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## Forensic Document Examination Terms and Definitions

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## Forensic Document Examination Terms and Definitions

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## Foreword

For over a century general and task specific terminologies and glossaries relating to forensic document examination have been presented in textbooks, technical papers, as well as in technical standards such those available through SWGDOC.<sup>1</sup> This Technical Report continues, consolidates, and updates those efforts.

The use of standardized terminology by forensic document examiners and other forensic service providers promotes consistency across jurisdictions and relieves the judicial system of conflicting terms and definitions.

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 Forensic Document Examination Consensus Body of the AAFS Standards Board. The draft of this standard was developed by the Forensic Document Examination 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@aafs.org](mailto:asb@aafs.org) or 410 N 21<sup>st</sup> Street, Colorado Springs, CO 80904.

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**Key Words:** *forensic document examination, terminology*

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<sup>1</sup> Available at <http://swgdoc.org/index.php/standards/published-standards>

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# Forensic Document Examination Terms and Definitions

## 1 Scope

This technical report provides terms and definitions used by forensic document examiners (FDE) in forensic examinations and comparisons involving the complex and ever-expanding range of issues concerning the forensic examination of documents.

The range of terms includes the varied materials, technologies, and methods used to generate documents and those used in their forensic examination.

Some terms and definitions in this Technical Report might vary from the usage of other forensic disciplines. This technical report may not cover every definition conceivably used by FDEs.

## 2 Normative References

There are no normative reference documents. See Annex A for bibliographical references.

## 3 Terms and Definitions

### 3.1 General Terms Relevant to Forensic Document Examinations

#### 3.1.1 absent character

A character or character combination which is present in one body of writing but is not present (for example, does not have a corresponding character) in another body of writing.  
(SWGDOC E01)

#### 3.1.2 accidental characteristic

One that falls outside of the writer's range of variation, and that would not be expected to be repeated in the writing because it may be an anomaly.

#### 3.1.3 Analysis, Comparison, Evaluation (see individual terms) ACE



A summary by Huber (1959) of three distinct stages through which the forensic or other examiner must pass, consciously or otherwise, in the course of any comparative examination.

NOTE These terms are similar to “study, comparison and interpretation” and “recognition, comparison and correct interpretation.”  
(Osborn, AS, 1910, pp 89, 105)

#### 3.1.3.1 analysis

The “unknown” item is classified according to its properties or characteristics. These properties can be directly observable, measurable, or inferred.  
(based on Huber, 1959)

- 36       **3.1.3.2**  
37       **comparison**  
38       A comparison is made of the properties of the item found through analysis with the known or  
39       recorded properties of others whose identity is unquestioned.  
40       (based on Huber, 1959)
- 41       **3.1.3.3**  
42       **evaluation**  
43       The process of assessing similarities and dissimilarities in characteristics for the purposes of  
44       association or dissociation.
- 45       **3.1.4**  
46       **active coat**  
47       A coating layer which contains the primary image (color) forming components.
- 48       **3.1.5**  
49       **aliasing**  
50       The stair stepped or jagged effect resulting from analog to digital conversion (see [3.1.294](#)  
51       **pixelation**).
- 52       **3.1.6**  
53       **alignment (handwriting)**  
54       Position of writing with respect to a real or imaginary baseline.  
55       (NIST HF)
- 56       **3.1.7**  
57       **alignment (typewriting)**  
58       The adjustment of various mechanisms of a typewriter to ensure the even printing of the characters  
59       and their proper positioning relative to the baseline and to the other characters.  
60       (SWGDOC E04-13)
- 61       **3.1.8**  
62       **alignment (general)**  
63       The appearance or position of a handwritten or printed character(s) or text relative to a real or  
64       imaginary baseline or to another handwritten or printed character(s) or text.
- 65       **3.1.9**  
66       **alignment defect**  
67       A deviation from the intended appearance or position of a character relative to another character  
68       (see [3.1.207](#) **impression defect**).
- 69       NOTE Alignment defects are usually categorized as vertical misalignment (character too high or low relative  
70       to the baseline established by the other characters), horizontal misalignment (character too far to the left or  
71       right relative to the other characters), and twisted or leaning (character leans to the left or to the right);  
72       because they are corrected in the alignment process, impression defects are considered as alignment defects.  
73       (SWGDOC E04-13)
- 74       **3.1.10**  
75       **allograph**  
76       Different forms of the same character such as capital hand-printed “A” and cursive “a.”  
77       (Adopted from HH)

