

Standard Scale ~~of and Criteria for~~ Source Conclusions
~~Criteria for in~~ Toolmark Examinations

DRAFT



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Standard Scale ~~of and Criteria for~~ Source Conclusions ~~Criteria for~~ in Toolmark Examinations

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410 North 21st Street
Colorado Springs, CO 80904

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Foreword

This document was developed to provide a standard scale of conclusions and criteria to be used for toolmark examinations and comparisons by forensic firearm and toolmark examiners.

Throughout this document, the term “toolmark” is used to refer to both firearm produced and non-firearm produced toolmarks.

The American Academy of Forensic Sciences established the Academy Standards Board (ASB) in 2015 with a vision of safeguarding Justice, Integrity and Fairness through Consensus Based American National Standards. To that end, the ASB develops consensus based forensic standards within a framework accredited by the American National Standards Institute (ANSI), and provides training to support those standards. ASB values integrity, scientific rigor, openness, due process, collaboration, excellence, diversity and inclusion. ASB is dedicated to developing and making freely accessible the highest quality documentary forensic science consensus Standards, Guidelines, Best Practices, and Technical Reports in a wide range of forensic science disciplines as a service to forensic practitioners and the legal system.

This document was revised, prepared, and finalized as a standard by the Firearms and Toolmarks Consensus Body of the AAFS Standards Board. The draft of this standard was developed by the Firearms and Toolmarks Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science.

Questions, comments, and suggestions for the improvement of this document can be sent to AAFS/ASB Secretariat, asb@aaafs.org or 410 N 21st Street, Colorado Springs, CO 80904.

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Standard Scale ~~of and Criteria for~~ Source Conclusions ~~Criteria for~~ Toolmark Examinations

1 Scope

This standard provides a ~~standard~~ scale of conclusions and criteria to be used for all toolmark examinations and comparisons. These comparisons are conducted for the forensic ~~purpose~~ purposes of determining ~~if whether or not~~ two or more toolmarks could have been created by the same tool. This document is limited to the process of ~~developing~~ reaching source conclusions and does not address or consider other types of conclusions possible in the analysis of toolmark evidence.

2 Normative References

There are no normative reference documents. Annex ~~BA~~, Bibliography, contains informative references.

3 Terms and Definitions

For purposes of this document, the following definitions apply.

3.1

class characteristics

~~observable~~ physical features of a specimen which indicate a restricted group source

NOTE Class characteristics result from design and manufacturing decisions that are within acceptable manufacturing tolerances and are, therefore, determined prior to manufacture.

3.2

Known Same Source Toolmarks

KSST

toolmarks known to have been made by the same tool

Note KSST was also termed as known match (KM).

3.3

Known Different Source Toolmarks

KDST

toolmarks known to have been made by different tools or different working surfaces of the same tool

~~random~~ Note KDST was also termed as known non-match (KNM).

3.4

individual characteristics

marks produced by the random imperfections or irregularities of ~~tool surfaces~~ ~~NOTE These random imperfections or irregularities are,~~ produced incidental to manufacture and/or caused by use, corrosion, or damage, and relevant for comparison between an individual item and a potential source

Note Individual characteristics are not expected to be seen in the same arrangement of detail repeated in another source.

AFTE Glossary [mod]

3.5

source conclusion

an opinion of same source, an opinion of different sources, or an inconclusive opinion

3.6

subclass characteristics

toolmarks produced during the manufacturing process that persist on a series of sequentially manufactured items fabricated by the same tool

NOTE These features are not determined prior to manufacture and are more restrictive than class characteristics.

3.53.7

task-relevant information¹

information that is necessary for drawing conclusions:

- a) about the propositions in question;
- b) from the physical evidence that has been designated for examination;
- c) through the correct application of an accepted analytic method by a competent analyst²

4 Requirements

4.1 Value Determinations

4.1.1 General

The examiner shall evaluate ~~the value of~~ each item as defined in 4.1.2 and 4.1.3.

4.1.2 Of No Value (Unsuitable) for Source Conclusion

The examiner shall render ~~an~~this opinion ~~that an item is of no value (unsuitable) for a source conclusion~~ when the item lacks sufficient quality or quantity of features, size, or clarity ~~(+suitable for source conclusions~~ (e.g., an object that does not bear any class, subclass and/or individual ~~toolmarks suitable for source conclusions~~characteristics). However, the item may have value to other paths of forensic inquiry (e.g., crime scene reconstruction).

