in the authors' opinion, carbon tetrachloride is the favorable method to be used. This liquid is non-flammable, so a blow torch or other heat source can be used to soften the rubber, thus rendering it more easily attackable to a solvent. The torch and the solvent are applied alternately until the results are obtained. Care must be taken when applying heat to avoid burning the rubber by holding the torch too close to the surface.

PHOTOGRAPHY

The officer should also realize that, due to the unevenness of the metal or the die which was used for stamping the number into the metal, some of the restored numbers may appear before others. Therefore, it is essential that he maintain the photographic capabilities throughout his attempts to restore an obliterated number. A 35mm single lens reflex camera with a normal lens is recommended to record all restoration attempts. The officer should also have at his disposal at least a series of one, two and three close-up lenses which can be attached to the camera, as well as sufficient lighting available to illuminate the surface of the obliterated number. It is highly recommended that the officer use an adequate floodlight system, rather than an electronic strobe. This will enable the officer to see what his lights are producing across the subject and allow him to situate them in a position producing low angle lighting across the surface area and thus enhance the ability to read the obliterated number. The authors of this manual have researched and tested many different types of films and would recommend that the officer use a black and white film, preferably Tri-X, with an ASA of 400.

RECORDING

Any time an officer is attempting to accurately record a number restoration, he should be ready to record them as they appear and he should be aware that they may disappear as quickly as they became visible. One very useful method of recording the numbers is as follows:

A. First establish the number of letters or digits believed to be recorded in the metal. The officer should have a N.A.T.B. book at his disposal at all times during an attempted restoration. This will assist him in determining how many digits there are on the vehicle. Mark the paper on which you are to record the number thusly: _ _ _ _ _ , leaving a space for each number to be recorded.

B. As the numbers become visible, fill them in on the paper.

Example: 6 _ _ _ _ A _ _ 3 _ _ _ _ .

C. Where the numbers are not clear, leave the area blank.

Example: 6 3 _ _ _ _ A _ _ 3 _ _ _ _ .

D. Where the numbers are not clear and several possibilities exist, list the possibilities below the designated area.

Example: 6 3 _ _ _ _ A _ _ 3 _ _ _ _ .
 3 7
 8 1

NOTE: Ford vehicles have eleven digits and all other American-made vehicles have thirteen.

ETCHING FORMULAS

By use of the following etching solutions with the type of metal they are designed for use with, the officer will be able to achieve a successful restoration, provided obliteration is not to such a depth as to preclude such restoration or that peining, heat application, stippling, or other method has not been used in order to make the task of restoration impossible. Too strong solutions may cause pitting, and when this is noted, use of another formula is advised, or cutting down of the strength of the formula by dilution is in order.

The writers of this manual take no credit for devising these formulas, and credit cannot be given where credit is due, as these (or closely associated) formulas have been in use for many years and who first devised the formula cannot be determined at this point in time.

ETCHING REAGENTS

ALUMINUM

- | | | |
|----|--|------------|
| 1. | Sodium Hydroxide (NaOH) | 1 gram |
| | Water (H ₂ O) | 99 cc |
| | | OR |
| | Sodium Hydroxide pellets | 25 pellets |
| | Distilled Water | 30 cc |
| 2. | Handle the following with <u>extreme care during and after mixing</u> . Mix in small amounts and use, or destroy by diluting with large quantity of water and pour diluted material on sandy ground. | |
| | Hydrofluoric Acid (HF) | 2 parts |
| | Nitric Acid (HNO ₃) | 1 part |
| | Glycerol | 3 parts |
| | <u>(Store in plastic bottle only)</u> | |
| 3. | Nitric Acid (HNO ₃) | 25 cc |
| | Water (H ₂ O) | 75 cc |

COPPER AND ALLOYS OF COPPER

1. Nitric Acid (HNO₃) – concentrated. May use various dilutions depending on the action on the metal being etched. Etching should not be so rapid as to cause overpitting. A .3% Silver Nitrate (AgNO₃) solution may be added to the Nitric Acid in one-to-one proportion.

2. The following is a good electrolytic solution especially for high nickel alloys.

Nitric Acid (HNO ₃)	5 cc
Water (H ₂ O)	85 cc

3. Testing has proven that all copper alloys respond favorably to:

Hydrogen Peroxide	10 cc
Ammonium Hydroxide	10 cc

LEAD AND LEAD ALLOYS

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|---|---------|
| 1. Molybdic Acid (H ₂ MoO ₄) 85% | 100 gms |
| Ammonium Hydroxide (NH ₄ OH) | 140 cc |
| Water (H ₂ O) | 240 cc |
| Filter and add | |
| Nitric Acid (HNO ₃) | 60 cc |

RESTORATION OF SERIAL NUMBERS ETCHANTS

For engine block numbers use:

5 to 10% ammonium persulfate
Also can be used on typewriter frames and other cast-iron objects.

