
Technical Procedure for the Examination of Tapes and Adhesives

1.0 Purpose – This technical procedure shall be followed for the examination of tapes and adhesives.

2.0 Scope – This procedure applies to the analysis of tapes and adhesives within the Trace Evidence Section. If the tape sample contains fiber reinforcement, the case shall be assigned to a Forensic Scientist trained in fiber analysis. Physical fit analyses involving tape shall be conducted by a Forensic Scientist trained in tape physical fit examinations.

3.0 Definitions – N/A

4.0 Equipment, Materials, and Reagents

4.1 Equipment

- Stereomicroscope
- Polarizing light microscope
- Comparison microscope
- FT-IR
- SEM/EDS
- Pyrolysis-GC-MS
- Microspectrophotometer
- UV light

4.2 Materials

- Forceps
- Scalpel or razor blade
- Ruler or calipers
- KBr discs and holder
- SEM adhesive lifts
- Heat gun
- Glass or transparency sheets
- Joliff cards
- Filler fibers

4.3 Reagents

- Hexane
- Methanol
- Xylene
- Liquid nitrogen

5.0 Procedure

5.1 Analytical Approach

5.1.1 Review the request for analysis and determine the type(s) of examination required based

on the request made by the agency and/or the evidence submitted. Examination(s) that may be performed are the comparison of the questioned item to determine if it could have originated from the known item, comparing two samples to determine if they could have been constructed by the same manufacturer, and an identification of generic manufacturing characteristics.

5.1.1.1 There may be times when an agency requests a variation on the above listed types of analyses. If the request falls within the scope of the technical procedures, the analysis may be permitted.

5.1.2 Evaluate the case information and evidence submitted.

5.1.2.1 If necessary, contact the submitting agency to obtain additional evidence, case information, and/or contact the submitting agency to request known tape standards following the Laboratory [Procedure for Obtaining Evidentiary Standards](#). If standards are not submitted, the examination may be limited or the evidence may be returned.

5.1.3 Most Trace cases involve some degree of evidence screening, either visually/microscopically or in combination with instrumental techniques. Preliminary evaluation of the known's characteristics is warranted when screening is performed in order that those questioned items suitable for further comparison can be selected. When proceeding to further comparison of questioned and known samples, beginning with the questioned items is required unless case constraints dictate otherwise.

5.1.3.1 The Forensic Scientist shall approach a tape comparison by attempting to show that the samples are different. The questioned and known items are analyzed using the same techniques and are compared at every step throughout the process. The failure to detect any significant differences, after exhausting the methodology available to the Forensic Scientist, results in the conclusion that the known and questioned items could have a common origin. If a difference is found, the analysis may be concluded at any step.

5.1.3.2 The order of the examination is based on the quantity, quality, type of the evidence and the Forensic Scientist's training and experience.

5.1.3.3 Some of the tests available to Forensic Scientists are destructive (e.g., pyrolysis gas chromatography-mass spectrometry). When sample size is limited, destructive testing, if necessary, shall be performed only after all non-destructive testing is complete.

5.1.3.4 All results shall be based on the Forensic Scientist's knowledge and experience and the case being examined. Results shall be in agreement with the technical reviewer.

5.1.4 Open the evidence container and describe the evidence present.

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- 5.1.4.1** If necessary, process the item to remove any trace evidence adhering to the item following the Trace Evidence Section [Technical Procedure for the Collection and Preservation of Evidence](#).
- 5.1.4.2** If the entire sample will be deconstructed during analysis, photographs shall be taken prior to analysis.
- 5.1.5** Begin the tape examination by using a stereomicroscope and performing a preliminary evaluation of the questioned and/or known tape standards and record the overall macroscopic characteristics.
- 5.1.5.1** The following is a list of macroscopic characteristics that may be used for classification and comparison of any tape that may be suitable for further analysis. The characteristics listed below are not all-inclusive and may or may not be present in every tape sample.
- Composition (i.e., Duct, Electrical, Packaging, etc.)
 - Size (i.e., Length and Relative Longitudinal Diameter)
 - Construction (i.e., backing, scrim, adhesive)
 - Color
 - Other characteristics (e.g., stains, damage, cut or torn ends)
- 5.1.5.2** If a questioned and known item will be brought into direct contact, visible debris shall be removed and secured for possible further examination.
- 5.1.5.3** No further analysis may be performed on tape found to be macroscopically not consistent with the applicable known standard.
- 5.1.6** Using either a physical (e.g., heating, freezing) or chemical (e.g., hexane, methanol) separation method, detach tape folded onto itself or adhered to another surface (e.g., garbage bag, layered tape). Lay the tape out and flatten on glass or a clear plastic sheet.
- 5.1.7** A physical fit examination shall be conducted if necessary. See the Trace Evidence Section [Technical Procedure for Physical Fit Examinations](#).
- 5.1.7.1** In addition to the standard analysis, look for points that may relate a questioned item to a specific known item. These may include, but are not limited to, the following: damage, stains or other foreign matter that continues over both items, and manufacturer's flaws.
- 5.1.7.2** If no physical fit is possible, or a physical fit cannot be made, the Forensic Scientist shall continue analyzing each item.
- 5.1.8** If no physical fit is found, remove a sample for analysis. Cut from the center of the item, leaving the original ends undamaged.
- 5.1.9** Document the construction of the sample and break down the sample into its major components.