4.1.3 Of Value for Source Conclusion

~~The~~When the examiner ~~shall reach a preliminary judgement~~determines that the item under consideration has potentially sufficient class, subclass and/or ~~random~~individual characteristics for

¹ Available from: <https://www.justice.gov/ncfs/file/818196/download>

² <https://www.justice.gov/ncfs/file/818196/download>

further evaluation, examination, or comparison with other known-source or questioned-source items for potential source conclusion, the examiner shall proceed with the examinations.

4.2 Scale of Source Conclusions and Related Criteria

4.2.1 Opinion of Different Source (Exclusion)

4.2.1.1 General

An examiner shall render an opinion that toolmarks originated from different sources based on the criteria listed in 4.2.1.2. An opinion of different source is justified when the observed characteristics of the items in question provide ~~very strong~~ high level of support that they were marked by different tools and ~~very weak~~ low level or no support that they were marked by the same tool.

4.2.1.2 Criteria for Opinion of Different Source (Exclusion)

4.2.1.2.1 An examiner shall render an opinion of different source when there is a demonstrable incompatibility in class characteristics between the items in question. ~~An opinion of different source may only be expressed as a certainty if it is physically impossible (i.e., zero probability) for the examined items to have been marked by the same source tool based on an incompatibility in class characteristics.~~

4.2.1.2.2 If the discernable class characteristics are compatible, an examiner shall render an opinion of different source only if there are demonstrable differences in random individual characteristics or potential subclass characteristics, such that the excluded toolmarks fall outside the range of variability of marks produced by the same tool (KSST) ~~and are consistent with the amount of disagreement demonstrated by toolmarks known to have been produced by different tools (KDST), based on the observed features, task-relevant information, and the cumulative results of training and other professionally obtained knowledge (e.g., published in peer-reviewed journals).~~

Task-relevant information should be considered when determining if differences observed in the comparison of two toolmarks support an opinion of different source ~~including~~ These include, but are not limited to, the following:

- a) ~~if/when examining~~ a suspect tool ~~is available for examination~~:
- evidence of potential alteration to the tool working surface ~~(e.g., fresh grinding or filing marks);~~
 - ability of the tool to consistently reproduce ~~random~~ the individual characteristics;
 - condition of the tool working surface or substrate (e.g., visible rust or corrosion);
 - relative hardness of the tool working surface or substrate;

~~EXAMPLE~~ ~~The face of a steel hammer was used to attempt to forcefully remove several carbide nails around a window during an attempted burglary. The impacts left deep gouges in the hammer face because the nail heads were harder than the steel used to make the hammer. In this example, the nail heads were the tool and the hammer face was the substrate. Performing reproducibility tests using the nails, not the hammer, could be an~~

~~appropriate course of analysis, if the suspected nails were or could be recovered from the scene.~~

EXAMPLE A bolt cutter was used to cut the hardened steel shackles of padlocks. Since the tool is not much harder than the workpiece, the tool is damaged each time it is used to act upon the workpiece. Therefore, the tool may exhibit changes from that damage in the test marks produced.

- history of the tool, to the extent it can be established, including any known time interval between deposition of questioned toolmark(s) and collection of the tool, during which changes to the tool could have occurred due to use, abuse, or corrosion.

NOTE For the purpose of determining if an opinion of different source is warranted based on differences in individual characteristics, investigative details relating to the possible use or non-use of the suspected tool during the time interval between the criminal incident and the collection of the tool as evidence may be contextual task-relevant information because it may help the examiner draw an accurate forensic conclusion.

b) ~~if a suspect tool is unknown or otherwise unavailable for examination:~~when examining questioned toolmarks:

- time interval between the production or collection of the questioned toolmarks, if related to different events;
- quantity and quality of any additional questioned toolmarks available for analysis, to the extent it can be determined that they represent a reliable range of variability of ~~random~~individual characteristics arising from the same source tool.

EXAMPLE A group of four questioned bullets determined to have been fired from the same unknown firearm based on consistently reproduced ~~random~~individual characteristics in the rifling impressions is compared to a bullet having ~~the same~~no exclusionary differences in the discernible class characteristics but displaying ~~no significant agreement~~sufficient disagreement of ~~random~~individual characteristics with the aforementioned group; in this example, the fifth bullet could justifiably be excluded (per the criteria in 4.2.1.2.2) as having been fired from the same firearm that marked the group of four bullets, if it can be assumed there are no ~~mitigating~~ factors (e.g., a lengthy time interval between the crime scenes, ~~or~~ a difference in ammunition) that could possibly account for the observed disagreement.

