Technical Procedure for Physical Match 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 match.

2.0 Scope – This procedure applies to all physical match cases in the Trace Unit.

3.0 Definitions – N/A

4.0 Equipment, Materials, and Reagents

- Camera
- Stereomicroscope
- Casting media
- Comparison 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 match analysis include a wide variety of materials. The Physical Match Technical Leader or designee shall assign a Forensic Scientist to each physical match case based on the type of examination requested and the instrumentation and expertise required to perform the analysis.

5.1.1.2 When pieces can be physically matched, the Forensic Scientist can say with certainty that the pieces were joined to form a single unit.

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

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 matching 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 selvedges.

5.1.3.1.1 When 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 Matching 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 match 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 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 physical matches. 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 match. 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 match, 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 Match Analysis Result Statements

5.2.1 The reports shall read as listed below. The wording of the results shall accurately describe the evidence.

5.2.2 Positive

5.2.2.1 Both class and individual characteristics match and the pieces fit together.

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

5.2.3 Inconclusive

5.2.3.1 Class characteristics match, but there is very limited detail in the break. No additional testing can be performed.

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

5.2.4 Negative

5.2.4.1 Class characteristics do not match.

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

5.2.4.2 Class characteristics match, but the pieces do not fit together.

5.2.4.2.1 Example: No physical match was found between Items A and B.

5.2.4.2.2 Evidence will go on for additional testing if possible (e.g., paint analysis).

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 match 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 matches.

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, 2003, "Standard Guide for Physical Match of Paper Cuts, Tears, and Perforations in Forensic Document Examinations." ASTM International, West Conshohocken, PA, 2003.

8.2 Books

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

8.3 Journals

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

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

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9.0 Records – N/A

10.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
09/17/2012	1	Original ISO Document
10/18/2013	2	Added issuing authority to header
08/29/2014	3	Updated header to Physical Evidence Section – Trace Unit, issuing authority to Physical Evidence Section Forensic Scientist Manager. Updated all references in procedure from Trace Evidence Section to Trace Unit.
03/20/2015	4	Changed title to Physical Match Examinations; added cut and/or torn to 1.0; added Comparison Microscope and SEM to 4.0; changed Forensic Scientist Manager to Physical Match Technical Leader or designee in 5.1.1.1; changed wording in 5.1.1.2; added cut and/or torn to 5.1.3; added additional documentation statement to 5.1.5; changed fracture to physical in 5.1.6; removed 5.6.2 and added five additional references to 8.3