
Technical Procedure for Physical Fit Examinations

1.0 Purpose – This procedure shall be followed for the examination of items of evidence that may have broken, cut and/or torn edges that can be joined together, demonstrating a physical fit.

2.0 Scope – This procedure applies to all physical fit cases in the Trace Evidence Section.

3.0 Definitions – N/A

4.0 Equipment, Materials, and Reagents

- Camera
- Casting media
- Scale
- Stereomicroscope
- Comparison Microscope
- Keyence Digital Microscope
- Scanning Electron Microscope (SEM)

5.0 Procedure

5.1 Analytical Approach

5.1.1 General Guidelines

5.1.1.1 Items submitted for physical fit analysis include a wide variety of materials. The Physical Fit Technical Leader or designee shall assign a Forensic Scientist to each physical fit case based on the type of examination requested and the instrumentation and expertise required to perform the analysis.

5.1.1.2 When pieces have edges that physically fit, the Forensic Scientist can say with certainty that the pieces were joined to form a single item.

5.1.1.3 For items in which a physical fit is not found, other examinations or comparisons may be performed.

5.1.1.4 If DNA analysis is requested, ensure that the items have been swabbed for DNA prior to proceeding with a physical fit analysis.

5.1.1.5 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 units suitable for further comparison can be selected. When proceeding to further comparison of known and questioned samples, beginning with the questioned items is required unless case constraints dictate otherwise.

5.1.2 Visually examine each item of evidence to determine its class characteristics (e.g., size, color, pattern, dimension, composition) and compare the items for similarities.

- 5.1.3** Orient the pieces and determine if they have broken, cut and/or torn edges that physically fit together.
 - 5.1.3.1** Fabric physical fit comparisons involves examining the general size and shape, weave/knit type, fiber type and twist, colors, and patterns, long versus short threads, unusual stretching or contours, stains, damaged areas and stitched edges or selvages.
 - 5.1.3.1.1** When comparing matching flexible materials (e.g., fabric, tape and some plastics), care must be taken to account for edge rolling, stretching, and twisting.
 - 5.1.3.2** Physical Fit comparison of rigid materials involves examining the general size and shape, colors and patterns, edges and contours, cracks, breaks and other damaged areas.
- 5.1.4** If the edges on the pieces physically fit together, observe all orientations of the physical fit for specific, individual characteristics (e.g., scratches, striations, inclusions, stains, defects, hackle marks) that traverse the broken, cut, or torn edges.
 - 5.1.4.1** If comparisons at the microscopic level are necessary, a stereomicroscope, comparison microscope, digital microscope, and/or SEM shall be used.
 - 5.1.4.2** Castings of samples may aid in the comparison. Any suitable casting media may be used, such as mikrosil.
- 5.1.5** Photographs shall be taken of all positive physical fit associations. Additional documentation (e.g., sketches) may be used to supplement the photographs.
- 5.1.6** If sufficient individual characteristics are present, it can be concluded that the items physically fit. All reported identifications shall be verified by a second qualified Forensic Scientist who will conduct the verification from the original evidence. If the initial Forensic Scientist has reconstructed the material for the physical fit association, it may be left assembled for the verifying Forensic Scientist. A Verification Review shall be completed in FA by the verifying Forensic Scientist.

5.2 Guidelines for Physical Fit Analysis Result Statements

- 5.2.1** A methodology statement shall be added to all reports in which analysis was performed.
 - 5.2.1.1** Example: The following methodologies were used in the examination of this case: visual examination and microscopy.
- 5.2.2** The reports shall read as listed below. The wording of the results shall accurately describe the evidence.

5.2.3 Positive

5.2.3.1 Both class and individual characteristics are consistent, and the pieces fit together.

5.2.3.1.1 Example: Item A has edges that physically fit the edges on Item B. Therefore, these pieces were once joined to form a single item.

5.2.4 Inconclusive

5.2.4.1 Class characteristics are consistent, but there is very limited detail in the break. No additional testing can be performed.

5.2.4.1.1 Example: Due to __ (limiting factor), the physical fit analysis of Items A and B was inconclusive.

5.2.5 Negative

5.2.5.1 Class characteristics are not consistent.

5.2.5.1.1 Example: Items A and B were found to have different __ (e.g., manufacturing characteristics); therefore, no physical fit is possible.

