TECHNICAL INFORMATION

Trace Metal Detection Kit

Catalog No. TMDT100

INTRODUCTION

A difficult problem in law enforcement is that of linking weapons (particularly undischarged firearms), tools, and like objects to specific individuals. The essential need for such identification in cases involving homicide, suicide, assault, burglary, robbery, and civil disorders has resulted in the development of a specific technique that shows whether an individual has been in contact with a particular metallic object. The technique can be conducted by police officers using simple equipment and the procedures described in this publication.

Research has determined that metal objects leave traces on skin and clothing surfaces in characteristic patterns

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with intensities proportional to the interaction of weight, friction, or duration of contact with metal objects. The Trace Metal Detection Technique (TMDT) makes such metal trace patterns visible when skin or clothing is treated with a test solution and is then illuminated by shortwave ultraviolet light. Examination by ultraviolet light of the trace patterns that appear as fluorescent colors on the hands or clothing of the suspect allows a police officer to determine whether a suspect has been in contact with certain metal objects, the type of metal or metals in the objects, and also to infer what type of weapon or metal object was probably involved. The patterns and fluorescent colors can be analyzed with reference to the circumstances requiring the use of TMDT and with other related information to provide an initial source of evidence. Physical evidence obtained by the use of TMDT, however, should be used as an adjunct to complete investigation.

PRECAUTIONS

- Before using this kit, consult the appropriate Material Safety Data Sheets (MSDS) found on our website at www.sirchie.com/support.
- This procedure requires the use of shortwave ultraviolet light. Shortwave UV is injurious to the eyes. Protective goggles should be worn. Avoid lengthy exposure by shortwave UV to exposed areas of the skin.

PROCEDURE

Detection of Metal Traces on the Hands

Select The Test Area—Select the areas to be examined in relation to the circumstances, the suspected item (handgun, rifle, knife, tools, bludgeon, etc.) and to the normal handling, use, possession, or concealment of the suspect item. If the suspect item is a handgun, for example, in addition to examination of the suspect's hands, those areas of clothing that may have been in contact with the weapon and the skin directly beneath should also be examined since metal traces and patterns are sometimes found to have penetrated clothing to the skin area beneath.

Apply The TMDT Test Solution—Completely coat the area to be examined with the TMDT test solution. A spray container is generally suitable for this purpose. Whenever possible, the surface should be in a vertical position while being sprayed to prevent the formation of puddles. Although the TMDT test solution is nontoxic to skin surfaces, it should not be taken internally. Care should be taken to avoid spraying the solution into the subject's eyes. If spray does get into the eyes, the subject should immediately flush his eyes with water for at least ten minutes and then obtain medical aid.

Suspect's hand shown above prior to reagent application.

Trace metal is detected on the suspect's hand (shown above) after reagent application and shortwave UV exposure.

Dry The Test Area—Allow the test area to dry for a period of two or three minutes. Swinging the arms will shorten the drying time of hands. Sunlight, breeze, and hot air also shorten the drying process. Test areas on clothing and other materials should be allowed to dry thoroughly before examination.

Darken The Room—Results of TMDT application are best viewed in total darkness.

Observe Background Fluorescence—The TMDT solution produces a light yellow fluorescence on those parts of the test area that have not been in contact with metal objects. This pale yellow fluorescence provides a background for the metal trace patterns seen on parts of the test area that have been exposed to metal contact. The metal trace patterns produce fluorescent colors unique to specific kinds of metal and will appear as silhouettes against the pale yellow background.

Examples of Metal Trace Fluorescence:

Background: PALE YELLOW
Brass/copper: PURPLE
Galvanized steel/iron: BRIGHT YELLOW
Aluminum: MOTTLED DULL YELLOW
Lead: BUFF (FLESH TONE), TAN
Steel: BLACKISH PURPLE

After determining the presence of metal traces in the test area, the investigator should then determine the pattern of the traces revealed by the fluorescence. The location, size, and shape of the traces on the hands form patterns consistent with the size, shape, and the normal way that weapons, tools, and other objects are handled and used. The shape, size, and weight of a metal object as well as the duration of contact and the use of the metal object all combine to produce the location and intensity of metal traces and the patterns they leave.

Metal traces left on the hand from holding a metal object depend on the shape of the object and the size of the hand that contacts the surface. In addition, the intensity of the metal traces left by a handgun is increased when the suspect resists action to disarm him.

Detection of Metal Traces on Clothing or Cloth Objects

As noted above, metals leave characteristic traces on clothing, therefore, the suspect's clothing should be examined with the TMDT test. The areas requiring examination are: gloves, hats, pockets, coat linings, shirts and other areas of clothing where the suspect may have carried or concealed a metal object. The reagent is best applied with the object held in a vertical position.

Clothing and other materials vary in absorbency so some test areas may require a heavier application of reagent to produce maximum fluorescence. Two or more applications, with drying time in between, may be necessary to produce adequate results.