5.1.9.1 For analysis of the backing, see **Analysis of the Backing**.

5.1.9.2 For analysis of the adhesive, see **Analysis of the Adhesive**.

5.1.9.3 For analysis of the scrim, see **Analysis of the Scrim**.

5.1.10 Once all visual, microscopic, chemical, and instrumental examinations have been completed and the results compared, the Forensic Scientist shall issue a report stating his or her findings.

5.1.11 If questioned and known samples are found to be microscopically consistent with each other and a fabric scrim is present, a second Forensic Scientist, who is qualified in fiber comparisons, shall confirm these microscopic comparisons. Additional verifications may be completed by other available Forensic Scientists who are qualified in fiber comparisons. A verification review shall be completed in Forensic Advantage (FA) and the microscope slides shall be initialed and dated by the verifying Forensic Scientist(s).

5.2 Analysis of the Backing

5.2.1 While the tape is still intact, measure the width of the tape backing.

5.2.2 If the tape is transparent, examine using a polarized light microscope (PLM) under crossed-polars and record observations of the physical and optical characteristics.

5.2.3 Clean off the adhesive and remove the scrim (if present).

5.2.4 Describe the texture of the backing and determine the manufacturing process.

5.2.5 Cross-section the backing to determine the number of layers. In addition, record the color and/or visual appearance of each layer.

5.2.6 The following Trace Evidence Section procedures may be used to analyze the tape backing, as appropriate based on the Forensic Scientist's training and experience:

- [Technical Procedure for Infrared Spectroscopy.](#)
- [Technical Procedure for Scanning Electron Microscope/Energy Dispersive X-Ray System \(SEM/EDX\) for non-GSR Casework.](#)
- [Technical Procedure for Microspectrophotometry.](#)

5.2.7 Compare all the above-listed color, construction and compositional characteristics of the known and questioned items.

5.3 Analysis of the Adhesive

5.3.1 While the tape is still intact, compare the color of the adhesive.

5.3.2 Remove a sample of the adhesive using forceps or a razor blade.

5.3.3 The following Trace Evidence Section procedures may be used to analyze the adhesive, as appropriate based on the Forensic Scientist's training and experience:

- [Technical Procedure for Infrared Spectroscopy.](#)
- [Technical Procedure for Scanning Electron Microscope/Energy Dispersive X-Ray System \(SEM/EDX\) for non-GSR Casework.](#)
- [Technical Procedure for Pyrolysis – Gas Chromatography-Mass Spectrometry.](#)

5.3.4 Compare all of the above-listed color, construction and compositional characteristics of the known and questioned items.

5.4 Analysis of the Scrim

5.4.1 If the sample is a fiber-reinforced tape, the fabric scrim shall be separated from the rest of the tape by soaking the sample in a solvent such as hexane or methanol.

5.4.2 The scrim construction shall be analyzed and compared following the Trace Evidence Section [Technical Procedure for the Examination of Fabric.](#)

5.4.3 Once the construction analysis and comparison is complete, the fabric shall be broken down into its component yarns. Yarns shall be analyzed and compared following the Trace Evidence Section [Technical Procedure for the Examination of Cordage.](#)

5.4.4 Once the yarn analysis and comparison is complete, the yarns shall be broken down into their component fibers. Fibers shall be analyzed and compared following the Trace Evidence Section [Technical Procedure for the Examination of Fibers.](#)

5.4.5 Compare all the above-listed color, construction and compositional characteristics of the known and questioned items.

5.5 Guidelines for Tape and Adhesive Analysis Result Statements

5.5.1 The reports shall read as listed below. The wording of the results shall accurately describe the evidence at hand.

5.5.2 Association (Consistent)

5.5.2.1 This statement shall be used when the questioned and known samples are consistent in color, construction, and chemical composition.

5.5.2.1.1 Example: Item A was found to be consistent in color, construction and composition with Item B. Therefore, Item A could have originated from [the same source as] Item B.

5.5.3 Inconclusive

5.5.3.1 These statements shall be used when, based on the analysis, no conclusion could be reached.

5.5.3.1.1 Item A was found to be consistent in __ to Item B; however, slight differences were noted in ____. Therefore, no conclusion could be reached as to whether or not Item A could have originated from [the same source as] Item B.

5.5.3.1.2 Example: Due to the nature/condition of Item A, no conclusion could be reached as to whether or not Item A could have originated from [the same source as] Item B.