- 78 **3.1.11**  
79 **alteration**  
80 A modification made to a document by any combination of physical, chemical, or mechanical means  
81 including, but not limited to, obliterations, additions, overwritings, or erasures.  
82 (ANSI/ASB Std 035)
- 83 **3.1.12**  
84 **anti-stokes luminescence**  
85 Photoluminescence whose radiation is located in a spectral region of shorter wavelengths than that  
86 of the exciting radiation.
- 87 NOTE This happens, for instance, when the energy of the emitted photons originates from the absorption of  
88 two exciting photons.  
89 (CIE S 017/E:2011 ILV)
- 90 **3.1.13**  
91 **apex**  
92 The uppermost point of a character.  
93 (SWGDOC T01)
- 94 **3.1.14**  
95 **apprentice**  
96 A student under in-person, direct supervision of a principal trainer on an almost daily basis. There  
97 may or may not be a financial arrangement between the trainer and apprentice.
- 98 **3.1.15**  
99 **apprenticeship**  
100 An arrangement in which a student is learning knowledge, skills, and abilities through practical  
101 experience under a skilled worker(s).
- 102 **3.1.16**  
103 **arcade**  
104 Stroke used to form the arcs of the cursive letters m and n; also a cursive writing  
105 style where upward arc forms predominate. May be referred to as over curve. 
- 106 **3.1.17**  
107 **arm**  
108 A stroke that is attached at one end to another portion of the character such as that in  
109 the upper right portion of the upper case "K". 
- 110 **3.1.18**  
111 **arrangement (general)**  
112 The placement of handwritten or printed text on the page, including characteristics such as  
113 margins, interline and inter-word spacing, indentations, and paragraphing.  
114 (based on NIST HF)
- 115 **3.1.19**  
116 **artifact**  
117 Any distortion, alteration, or information not present in the original object or image, produced by an  
118 external agent or action, or inadvertently introduced by image copying, capture, processing,  
119 compressions, transmission, display, or printing.

- 120 **3.1.20**  
 121 **ascender**  
 122 A stroke that rises above the height of the body of the letter formation.  
 123 (SWGDOC T01)
- 124 **3.1.21**  
 125 **assisted hand signature**  
 126 A signature executed by a writer while the writer's hand, arm, or writing instrument is **supported**,  
 127 steadied, or stabilized by another **resulting in a distorted signature**. (See [3.1.189 guided](#)  
 128 **signature**.)  
 129 (SWGDOC T01)
- 130 **3.1.22**  
 131 **authorized document**  
 132 a document made or issued by or under the authority of a governmental or private organization or  
 133 an individual.
- 134 **3.1.23**  
 135 **awkward hand**  
 136 (See [3.1.419 unaccustomed hand](#).)  
 137 (SWGDOC T01)
- 138 **3.1.24**  
 139 **ball element**  
 140 An element used in a single element typewriter in which the fully formed  
 141 characters are located on the outer surface of a spherelike device.  
 142 Frequently called golf ball element.  
 143 (SWGDOC E04-13)
- 144 **3.1.25**  
 145 **ballpoint pen ink**  
 146 Writing or marking media intended for use in a ball point pen. Typically, a thick, high viscosity ink  
 147 with an oil, glycol, or rubber base.  
 148 (SWGDOC M01)
- 149 **3.1.26**  
 150 **ball terminal - typewriting**  
 151 Small round globe on some typefaces.
- 152 **3.1.27**  
 153 **banding**  
 154 Uniform density variations or voids in a given color which appear in the direction that the printhead  
 155 travels.  
 156 (ASTM F1857)
- 157 **3.1.28**  
 158 **base**  
 159 The lowest element of letters such as the capital letters "E" and "L".





- 160 **3.1.29**  
161 **baseline**  
162 The ruled or imaginary line upon which writing, typographic printing, or typewriting appears to  
163 rest.
- 164 **3.1.30**  
165 **batch to batch variation**  
166 Within an ink formulation, difference in the concentration of a component of an ink formula due to  
167 deviations during production that are within the manufacturer's tolerance limit.  
168 (SWGDOC M01)
- 169 **3.1.31**  
170 **bead defect**  
171 Inked or un-inked impression or hole in the paper caused by a contaminant particle encased in  
172 plating material located on or adjacent to the printing area of the typeface on a metal coated  
173 element.  
174 (SWGDOC E04)
- 175 **3.1.32**  
176 **bias**  
177 Any factor that has the potential of causing systematic deviation from any part of an evaluative  
178 process.
- 179 **3.1.33**  
180 **bias, cognitive**  
181 The effect of a set of influences, which can be unconscious, on the reliability and validity of an  
182 individual's observations and conclusions.
- 183 **3.1.34**  
184 **bias, confirmation**  
185 The tendency to search for data or interpret information in a manner, which can be unconscious,  
186 that supports one's preconceptions, expectations or desires.
- 187 **3.1.35**  
188 **bias, contextual**  
189 A deviation in human judgment caused by exposure to information that is either irrelevant to the  
190 judgmental task or inappropriate for consideration.
- 191 **3.1.36**  
192 **black write**  
193 Process in electrostatic printing in which the photoconductive element is charged with a charge of  
194 the same sign as that of the toner. A light beam, used like a "stylus" is used to discharge only those  
195 areas that are to receive toner to form the image. In the development process, the charged  
196 background areas repel the like charged toner to the discharged areas on the photoconductor.  
197 (ASTM F909)
- 198 **3.1.37**  
199 **bleed**  
200 Ink feathering of one color into an adjacent color over time.  
201 (ASTM F1857)

