

	<b>TRACE-PM 10.9 Physical Matches</b>	
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	Document Manager: Cheryl Lozen	Approved By: Jeffrey Nye

## 10.9 Physical Matches

*(Note: Physical matches involving documents/paper (cuts, tears and perforations), including paper matches, will likely be performed by the Questioned Document (QD) Unit. If in question, contact the QD Unit for discussion.)*

This procedure does not cover the possible further analysis to assess the level of association of class characteristics between items. See other sub-discipline-specific procedure manuals if further analysis is to be performed.

### 10.9.1 Physical Match / Physical Fit / Fracture Match - defined

Items being submitted for fracture match, or physical fit, analysis include a variety of materials. Typically, when a material having reasonable rigidity breaks, irregularities appear at the break which may create unique edges. Other types of materials may be subject to separation by cutting, tearing, shattering and so forth.

The reassembly of two or more separated objects either through physical, optical or photographic means which permits one to reach the opinion that the objects were either once one entity or were once held or bonded together in a unique arrangement. When accomplished, this examination provides support that the materials were at one time a single unit.

### 10.9.2 Principles

#### Criteria for a Physical Fit (Physical Match):

- Correspondence of general gross physical characteristics
- Broken or separated
- Capable of being fit back together or physically realigned
  - An edge-to-edge physical fit
  - Surface markings
  - unique bonding material pattern
- Pieces appear to be unique
- Not interchangeable with similar pieces elsewhere

### 10.9.3 Types of Physical Matches

#### 2D Contiguous Edges

**Breaks** (examples: paint chips, plastic, glass, knife blades)

**Tears** (examples: tape, paper, cloth)

**Cuts through unique arrays** (examples: wood grain, surface scratches)

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### **3D Junctions** (examples: upturned edges of severed or broken objects)

Examples:

- Upturned edges of broken glass and plastic
- Broken-off auto accessories, emblems, ornaments, etc.
- Cut hoses, sawed pieces of wood, paper matches

### **Overlaid objects**

- Requires a unique-appearing pattern at the interface

### **Special cases- Contiguous edges missing**

Examples:

- "Ream" patterns
- Wood grain
- Surface stria/polish marks
- Fingernail ridges

## **10.9.4 Methods**

Methods that can be utilized for conducting physical match examinations:

### **Appearance, Measurements and Pattern Count**

Examine for correspondence in gross physical appearance

### **Visual Inspection and Manual Alignment**

Examine each item of evidence visually to determine the correct orientation of the pieces. Begin with matching a surface (e.g., the outer color coat of paint chips, the fluorescing surface of float glass pieces, the smooth or finished surface of plastic fragments, etc.). After the pieces are marked for identification and "sided", contours, edges, colors, surface markings and so forth, can be used to help align pieces correctly. It is often helpful to fit together pieces of a given item to themselves ("knowns") and then fit them to additional items ("questioned") in the case.

### **Edge-To-Edge Realignment Considerations**

- Rigidity of specimens
- Fracture edge distortion
- Apparent uniqueness (points of comparison)

**Surface Markings Alignment** - Observe all orientations of the fit. Scratches, stains or defects that traverse the broken, cut or torn edge may serve to reinforce the physical fit opinion.

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- Manufacturer's markings
- Polishing mark striations
- Accidental surface abrasions markings
- Surface pattern, print, design, color sequence, word lettering, etc.

**3-D Types (Upturned Edges)** - Observe the potential matching fractures “on end”. Matching hackle marks and defects may be seen and serve to reinforce the physical fit opinion.

Both pieces accessible and in possession of the examiner:

- Normal examinations for severed inclusions or grain (matches, wood)
- Oblique lighting for items with ridges and valleys
- Reverse oblique lighting to overcome + - effects
- Casting

One piece inaccessible or unmanageable:

- Casting of inaccessible surface with impression material followed by direct comparison with the evidence piece

**Separated overlying objects** (examples: glue patterns on separated objects)

- Side by side direct examination (taking into account right-left reversal and possible + - effects)
- Photograph both surfaces (reverse one image and print both to the same size)
- Casting of a harder surface that has left an imprint in a softer surface; cast compared directly with embossed pattern in the softer object

### **Fabric**

- Fiber examiners will conduct fracture match examinations of textile materials
- Matching fabric pieces involves examination of general size and shape, weave, fiber type and twist, colors, long versus short threads and thread counting

### **Flexible materials**

- When matching flexible materials (e.g., fabric, tape and some plastics), care must be taken to account for edge rolling, stretching, and twisting
- If the evidence does not already have an adhesive, use of double stick tape on a rigid clear backing (glass, clear overlay, etc.) may be useful to stabilize the edge during comparison and to reduce the effects of distortion of stretching or twisting

### **Lighting**

- Light sources of sufficient intensity can allow fine detail to be distinguished
- Examples include natural light, incandescent, fluorescent, oblique lighting, transmitted
- Lights of various wavelengths may reveal surface stains, etc. which may be helpful in re-alignment or elimination

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## Microscopic Examinations

- Microscopic examinations may be performed and documented when necessary to assess the fractures and/or fracture match(es)

### 10.9.5 Procedures

All procedures shall be performed when applicable and noted when appropriate. These procedures need not be performed in the order given.