4.2.2 Opinions of Inconclusive

4.2.2.1 General

An examiner shall render an inconclusive opinion as to the source of toolmarks based on the criteria listed in 4.2.2.2.1, 4.2.2.3.1, and 4.2.2.4.1. An inconclusive opinion is justified when there is agreement of discernible class characteristics, but ~~the observed random~~there is insufficient agreement or disagreement of the individual characteristics ~~of observed on~~ the items in question ~~are insufficient~~ to support either ~~that~~ the items were marked by the same tool or ~~that~~ the items were marked by different tools. This source conclusion may be expressed as one general inconclusive statement (section 4.2.2.3), or can be further specified as described in the sections 4.2.2.2 and 4.2.2.4. The FSSP shall conduct a risk assessment to determine whether or not they choose to adopt categories 4.2.2.2 (insufficient support for opinion of different source (exclusion))

and 4.2.2.4 (insufficient support for opinion of same source (identification)). The FSSP shall have procedures that include what additional information beyond the term “inconclusive” can be added to the report and what, if any, additional quality control or documentation shall be required.

4.2.2.2 Insufficient Support for Opinion of Different Source (Exclusion)

4.2.2.2.1 General

An examiner shall render an inconclusive opinion of Insufficient Support for Opinion of Different Source (Exclusion) based on the criteria listed in 4.2.2.2.2. This opinion is justified when the observed characteristics of the items in question provide support that they were marked by different tools coupled with low level or no support that they were marked by the same tool, but the differences are potentially within the range of variability of marks produced by the same tool (KSST) and are, therefore, insufficient for an Opinion of Different Source (Exclusion).

4.2.2.1.14.2.2.2 Criteria for ~~Inconclusive~~ Insufficient Support for Opinion of Different Source (Exclusion)

An examiner shall conclude that there is insufficient support for an opinion of different source (exclusion) when there is agreement of discernible class characteristics and some differences in individual characteristics or possible subclass characteristics, but potentially within the range of variability of marks produced by the same tool (KSST).

4.2.2.3 Insufficient Support for Either Opinion of Different Source (Exclusion) or Opinion of Same Source (Identification)

4.2.2.3.1 General

An examiner shall render an inconclusive opinion of Insufficient Support for Either Opinion of Different Source (Exclusion) or Opinion of Same Source (Identification) based on the criteria listed in 4.2.2.3.2. This opinion is justified when there is agreement of discernible class characteristics, but, due to an absence of individual characteristics, lack of demonstrable agreement or disagreement of individual characteristics, or lack of reproducibility of individual characteristics, no other conclusion can be reached.

4.2.2.3.2 Criteria for Insufficient Support for Either Opinion of Different Source (Exclusion) or Opinion of Same Source (Identification)

An examiner shall conclude that there is insufficient support for either an opinion of same source (identification or elimination when any of) or opinion of different source (exclusion) when there is insufficient agreement and/or insufficient disagreement of observable characteristics.

4.2.2.4 Insufficient Support for Opinion of Same Source (Identification)

4.2.2.4.1 General

An examiner shall render an inconclusive opinion of Insufficient Support for Opinion of Same Source (Identification) based on the criteria listed in 4.2.2.4.2. This opinion is justified when the observed characteristics of the items in question provide support that they were marked by the same tool coupled with low level or no support that they were marked by a different tool, but the similarities are potentially

outside the range of variability of marks produced by the same tool (KSST) and are, therefore, insufficient for an Opinion of Same Source (Identification).

4.2.2.4.2 Criteria for Insufficient Support for Opinion of Same Source (Identification)

An examiner shall conclude that there is insufficient support for an opinion of same source (identification) when there is agreement of discernible class characteristics and some agreement of individual characteristics, but potentially within the range of agreement that has been demonstrated by toolmarks made by different tools (KDST).

4.2.2.5 Additional Considerations for Opinions of Inconclusive

An examiner shall consider the following (non-exhaustive) conditions ~~apply~~ which may contribute to an inconclusive opinion:

- a) an absence quantity/quality of random individual characteristics;
- ~~b) lack variability of reproducibility of random characteristics;~~
- ~~e)b) insufficient agreement, or insufficient disagreement, of random individual~~ characteristics;
- ~~d)c) damage;~~
- ~~e)d) poor~~ sample quality;
- ~~e) limited~~ sample size;
- f) potential subclass characteristics.

4.2.3 Opinion of Same Source (Identification)

4.2.3.1 General

An examiner shall render an opinion that toolmarks originated from the same source based on the criteria listed in 4.2.3.2. An opinion of same source is justified when the observed characteristics of the items in question provide ~~very strong~~ a high level of support that they were marked by the same tool and ~~very weak~~ low level or no support that they were marked by different tools.