- 202 **3.1.38**  
203 **blemish**  
204 A small extraneous spot found near inked regions of checkwriter impressions that is characteristic  
205 of machines that use ribbons as their ink source.  
206 (SWGDOC E07)
- 207 **3.1.39**  
208 **blunt ending**  
209 Effect on commencement and terminal strokes of letters, both uppercase and lowercase, by the  
210 application of the writing instrument to the paper prior to the beginning of any horizontal  
211 movement; an action that usually omits any beard, hitch, knob, or tick.  
212 (H & H Glossary)
- 213 **3.1.40**  
214 **boat**  
215 A dish-shaped figure consisting of a concave stroke and straight or curved stroke sometimes  
216 forming the base of letters.
- 217 **3.1.41**  
218 **bone folder**  
219 A piece of shaped bone or other material, such as plastic or Teflon, typically used by bookbinders to  
220 crease paper and to separate pieces of paper that are stuck together.  
221 (SWGDOC P01)
- 222 **3.1.42**  
223 **bowl**  
224 A curved stroke joining a stem that partially encloses an area forming an open cup-like shape.
- 225 **3.1.43**  
226 **buckle**  
227 The eyelet that is often used to form the middle of such letters as the cursive capital letters “K”, “R”,  
228 and “B”, where an element of a letter connects, abuts, or is closely adjacent to the staff.
- 229 **3.1.44**  
230 **bulletin**  
231 Type designs with a cap height greater than the height of the Roman type, usually used with a  
232 horizontal spacing of 3.5 mm or more per character or space (greater than or equal to 8 pitch).
- 233 **3.1.45**  
234 **cap**  
235 The uppermost element of letters such as the capital letters “F” and “T”.
- 236 **3.1.46**  
237 **caps height-typewriting**  
238 Height of a font’s uppercase letters, measured by the letter “H”.

- 239 **3.1.47**  
240 **carbon paper**  
241 A sheet composed of a supporting substrate on one or both sides of which is a coating containing a  
242 transferable (usually colored) material. The coating is of such nature that it will transfer in part or  
243 entirely to a copy sheet at the point of pressure contact.  
244 (ASTM F221)
- 245 **3.1.48**  
246 **case file**  
247 All case notes, correspondence provided by interested parties, images of submitted documents,  
248 billing and time sheets (where applicable), and any task-irrelevant information received. This file  
249 may be wholly or partially in an electronic format.
- 250 **3.1.49**  
251 **case notes**  
252 **examination notes**  
253 The record of procedures, standards, controls and instruments used, observations made, results of  
254 tests conducted, charts, graphs, images, audio, video, and other documentation generated during  
255 the examiner's analysis. This also includes any resulting findings, opinions, and conclusions.
- 256 **3.1.50**  
257 **certified reference material**  
258 **CRM**  
259 Reference material, accompanied by documentation issued by an authoritative body and providing  
260 one or more specified property values with associated uncertainties and traceabilities, using valid  
261 procedures.  
262 (JCGM 200:2012)
- 263 **3.1.51**  
264 **character**  
265 Any language symbol (for example, letter, numeral, punctuation mark, or other sign), other symbol,  
266 or ornament.  
267 (SWGDOC E01)
- 268 **3.1.52**  
269 **character pitch**  
270 The number of characters that can be printed in a horizontal 1 in. (25.4 mm).  
271 (ASTM F1457)
- 272 **3.1.53**  
273 **character spacing**  
274 **horizontal escapement**  
275 The width allotted to each character in a fixed pitch (monospacing) typewriter or to the basic unit  
276 in a proportional spacing typewriter; usually expressed in millimeters or as a fraction of an inch.  
277 (SWGDOC E04)
- 278 **3.1.54**  
279 **characteristic**  
280 A feature, quality, attribute, or property of an item.  
281 (SWGDOC E01)