At various points in these procedures, a determination that a particular feature is not present or that an item is lacking in quality or comparability may indicate that the examiner should discontinue or limit the procedure(s). It is at the discretion of the examiner to discontinue the procedure at that point and report accordingly or to continue with the applicable procedures to the extent possible. The reasons for such a decision shall be documented.

**10.9.5.1** Determine correspondence of general gross physical characteristics

**10.9.5.2** Determine whether or not the specimens are broken or separated.

**10.9.5.3** Determine whether or not the specimens are suitable to be physically realigned.

**10.9.5.4** Evaluate the specimens for characteristics that are possibly unique.

**10.9.5.5** Conduct a side-by-side comparison of the specimens using the following steps:

- Visual inspection
- Manual alignment
- Edge-to-edge realignment
- Surface markings

**10.9.5.6** Measurements and pattern count if applicable.

**10.9.5.7** Evaluate similarities, differences, and limitations. Determine their significance individually and in combination.

**10.9.5.8** Reach a conclusion and report accordingly.

### 10.9.6 Documentation

Examinations performed, relevant observations, and results shall be documented.

Along with case file notes, documentation of a fracture match shall include one or more of the following:

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- Photographs of the fracture match
- Detailed sketches of the fracture match

Each of the above is to be documented within the case notes and should have legible markings for item identification which are also described in the notes, or labeled onto the photograph if not obvious from the photograph itself.

### 10.9.7 Verification

All fracture match identifications shall be confirmed/verified by the technical reviewer (i.e. the technical reviewer, by passing the technical review is verifying all conclusions, including any identifications). This can be performed by in-person examination of the evidence by the reviewer, or by review of the case record if sufficient photographic documentation is available.

### 10.9.8 Report Writing and Conclusion Scale

The techniques utilized in the analysis will be listed in the report.

- Example: "Items \_\_\_ and \_\_\_ were examined visually and using stereomicroscopy"

The findings may range from fracture match to unsuitable (see scale below); Wording similar to that in the scale below should be utilized in the report. The report should also include the particular details of the fracture match or the dissimilarities or limitations of the items not found to fracture match, where applicable.

Example fracture match opinion wording:

- "A fractured edge of the questioned paint chip (Item 2) physically aligned with a fractured edge of paint from the hood of Vehicle 2. When aligned, there were also corresponding striations on the underside of the chips. In the opinion of this analyst, this paint chip originated from the hood of Vehicle 2. The alignment of fractured edges and striations between the questioned paint chips and the hood paint would not be expected except by paint that was once formerly connected. (Fracture Match – See conclusion scale below)"

**This scale shall be placed in the reports of fracture match cases, unless further chemical/physical analysis is performed and reported within the same report:**

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### Conclusion Scale for Fracture Match Examinations

The following descriptions are meant to provide context to the levels of opinions reached in this report.

*Fracture Match (Physical Match): The physical fit and/or alignment of features supports the opinion that the items were once a single object or from the same object. While this opinion cannot specifically exclude all other possible sources, the quality and extent of corresponding detail would only be expected by items that were once part of the same object.*

*High Degree of Alignment: No fracture match was found; however, the items had apparent similarities of general physical properties in addition to sharing atypical characteristic(s) and/or having possible alignment. There were limiting factors that prevented a more definitive conclusion.*

*No Fracture Match: The items had apparent similarities of general physical properties; however, no fit or alignment of fractured edges was found.*

*Unsuitable for Fracture Match Examination: The items had apparent dissimilarities of general physical properties or some other limiting factor(s) which prevented a fracture match examination.*

**The following statements (or similar) can be utilized to express possible further analysis considerations:**

#### **NOTE choices for report:**

NOTE: Additional, more discriminating analysis to compare physical, chemical and elemental properties may be possible. If further analysis is desired, please contact the undersigned for more information.

NOTE: Further analysis to compare physical, chemical and/or elemental properties will be performed on this evidence. That analysis will be the subject of a separate report.

NOTE: Due to the dissimilarities or limiting factors observed, no further comparative analysis will be performed.

## **10.9.9 References**

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