5.2.5.2 Class characteristics are consistent, but the pieces do not fit together.

5.2.5.2.1 Example: No physical fit was found between Items A and B.

5.2.5.2.2 Evidence may go on for additional testing (e.g., paint analysis).

5.2.5.2.3 Evidence does not need additional testing (e.g., questioned and known items are both broken bottle necks and are both broken knife tips, therefore; they did not originate from each other).

5.3 Standards and Controls – N/A

5.4 Calibrations – N/A

5.5 Maintenance – N/A

5.6 Sampling and Sample Selection

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

5.6.2 Once a physical fit has been made conclusively linking two objects, scenes, etc., no additional pieces originating from those same areas need to be further evaluated for additional physical fit associations.

5.7 Calculations – N/A

5.8 Uncertainty of Measurement – N/A

6.0 Limitations – N/A

7.0 Safety – Broken edges can be sharp. Care shall be exercised during this technical procedure.

8.0 References

8.1 ASTM / SWG Guidelines

ASTM Standard E2288, “Standard Guide for Physical Match of Paper Cuts, Tears, and Perforations in Forensic Document Examinations.” ASTM International, West Conshohocken, PA.

8.2 Books

Saferstein, R., ed. *The Forensic Science Handbook, Volume I, 2nd Edition*. New Jersey: Pearson Education, Inc., 2002. Chapter 4: Forensic Glass Comparisons.

Deforest, P.R., R.E. Gaensslen and H.C. Lee. *Forensic Science – An Introduction to Criminalistics*. New York: McGraw-Hill, 1983. Chapter 11 – Physical Patterns.

Kirk, Paul L. *Crime Investigation*. New York: Interscience Publishers, Inc, 1953. Chapters 20 and 22: “Casts and Replicas” and “Metals.”

8.3 Journals

Argon, N., Schecter, B. “Physical Comparisons and some Characteristics of Electrical Tape.” *AFTE Journal* 18.3 (1986): 53-59.

Bradley, M.J., et al. “A Validation Study for Duct Tape End Matches.” *Journal of Forensic Sciences* 51.3 (2006): 504-508.

Dixon, K. “Positive Identification of Torn Burned Matches with Emphasis on Cross Cut and Torn Fiber Comparisons.” *American Academy of Questioned Document Forensic Scientists* (August 1982).

Funk, H.J. “Comparison of Paper Matches.” *Journal of Forensic Sciences* 13.1 (1968): 137-143.

Katterwe, H. “Fracture Matching and Repetitive Experiments: A Contribution of Validation.” *ATFE Journal* 37.3 (2005): 229-241.

Klein, A., L. Nedivi and H. Silverwater. “Physical Match of Fragmented Bullets.” *Journal of Forensic Sciences* 45.3 (2000): 722-727.

Laux, D. “Identification of a Rope by Means of a Physical Match Between the Cut Ends.” *Journal of Forensic Sciences* 29.4 (1984): 1246-1248.

Miller, J. “Metal Fractures: Matching and Non Matching Patterns”. *AFTE Journal* 38.2 (2006): 133-165.

Shor, Y., et al. “Physical Match: Insole and Shoe.” *Journal of Forensic Sciences* 48.4 (2003).

Tsach, T., Wiesner, S., Shor, Y. “Empirical proof of physical match: Systematic research with tensile machine.” *Forensic Science International*. 166 (2007): 77-83.

VonBremen, U.G. and B. Lorne. “Physical Comparison of Plastic Garbage Bags and Sandwich Bags.” *Journal of Forensic Sciences* 28.3 (1983).

Weimar, B. “Physical Match Examinations of Adhesive PVC – Tapes: Improvement of the Conclusiveness by Heat Treatment.” *AFTE Journal* 40.3 (2008): 300-302.

Weimar, B. “Physical Match Examination of the Joint Faces of Adhesive PVC-Tapes”. *AFTE Journal*. 42.3 (2010): 271-277.

9.0 Records – N/A

10.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
06/21/2023	1	Original document created from the Technical Procedure for Physical Match Examinations