- 282 **3.1.55**  
 283 **characteristic, class**  
 284 A feature determined prior to manufacture that is intended to be present in a particular form in  
 285 every member of a group and can be used to define that group (e.g., a copybook style of writing, a  
 286 specific type style, print process).
- 287 **3.1.56**  
 288 **characteristic, common (handwriting)**  
 289 A feature found in a similar, but not necessarily exact, form in the handwriting of individuals who  
 290 are not members of a definable group and is not attributable to the study of a particular  
 291 handwriting system.
- 292 **3.1.57**  
 293 **characteristic, group (handwriting)**  
 294 A feature found in a similar, but not necessarily exact, form in the handwriting of individuals who  
 295 are members of a definable group and is not attributable to the study of a particular handwriting  
 296 system.
- 297 **3.1.58**  
 298 **characteristic, (individual, distinguishing) (non-handwriting)**  
 299 A deviation from a class characteristic that would be present only by chance in another member of  
 300 the class.
- 301 **3.1.59**  
 302 **characteristic, (individual, distinguishing) (handwriting)**  
 303 A feature found in handwriting that is not attributable to a class of writing and it is not taught. Only  
 304 in combination would this characteristic(s) distinguish class from non-class.
- 305 **3.1.60**  
 306 **characteristic, subclass (non-handwriting)**  
 307 A feature, determined prior to manufacture, that is intended to be present in a particular form in  
 308 every member of a sub-group within a class and can be used to define that sub-group.
- 309 **3.1.61**  
 310 **characteristic, system (handwriting)**  
 311 A feature found in an individual's handwriting that is attributable to the study of a particular  
 312 handwriting system.
- 313 **3.1.62**  
 314 **characteristic, transitory**  
 315 A feature or defect that can be modified over time or removed entirely by use, cleaning,  
 316 replacement, or repair.
- 317 **3.1.63**  
 318 **charred documents**  
 319 Items damaged by heat or fire.  
 320 (SWGDOC P01)

- 321 **3.1.64**  
322 **checkwriter**  
323 A device manually or electrically powered or computer generated, designed to ink, emboss, print,  
324 perforate, or shred a monetary value, along with other peripheral information, onto a document.  
325 (SWGDOC E07)
- 326 **3.1.65**  
327 **chromatography**  
328 A method of separating substances that is widely used in analytical and preparatory chemistry. It  
329 involves the flow of a liquid or gas mobile phase over a solid or liquid stationary phase. As the  
330 mobile phase flows past the stationary phase, a solute will undergo repeated adsorption and  
331 desorption and move along at a rate depending, among other factors, on its ratio of distribution  
332 between the two phases. If their distribution ratios are sufficiently different, components of a  
333 mixture will migrate at different rates and produce a characteristic pattern (chromatogram).  
334 (SWGDOC M01)
- 335 **3.1.66**  
336 **circularity**  
337 Ratio of a single ink dot height divided by its width with 1.0 being a perfect circle.  
338 (ASTM F1857)
- 339 **3.1.67**  
340 **class defect**  
341 **common defect**  
342 A deviation from a class characteristic that is present in a similar, but not necessarily exact, manner  
343 in a significant number, even most, but not all, of the members of a class or subclass.
- 344 **3.1.68**  
345 **closed loop**  
346 A loop formation that approximates a retrace, where the sides of the loop run parallel together.
- 347 **3.1.69**  
348 **coalescence**  
349 Puddling or pooling of adjacent ink drops on the substrate before they can be dried or absorbed  
350 resulting in non-uniformity of color density.  
351 (ASTM F1857- Withdrawn 2020)
- 352 **3.1.70**  
353 **cockle**  
354 Of paper, a defective, puckered condition of a paper sheet as a result of nonuniform hygroexpansion  
355 which can be related to any nonuniformity in the sheet, including mass distribution and drying  
356 stresses.  
357 (ASTM D1968)
- 358 **3.1.71**  
359 **coincidental peripheral printing**  
360 Resulting from an impression of unintended printing areas, often on the periphery, of a stamp. This  
361 may be due to the manufacturing process or the stamping technique.  
362 (SWGDOC E10)


- 363 **3.1.72**  
 364 **collapsed side**  
 365 Occurs in the formation of the cursive letters “m” and “n” when the left or right arcade is formed as a  
 366 retrace or near retrace movement.
- 367 **3.1.73**  
 368 **collate**  
 369 1) Analyze and compare to identify points of agreement and difference; critical comparison or side  
 370 by side examination.  
 371 2) Arrange paper in the proper sequence, such as by photocopiers.
- 372 **3.1.74**  
 373 **collected writing**  
 374 **handwritten standard**  
 375 A subset of known writing. Samples of a known person’s handwriting/signatures that have been  
 376 produced throughout the course of day-to-day business, are typically not related to the case at hand,  
 377 and have been collected for the purposes of comparison against questioned material. Examples  
 378 include letters, diaries, business records, forms, or checks. These are also known as normal course  
 379 specimens, course of business specimens, or undictated writing.
- 380 **3.1.75**  
 381 **color-shifting ink**  
 382 An ink that reflects various wavelengths of white light differently, depending on the angle of  
 383 incidence to the surface.
- 384 **3.1.76**  
 385 **common writership**  
 386 A document or group of documents that have been written by the same individual.
- 387 NOTE The term “common authorship” is sometimes used, but it is deprecated because authorship is  
 388 becoming recognized as the originator of the words/ideas, as opposed to the physical writing of a document.
- 389 **3.1.77**  
 390 **comparable (general)**  
 391 Pertaining to items that contain the same type(s) of characteristic or features, singularly or in  
 392 combination.
- 393 **3.1.78**  
 394 **comparable (handwriting)**  
 395 Pertaining to handwritten items that contain the same type(s) of writing and similar characters,  
 396 words, and combinations. Contemporaneousness and writing instruments may also be factors.  
 397 (SWGDOC E01)
- 398 **3.1.79**  
 399 **competency**  
 400 Possessing and demonstrating the requisite knowledge, skills, and abilities to successfully perform  
 401 a specific forensic document examination task, as per ANSI standards.