For brass use:

Sodium sulfate (anhydrous)	1.5 gms
Chromic acid	20. gms
Distilled water	100. (CC)

For steel use:

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|-------------------------------------|--------|
| 1. Hydrochloric acid (concentrated) | 120 cc |
| Distilled Water | 100 cc |
| Cupric Chloride crystals | 90 gms |
| 2. Hydrochloric acid (concentrated) | 160 cc |
| Distilled water | 120 cc |
| Ethyl alcohol | 100 cc |
| Cupric Chloride crystals | 25 gms |

- | | | |
|----|----------------------------------|--------|
| 3. | Cupric Chloride crystals | 1 gm |
| | Hydrochloric acid (concentrated) | 12 cc |
| | Distilled water | 12 cc |
| 4. | Sulfuric acid (concentrated) | 22 cc |
| | Distilled water | 320 cc |
| | Potassium dichromate | 40 cc |

RECOGNITION, RECOVERY, PRESERVATION, AND ANALYSIS OF PHYSICAL EVIDENCE

The recognition, recovery, preservation, and analysis of physical evidence is an important part of any investigation. If not properly done, it may jeopardize what may well have been an excellent investigation. An officer must first realize what constitutes a crime scene. "A crime scene is any area over, or through which a victim or suspect might pass en route to, or during the commission of, or going away from a criminal episode." A crime scene is anywhere that evidence might be gathered which will help to solve the crime.

Evidence should be looked at in three groups — the scene, the victim, and the suspect. All evidence falls into one of two types — either direct evidence, those facts which you have personal knowledge of, such as being an eyewitness to a crime; and indirect evidence, such as fingerprints, blood type, hair analysis, paint analysis, and all other types of physical evidence. In general, physical evidence should consist of items which (1) Show or indicate whether or not a crime was committed; (2) Indicate that a particular person or persons committed a crime, or; (3) May have been left or removed from the crime scene by either a victim or a suspect.

In the court systems today, physical evidence plays a far more important role than ever before, particularly in the convictions of persons accused of major crimes. A police officer must be able to present physical evidence in such a manner that it gives the court and the jury a clear and concise picture of the crime scene and persons involved in the commission of a crime. In most departments, the original responding officer will be required to collect physical evidence which is left at the scene. Every officer should be able to recognize and preserve physical evidence. The professionalism he displays in conducting this phase of the investigation will instill in the jury the confidence and importance that they will attach to the physical evidence.

PRESERVING PHYSICAL EVIDENCE

Photographs will almost invariably enhance the testimony given by an officer. A well presented testimony is effective, but may be diminished with the passing of time, and often the officer testifies

days before the jury deliberates. A photograph showing the facts will remain and be a constant reminder to the jury. One good photograph is worth a thousand words.

The officer should photograph the entire crime scene, both interior and exterior. Crime scene photographs fall into three major categories: **overview, midrange and closeup.**

- A. **Overview** — The officer should, when photographing a crime scene, shoot a series of photographs which will provide the maximum amount of useful information. This should enable the viewer to understand how the crime was committed.
- B. **Midrange** — Photographs should always show the relationship of various objects to one another.
- C. **Closeup** — Photographs which are taken of small items should always be photographed with and without a scale. The photograph with a scale will provide the officer with the ability to produce a one-to-one photograph for comparison. These photographs should distinguish the item from all others of similar type.

The officer should use common sense, knowledge, experience and intelligence in the collecting of evidence. He should consider the significance the exhibit may have and what examinations the laboratory may be able to perform. It will be necessary to keep accurate records and to prepare notes as items are collected. Record the item, its condition (if appropriate) and its exact location, relative to a fixed and permanent position.

The officer should mark each exhibit collected with the date, time, his initials or monogram, and/or his employee number, along with the exact location where it was seized. By placing a permanent and distinctive mark directly on the object collected, the officer, when called upon to testify several months later, will be able to identify the object he collected at the time of the investigation.