4.2.3.2 Criteria for Opinion of Same Source (Identification)

If the discernable class and subclass characteristics are compatible, an examiner shall render an opinion that toolmarks originated from the same source only if there are demonstrable similarities in random individual characteristics, such that the ~~identified~~ toolmarks fall within the range of variability of marks produced by the same tool (KSST) and ~~are inconsistent with the amount of disagreement the agreement exceeds that which has been~~ demonstrated by toolmarks ~~known to have been produced~~ made by different tools (KDST), ~~based on the observed features, task-relevant information, and cumulative results of training and other professionally obtained knowledge (e.g., published in peer-reviewed journals).~~

Task-relevant information should be considered ~~if a suspect tool is available for examination~~ when determining if similarities observed in the comparison of two toolmarks support an opinion of same source including, but not limited to, the following:

- ability of the ~~tool to consistently reproduce random individual~~ characteristics ~~on the tool surface to be reproduced~~;
- condition of the tool working surface or substrate, ~~if available~~;
- relative dates of collection of all evidence.

5 **Qualifications and Limitations**

5.1— **Effects on Conclusions**

~~A source conclusion is ultimately an examiner's opinion and as such is necessarily subjective, potentially subject to error, and cannot be made to the exclusion of all other tools, or to any specific degree of certainty. Care must be taken when choosing terminology; terms such as "unique" or "individualize" can imply that a source conclusion is justified without fairly representing the significance of the science or data.~~

~~The laboratory examiner shall include training on potential sources be aware of bias and a procedure for minimizing intercept the negative effects of bias at the points they impact the process of making source conclusions.~~

~~5.1.1— An examiner should be aware that comparison requests based on database associations. The FSSP shall have the potential for confirmation bias and have the capacity to produce close non-matches.~~

~~5.1.2— The examiner should be aware of and evaluate their conclusion reasoning for contextual biases.~~

5.2— **Expressing Conclusions³**

~~5.2.1— A conclusion provided during a policy regarding the expression of source conclusions through testimony or in a report is ultimately an examiner's decision and is not based on, lab reports, lab notes, and other written or verbal communications to include suitable limitations. At a statistically derived or verified measurement or comparison to all other firearms or toolmarks. Therefore, minimum, the FSSP shall include in the policy that an examiner shall not:~~

- ~~assert that a 'source identification' or a 'source exclusion' conclusion is based on the 'uniqueness' of an item of evidence.~~
- ~~use the terms 'individualize' or 'individualization' when describing a source conclusion.~~
- ~~assert that two toolmarks originated from the same source to the exclusion of all other sources.~~

³ <https://www.justice.gov/olp/page/file/1284766/download>

~~5.2.2—An examiner shall not assert that examinations conducted in the forensic firearms/toolmarks discipline are infallible or have a zero error rate.~~

~~5.2.3—An examiner shall not provide a conclusion that includes a statistic or numerical degree of probability except when based on relevant and appropriate data.~~

~~5.2.4—An examiner shall not cite the number of examinations conducted in the forensic firearms/toolmarks discipline performed in his or her career as a direct measure for the accuracy of a conclusion provided. An examiner may cite the number of examinations conducted in the forensic firearms/toolmarks discipline performed in his or her career for the purpose of establishing, defending, or describing his or her qualifications or experience.~~

~~An examiner shall not assert that two toolmarks originated from the same source with absolute or 100% certainty, or use the expressions ‘reasonable degree of scientific certainty,’ ‘reasonable scientific certainty,’ or similar assertions of reasonable certainty in either reports or testimony unless required to do so by a judge or applicable law. to any numerical/statistical degree of certainty and cannot be made to the exclusion of all other tools. The examiner should be familiar with contemporary statements pertaining to these issues.⁴~~

⁴ <https://www.justice.gov/olp/page/file/1284766/download>

Annex A
(informative)

Bibliography

This is not meant to be an all-inclusive list; other publications on this subject may exist. At the time this standard was drafted, these were the publications available for reference. Examiners should take into consideration the current state of professional practice and scientific research.

1] AFTE Criteria for Identification Committee "Theory of Identification, Range of Striae Comparison Reports and Modified Glossary Definitions - AFTE Criteria for Identification Committee Report." *AFTE Journal*, 1992, Vol. 24(3), pp. 336-338.

2] AFTE Glossary⁵

⁵ Available from: https://afte.org/uploads/documents/AFTE_Glossary_Version_6.091922_FINAL_COPYRIGHT.pdf

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