- 402 **3.1.80**  
 403 **complexity**  
 404 A combination of speed, skill, style, and construction that contributes to handwriting being difficult  
 405 to simulate.  
 406 (NIST HF)
- 407 **3.1.81**  
 408 **conclusion**  
 409 A judgement or decision reached by reasoning based on the examination and evaluation of all  
 410 observations, findings, and available task relevant information.
- 411 NOTE Conclusions expressed by forensic document examiners are expert opinions based on the  
 412 characteristics, features, or information under observation and interpreted using the training, knowledge,  
 413 skills, abilities, and experience of a specific forensic document examiner.
- 414 **3.1.82**  
 415 **conclusion, classification**  
 416 A conclusion in which an examiner is assessing the type or classification of a single item (e.g.,  
 417 whether a document was produced by a particular printing process, typed by the same typewriter).
- 418 **3.1.83**  
 419 **conclusions, source**  
 420 Conclusions in which an examiner is assessing at least two opposing propositions: whether or not  
 421 two (or more) items came from the same source (e.g., whether unknown and known items came  
 422 from the same source), or whether or not one (or more) item(s) came from a specific source (e.g.,  
 423 whether a typewritten document was produced by a specific typewriter).
- 424 **3.1.84**  
 425 **connecting stroke**  
 426 A line joining two adjacent characters.  
 427 (SWGDOC T01)
- 428 **3.1.85**  
 429 **connections**  
 430 The union of two characters e.g., in cursive writing.  
 431 (Modular Method)
- 432 **3.1.86**  
 433 **contemporaneous writing**  
 434 A document or a sample of writing that was prepared around or about the same timeframe as the  
 435 document in question. The timeframe may be determined by the task at hand.
- 436 **3.1.87**  
 437 **continuous spray**  
 438 Ink jet technology where drops are generated at a regular unbroken rate. Images are then generated  
 439 by deflections of the ink droplets after they are charged so they are either intercepted by a catcher  
 440 and not permitted to impact the substrate or deflected to intercept the substrate at specific  
 441 locations.  
 442 (SWGDOC E06)

- 443 **3.1.88**  
 444 **continuous tone**  
 445 A characteristic of an image such that it has all the values (0% to 100%) of gray (black and white) or  
 446 color in it. A continuous tone can be approximated by the use of thousands or millions of  
 447 gradations of black and white or colors.
- 448 **3.1.89**  
 449 **conventional printing**  
 450 A group of processes that utilize printing plates and fall into four categories including planographic,  
 451 relief, intaglio, and screen printing methods.
- 452 **3.1.90**  
 453 **copybook**  
 454 A manual of writing instruction that provides models to be copied by the student.
- 455 **3.1.91**  
 456 **corona**  
 457 Device used to place a uniform electrical charge on the surface of a xerographic photoreceptor.  
 458 (ASTM F1457)
- 459 **3.1.92**  
 460 **correctable ribbon**  
 461 A ribbon that produces an image that is designed to allow for the removal of the image from the  
 462 substrate by means of liftoff correction media.
- 463 **3.1.93**  
 464 **correction media**  
 465 Ribbons, tapes, and sheets designed to be struck by the typeface to coverup or liftoff typed text.  
 466 (SWGDOC E04)
- 467 **3.1.94**  
 468 **counter (manually or machine produced)**  
 469 An enclosed or partially enclosed space inside a letterform or symbol, e.g., “O”, “p”, “e” and “g” or  
 470 forms such as “G” and “c”.
- 471 **3.1.95**  
 472 **counterfeit document**  
 473 A document that purports to be genuine but is not, because it has been falsely made or  
 474 manufactured in its entirety.[18 USC 513 (c) (1)]
- 475 NOTE A counterfeit document is an attempt to create an exact copy of a document that exists (e.g., trying to  
 476 recreate the US passport including all security features). A fabricated document is completely fictitious (e.g.,  
 477 creating a passport from a country that is fictitious). A forged document alters or changes a genuine  
 478 document (e.g., altering the photo, name, or date on an existing passport).
- 479 **3.1.96**  
 480 **coverup**  
 481 Obliteration of text or images by means of an opaque material.