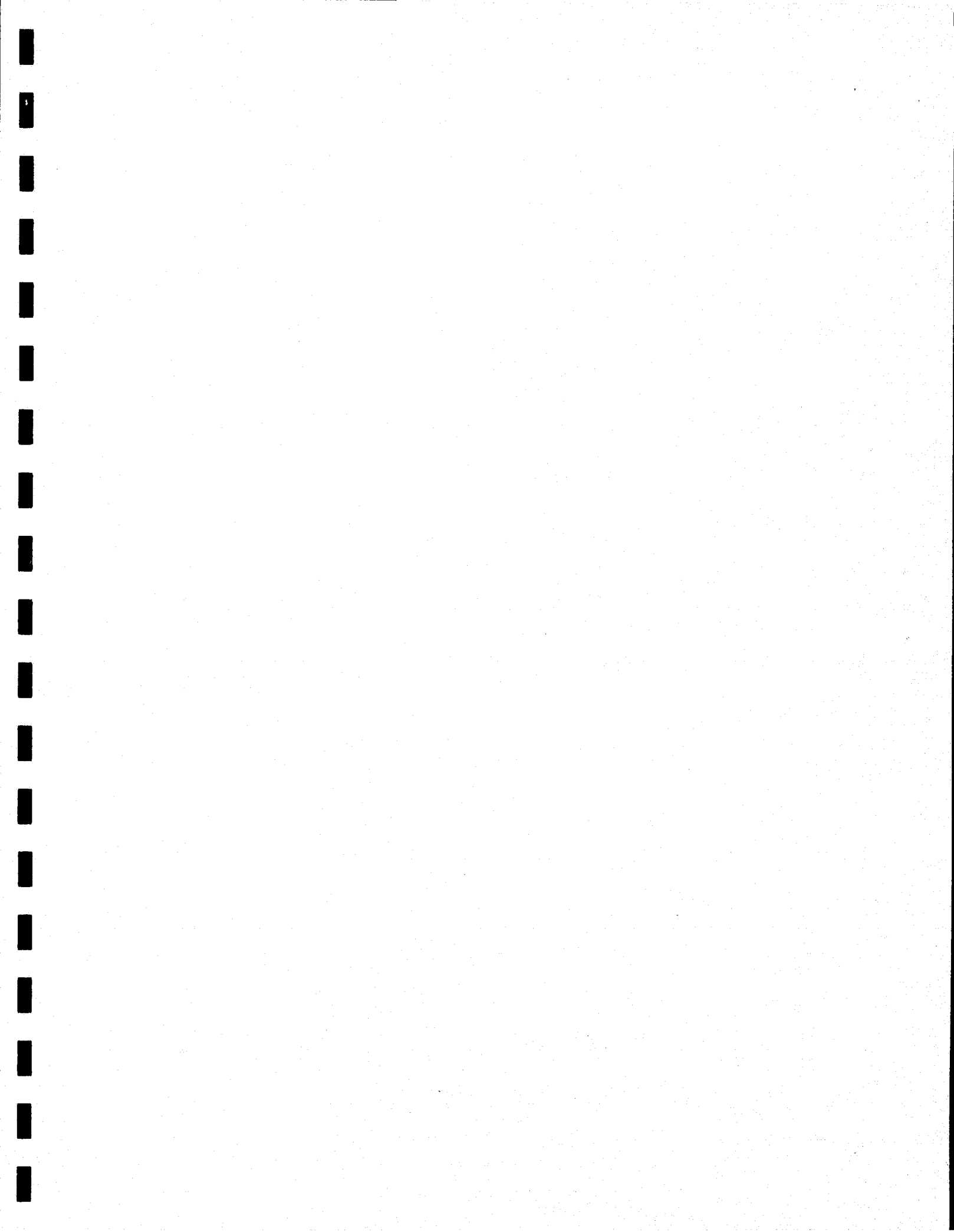
Some items of evidence will not be suitable for direct marking. When the officer is unable to mark the exhibit, such as in the case of strands of hair, paint or blood samples, a small plastic or

other type of container should be used and the evidence should be sealed within the container. The container should then be marked with the date, time, the officer's initials or monogram and/or his employee number, and the exact location where the evidence was seized. The case number should also be affixed to the container.

CONTAINERS

In order to protect evidence from contamination, all items seized, regardless of size or shape, should be sealed in some type of container. Plastic or cellophane envelopes are excellent for small objects. Paper envelopes can be used, but all the edges must be sealed adequately if small powdery materials are to be enclosed. Paper envelopes should not be used for hairs and fibers. Vials, pill boxes, capsules and light-tight containers are suitable, depending on the exhibit and its condition. Garments and larger exhibits can be placed into a bag or a large cardboard box.

Each item of evidence should be placed in a clean, new container to prevent contamination. Every container should be sealed to prevent loss or evaporation. In order to keep those involved in the chain of custody to a minimum, the officer who seized the evidence should be the one to seal it.





END