Metal traces may sometimes penetrate clothing. It will be necessary to apply reagent to the hands even though the suspect wore gloves. Skin areas directly beneath clothing should not be overlooked either. A weapon tucked into the pants may leave traces on the clothing and the skin underneath. It should be

noted that plastic, leather and rubber materials are impervious to penetration of metal traces.

Handgun Detection

Because of their unique shape and use, handguns leave characteristic patterns and distinct signatures on the hands that are specific to types, makes, models, and calibers of these weapons.

1. Have the suspect extend his hands away from his body with the palms in a vertical position. Be certain to spray the entire surface of each hand—front and back.
2. Make a written record of the test results when examining the hands with a shortwave UV light. Note and record the fluorescent colors of the metal traces that make up the patterns on the hands. Especially note those areas of the hands that would normally come into contact with the handgun: the index finger that rested on the trigger, the thumb and other fingers that enclosed the gun, the palm and the degree of protrusion of the gun into the area beyond the junction of the thumb and index finger. Extensive protrusion of metal traces beyond this area is caused by the overhang at the top of the back strap on certain automatic pistols.
3. Look for any irregularities or distinguishing marks in the pattern that may be made by screws, protrusions, ornaments or other markings on the gun.
4. Look for interruptions in the pattern that were caused by non-metal parts of the gun.
5. Photograph any patterns visible under shortwave UV light.

Detectable metal traces have been found up to 36-48 hours after the suspect may have held the gun. Washing with soap and water generally will not remove the metal traces.

If the suspect handgun has not been recovered, the patterns on the suspect's hands should be compared with photographs of handgun patterns in a catalog of handgun signatures that you have created.

Identification of Tools and Other Metal Objects

Patterns left by some tools and other metal objects are characteristic of their shape, normal handling and use (i.e.: pliers, wrenches, shears, scissors, etc.). Other tools and metal objects may leave similar patterns because they are similar in size and shape (i.e.: crowbars, pipes, metal bars, etc.). A catalog of patterns and metal traces produced by tools and other metal objects would be useful here.

The hands of a suspect may have metal traces from contact with other metal objects such as handles, doorknobs, keys, etc. These traces produce weak fluorescence due to light or limited contact. But these traces may interfere, mask, or distort the patterns of significant metal objects.

Special Notes:

Disassembly or assembly of a handgun will leave metal traces that do not conform to the signature of the handgun; but if the suspect held the weapon in the usual way for a period of time, the specific pattern of the weapon is detectable. It should also be noted that some gun oils produce a mother-of-pearl fluorescence. The maximum fluorescence brightness of metal traces and patterns depends not only on the amount of metal deposited but also upon the following factors:

- Adequate application and coverage of the TMDT reagent
- Using a strong source of shortwave ultraviolet illumination
- Working in total darkness when examining the test areas
- The proximity of the UV light source to the test area

UV PHOTOGRAPHY

Illumination—An efficient source of shortwave UV light, placed as close as possible to the area to be examined, is used to excite the maximum fluorescence brightness on the test area. The angle of incidence of the illumination should be at an angle of 45 degrees. Two similar light sources, one on each side of the object provides twice as much light and will prove more practical in photograph-

ing three dimensional objects.

Barrier Filter—Place a barrier filter over the camera lens to absorb the UV illumination transmitted by the exciter source and to transmit only the fluorescence given off by the test area.

Exposure Determination—Fluorescence produces low brightness at best so proper exposures must be determined by prior testing. The recommended procedure is to determine the aperture setting that produces the best depth of field, and then make any changes in exposure value by adjusting the shutter speed. A good-quality, sturdy tripod is a must for fluorescence photography. When using photographic film always bracket exposures for best results.

Film Selection—The advantages of using color film are obvious. Color film records the actual appearance of the fluorescence while black and white film produces photos in varying shades of gray and should, therefore, not be used. Select a film with the highest ASA/ISO rating available. Films with an ASA/ISO of 400 to 1000 are recommended.

Digital Photography—Digital cameras are now widely accepted for forensic photography and offer some distinct advantages. Many digital cameras offer an LED viewing screen that eliminates the need for exposure bracketing. (What you see is what you get.) Making prints immediately following the photo session ensures that the evidence has been faithfully recorded. A camera with a high resolution is recommended.

TMDT100 CONTENTS:

12- FPT1C1 Super Cleaner Towelettes

4- KCP230 AA-Cell Batteries, Alkaline

1- SB4 Spray Bottle, 4 oz. (118ml)

1- SWL100 Shortwave Ultraviolet Light Source, 6V DC, 4-watt bulb

4- TMDT01 Trace Metal Reagents, 1 oz. (30ml)

1- TMDT1001 Carrying Case, Molded Copolymer w/ Machined Plastic Insert;
Dimensions: 12.125" x 7.25" x 5.5" (30.8cm x 18.4cm x 14cm);
Weight: 3 lbs. (1.4kg)

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