- 482 **3.1.97**  
483 **coverup correction**  
484 (See [3.1.275 overprint correction.](#))  
485 (SWGDOC E11)
- 486 **3.1.98**  
487 **cracking**  
488 Condition in which ink that has been absorbed into a substrate causes the coating to shrink to a  
489 state much smaller than the original coating dimension causing fractures in the image area.  
490 (SWGDOC E06-13)
- 491 **3.1.99**  
492 **cross mark**  
493 Usually an “x” used as a signature and, if witnessed, may be legally binding. Also known as “His  
494 Mark”.
- 495 **3.1.100**  
496 **cross stroke**  
497 A stroke that crosses another portion of the character and is not attached at either end (for  
498 example, the horizontal stroke of the “t”) (see [3.1.101 crossbar](#)).  
499 (SWGDOC T01)
- 500 **3.1.101**  
501 **crossbar**  
502 A stroke that intersects other portions of the character at both ends (see [3.1.17 arm](#) and [3.1.100](#)  
503 **cross stroke**).  
504 (SWGDOC T01)
- 505 **3.1.102**  
506 **crystallization**  
507 Condition in which ink evaporates and forms crystals.  
508 (SWGDOC E06-13)
- 509 **3.1.103**  
510 **cursive**  
511 A type of writing in which the letters are joined and the writing instrument is not lifted after most  
512 strokes.  
513 (SWGDOC T01)
- 514 **3.1.104**  
515 **daisy wheel element**  
516 **print wheel**  
517 An element used in typewriters or computer printers in which the fully formed characters are  
518 contained on the ends of fingerlike projections radiating out from the center of a disk.  
519 (SWGDOC E04-13)

- 520 **3.1.105**  
 521 **defect, subclass**  
 522 A feature not determined prior to manufacture that is an unintended deviation from a class  
 523 characteristic, which is present in a particular form in all members of a definable sub-group of items  
 524 within a class, generally caused by one or more Randomly Acquired Characteristics (RAC) of the  
 525 tool(s) or equipment producing the items while in the same approximate condition.
- 526 **3.1.106**  
 527 **descender**  
 528 A stroke that extends below the baseline of the body of the letter formation.  
 529 (SWGDOC T01)
- 530 **3.1.107**  
 531 **detached letter**  
 532 A letter, which when alone, constitutes a word, such as “I” and “A”. Also, a letter which is not  
 533 connected to the remaining letters of a word, such as the capital letter in some names.
- 534 **3.1.108**  
 535 **diacritic**  
 536 Those dots, lines, and swoops that appear above, below, and occasionally even  
 537 beside certain letters in words. The purpose of diacritical marks is to change the  
 538 sound of the individual letter they are marking or to change the meaning of an  
 539 entire word by changing which syllable is accented. Often incorrectly used to  
 540 describe such characteristics as the “i” and “j” dot. 
- 541 **3.1.109**  
 542 **diagonal stroke**  
 543 A slanting stroke, as in the center stroke of the printed capital “N”.
- 544 **3.1.110**  
 545 **dichroic filters**  
 546 A filter with two transmission bands. These bands are usually widely separated, and can be of  
 547 significantly different size.  
 548 (SWGDOC M01)
- 549 **3.1.111**  
 550 **dielectric printing process**  
 551 Nonimpact printing technique in which specially treated paper consisting of a conductive base layer  
 552 coated with a nonconductive thermoplastic material is used to hold an electric charge usually  
 553 applied directly by a set of electrode styli. The electric charge corresponds to the latent image of the  
 554 original. Following the charging step, the paper is imaged by a toner system similar to that of  
 555 electrostatic copying devices. This technique is sometimes called electrographic, and is currently  
 556 used on general purpose non-impact printers, plotting and facsimile devices.  
 557 (SWGDOC E05)
- 558 **3.1.112**  
 559 **difference**  
 560 Consistent, repeated dissimilarity in a structural or other characteristic or feature, that cannot be  
 561 reasonably explained as variation or deviation from natural variation of a single source or class.