5.5.4 No Association (Not Consistent)

5.5.4.1 This statement shall be used when one or more of the characteristics associated with the questioned and known samples are different.

5.5.4.1.1 Example: Item A is not consistent with Item B. Therefore, Item A could not have originated from the same source as Item B.

5.5.4.1.2 Example: Item A was found to have different manufacturing characteristics from Item B. Therefore, Item A could not have originated from the same source as Item B.

5.5.5 No Analysis

5.5.5.1 No analysis is performed. The reason for no analysis shall be noted in the case notes.

5.5.5.1.1 Example: The above listed evidence is being returned unanalyzed. If you have any questions, please contact the Forensic Scientist who issued this report.

5.5.5.2 No analysis is performed due to the results of the DNA analysis.

5.5.5.2.1 Example: Based on the results of nuclear DNA analysis, the above listed evidence is being returned unanalyzed. If you have any questions, please contact the Forensic Scientist who issued this report.

5.6 Standards and Controls – N/A

5.7 Calibrations – This procedure does not require any calibrations or performance checks. However, it does utilize instruments that require performance checks. See the individual technical procedures for the operations of those instruments.

5.8 Maintenance – No maintenance is required in this procedure. However, the procedure does utilize instruments that require maintenance. See the individual technical procedures for the operations of those instruments.

5.9 Sampling and Sample Selection

5.9.1 No sampling is performed. When sample selection occurs, it shall be based on the Forensic Scientist's training and experience.

5.9.2 If DNA analysis has been performed on the evidence in the case, based on the results of the DNA analysis, the fiber evidence may be returned unanalyzed.

5.10 Calculations – N/A

5.11 Uncertainty of Measurement – N/A

6.0 Limitations - Tape and adhesives are manufactured materials. In general, it shall not be possible to identify a questioned item as having come from a particular source to the exclusion of all others. One exception to this shall be a physical fit.

7.0 Safety

7.1 Burns may result from contact with hot items such as heat guns.

7.2 Wear protective clothing when using liquid nitrogen.

7.3 Items may have blood or other body fluids present. Use protective equipment when dealing with items that may contain biohazard material.

7.4 Care shall be exercised when using solvents.

7.5 Glass pipettes, razor blades, and probes are sharp and can be dangerous.

8.0 References

8.1 ASTM / SWG Guidelines

ASTM Standard E1732, "Standard Terminology Relating to Forensic Science." ASTM International, West Conshohocken, PA, 2000.

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SWGMA. "Guideline for Assessing Physical Characteristics in forensic Tape Examinations." online (December 14, 2010)

<http://www.swgmat.org/SWGMAT%20Assessing%20Physical%20Characteristics.pdf>

SWGMA. "Guideline for Using Light Microscopy in forensic Examination of Tape Components." online (December 14, 2010)

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8.2 Books

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Smith, Jenny M., "Forensic Examination of Pressure Sensitive Tape." Robert D. Blackledge, ed., *Forensic Analysis On the Cutting Edge*, John Wiley & Sons, Inc., 2007, pp. 291-331.

8.3 Journal Articles

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Goodpaster, J.V., et al. "Identification and Comparison of Electrical Tapes Using Instrumental and Statistical Techniques: I. Microscopic Surface Texture and Elemental Composition." *Journal of Forensic Sciences* 52.3 (2007): 610-629.

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Smith, J. "The Forensic Value of Duct Tape Comparisons." *Midwestern Association of Forensic Scientists Newsletter* 27.1 (1998): 28-33.

Snodgrass, H. "Duct Tape Analysis as Trace Evidence." *Proceedings of the International Symposium on the Forensic Aspects of Trace Evidence* (June 1991): 69-73.

Teetsov, A.S. and M.L. Stellmack. "Hand-Sectioning and Identification of Pressure-Sensitive Tapes." *Modern Microscopy Journal* 30 (June 2004).

8.4 Training Materials

The Forensic Analysis of Pressure Sensitive Tapes (Training Materials). FBI, June 2005.

Smith, Jenny. Introduction to Forensic Examinations of Pressure Sensitive Tape (Training Materials). Southern Association of Forensic Scientists Meeting, Savannah, Georgia, May 5, 2003.

9.0 Records – N/A

10.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
06/21/2023	5	<ul style="list-style-type: none">• Updated header to Trace Evidence Section, issuing authority to Trace Evidence Section Forensic Scientist Manager.• Updated all references in procedure from Trace Unit to Trace Evidence Section• Updated all references in procedure from Physical Match to Physical Fit• 5.1 – Reorganized and updated to clarify ISO 17025 requirements to examine questioned before known.• 5.1.6 – Added “or adhered to another surface (i.e., garbage bag, layered tape, etc.)”• Added 5.1.7.2• Clarified 5.1.11• 5.5.2 – Renamed Association (Consistent)• 5.5.4 – Renamed No Association (Not Consistent)• Removed 5.9.2 through 5.9.4• Added 7.5• 8.1 – Added ASTM E1732 reference