- 562 **3.1.113**  
 563 **diffuse reflection**  
 564 Diffusion by reflection in which, on the macroscopic scale, there is no regular reflection.  
 565 (CIE S 017/E:2011 ILV)
- 566 **3.1.114**  
 567 **digital image**  
 568 An image that is represented by discrete numerical values organized in a two-dimensional array;  
 569 when viewed on a monitor, projected image or printed on paper, it appears similar to a photograph.  
 570 (SWGIT/SWGDE)
- 571 **3.1.115**  
 572 **digital image processing**  
 573 Any activity that transforms a digital image.  
 574 (SWGDOC E03) (ANSI/ASB Std 035)
- 575 **3.1.116**  
 576 **digital printing**  
 577 A method of printing from a digital-based image directly to a variety of media.
- 578 **3.1.117**  
 579 **digital signature**  
 580 An electronic signature that includes an authentication scheme, such as through the use of public  
 581 key encryption cryptography.
- 582 **3.1.118**  
 583 **digitally captured signature**  
 584 **DCS**  
 585 The data produced from the capturing of the physical properties of the movement of a handwritten  
 586 signature in the act, also known as Electronically Captured Signatures, Electronic Handwritten  
 587 Signature, Biometric Signature.  
 588  
 589 NOTE While a digitally captured signature is one kind of an **electronic signature**, it is not synonymous with  
 590 **digital signature, electronic signature, or eSignature.**
- 591 **3.1.119**  
 592 **direct contact**  
 593 Two sheets of paper, one on top of the other, with no intervening sheets.  
 594 (SWGDOC E02)
- 595 **3.1.120**  
 596 **direct thermal product**  
 597 Substrate coated with a heat sensitive formulation for the purpose of creating an image when heat  
 598 is applied from a thermal printhead.  
 599 (ASTM F1623).
- 600 **3.1.121**  
 601 **directional change**  
 602 A modification in the progress of the written line; such changes can occur as gradual curves, abrupt  
 603 angles, or curves and retracings.

- 604 **3.1.122**  
605 **directional skipping**  
606 A skip in a handwritten line that may occur after an abrupt change in the direction of the stroke.
- 607 **3.1.123**  
608 **disguised writing**  
609 Deliberately altered in an attempt to hide normal writing habits.
- 610 NOTE This is a type of distorted writing and determining the intent between the two remains with the trier of  
611 fact.  
612 (Modular Method)
- 613 **3.1.124**  
614 **dissimilarity**  
615 A feature or characteristic in one item or group of items that is not in the same form in a  
616 comparable item or group of items.
- 617 **3.1.125**  
618 **distorted writing**  
619 Writing that does not appear to be, but may be natural. This appearance can be due to either  
620 voluntary factors (for example, disguise, simulation) or involuntary factors (for example, physical  
621 condition of the writer, writing conditions). (NIST HF, SWGDOC E01)
- 622 **3.1.126**  
623 **distributed learning**  
624 Educational methods that use models of distant or remote education such as video, the internet,  
625 networked multimedia, and independent or proctored study models. This does not replace in-  
626 person training, but is used to complement that training.
- 627 **3.1.127**  
628 **document**  
629 Any material containing marks, symbols, or signs visible, partially visible, or invisible (to the naked  
630 eye) that may ultimately convey meaning or a message.  
631 (Kelly, Lindblom)
- 632 NOTE This definition of a document is broad; it extends to electronic documents, including e-mail and other  
633 electronic communications, word processed documents and databases. In addition to documents that are  
634 readily accessible from computer systems and other electronic devices and media, the definition covers those  
635 documents that are stored on servers and back-up systems and electronic documents that have been 'deleted';  
636 it also extends to additional information stored and associated with electronic documents known as  
637 metadata.  
638 (Practice Direction 31A – Disclosure and Inspection UK)
- 639 **3.1.128**  
640 **dot matrix**  
641 A method of character generation in which each character is formed by a pattern of dots selected  
642 from a grid or matrix.

- 643 **3.1.129**  
644 **downstroke**  
645 The part of a letter that is made when the writing instrument is moving from the top to the bottom  
646 of a letter.
- 647 **3.1.130**  
648 **drag line**  
649 **drag stroke**  
650 **hairline (handwriting)**  
651 A stroke resulting from incomplete lifting of the pen, usually faint in ink coverage. Also, a very thin  
652 or light stroke of a writing instrument in areas where its movement is not normally recorded.
- 653 **3.1.131**  
654 **drop on demand**  
655 Ink jet technology where drops are generated as needed to create an image.  
656 (SWGDOC E06)
- 657 **3.1.132**  
658 **dry letter transfer process**  
659 Plastic lettering on specially prepared paper which can be transferred to a substrate by the  
660 application of pressure.
- 661 **3.1.133**  
662 **dry seal**  
663 A non-inked mechanical device which embosses a design on paper.  
664 (SWGDOC E08)
- 665 **3.1.134**  
666 **dry toner**  
667 Material in a dry developer system which when deposited on a substrate by the field of an  
668 electrostatic charge pattern, becomes the visible record.  
669 (SWGDOC E05)
- 670 **3.1.135**  
671 **dual component development**  
672 Mixture of dry toner and iron oxide developer that is used for developing electrostatic images in  
673 copiers.  
674 (SWGDOC E05)
- 675 **3.1.136**  
676 **ductus**  
677 The direction, sequencing, and speed with which the strokes making up a character are executed.
- 678 **3.1.137**  
679 **dye diffusion thermal transfer**  
680 **dye sublimation**  
681 An imaging process that uses thermal dye ribbons with selected organic dyes, the imaging  
682 characteristics of which are different from the pigmented materials used in thermal transfer wax  
683 ribbons.

- 684 **3.1.138**  
 685 **electric typewriter**  
 686 A typewriter in which an electromechanical device causes the type element to be activated when  
 687 the keys are struck.  
 688 (ASTM F909)
- 689 **3.1.139**  
 690 **electromagnetic radiation**  
 691 Emission or transfer of energy in the form of electromagnetic waves with the associated photons.
- 692 NOTE The French term “radiation” applies preferably to a single element of any radiation, characterized by  
 693 one wavelength or one frequency.  
 694 (CIE S 017/E:2021 ILV)
- 695 **3.1.140**  
 696 **electronic document**  
 697 Text, image files, spreadsheets, or other documents generated by computer on any media or device  
 698 for any electronic processing. Electronically stored documents follow no format or readability  
 699 requirements except when retrieved for human-use.
- 700 **3.1.141**  
 701 **electronic signature**  
 702 **eSignature**  
 703 Digital data embedded in a digital file for the purposes of authentication, which may consist of a  
 704 password, a photo, biometric data (DCS, fingerprint, etc.), One-Time-Passwords, voice recording, etc.
- 705 **3.1.142**  
 706 **electronic typewriter**  
 707 An electric typewriter in which the keyboard input is received by an electronic processor built into  
 708 the typewriter. This unit then controls the print head and other features to produce the typing  
 709 action.  
 710 (ASTM F909)
- 711 **3.1.143**  
 712 **electrophotography**  
 713 A non-impact printing process in which the image is formed using photoconductive paper or a  
 714 photoconductive intermediate drum.
- 715 **3.1.144**  
 716 **electrostatic detection device**  
 717 **EDD**  
 718 An instrument that uses an electrostatic charge along with toner distribution as the mechanism to  
 719 visualize paper fiber disturbances (for example, indentations and erasures).  
 720 (ANSI/ASB Std 044)
- 721 **3.1.145**  
 722 **element**  
 723 The interchangeable typeface carrier of a single element typewriter. See [3.1.24 ball element](#),  
 724 [3.1.104 daisy wheel element](#), [3.1.399 thimble element](#).  
 725 (SWGDOC E04-13)

- 726 **3.1.146**  
727 **embellishments**  
728 Flourishes, ornaments, paraphs, rubrics and underscores. It adds or extends strokes that are easily  
729 executed and are not essential to the recognition of the character or the word.  
730 (NIST HF)
- 731 **3.1.147**  
732 **embossment variation**  
733 Nonuniformity of the dry seal impression on the paper stock. It can be caused by the manner of  
734 application or by defects in the dry seal.  
735 (SWGDOC E08)
- 736 **3.1.148**  
737 **emission (of radiation)**  
738 Release of radiant energy.  
739 (CIE S 017/E:2011 ILV)
- 740 **3.1.149**  
741 **empty magnification**  
742 Occurs when the image continues to be enlarged, but no additional detail is resolved.
- 743 **3.1.150**  
744 **enhancement**  
745 A process to reveal, intensify, magnify, or clarify an observation. Image enhancement is the process  
746 of adjusting a digital image, making it more suitable for display or further image analysis. For  
747 example, sharpening or brightening an image.
- 748 **3.1.151**  
749 **erasure**  
750 The area where material has been removed from a document by chemical, abrasive, or other means.  
751 (SWGDOC E03) (ANSI/ASB 035)
- 752 **3.1.152**  
753 **evidence**  
754 (See [3.1.229](#) item.)
- 755 **3.1.153**  
756 **examination**  
757 The process of observing, searching, detecting, recording, prioritizing, collecting, analyzing,  
758 measuring, comparing and/or interpreting.
- 759 **3.1.154**  
760 **excitation**  
761 Elevation of the energy levels of atoms, molecules or ions to higher energy levels.  
762 (CIE S 017/E:2011 ILV)

- 763 **3.1.155**  
 764 **exclusion**  
 765 **elimination**  
 766 The determination that there are sufficient characteristics in disagreement, with no significant  
 767 limitations, to support an opinion that two or more items did not originate from the same source.
- 768 **3.1.156**  
 769 **exemplars**  
 770 Samples of handwriting, printed text, paper, ink, etc., known (or purported) to have been produced  
 771 by a particular individual, machine, or manufacturer.
- 772 **3.1.157**  
 773 **external (extrinsic) factors (handwriting)**  
 774 Writing conditions such as underlying writing surface, substrate, writing implement, writing  
 775 position, interruptions during the writing activity etc. that affect the handwriting movement or the  
 776 resulting writing.  
 777 (NIST HF)
- 778 **3.1.158**  
 779 **eyelet**  
 780 Often found in cursive writing, a small oval or loop formation.
- 781 **3.1.159**  
 782 **fabric ribbon**  
 783 An inked ribbon wherein the substrate is a woven cloth material, such as nylon, cotton, or silk.
- 784 **3.1.160**  
 785 **fabricated document (fictitious instrument)**  
 786 A falsely manufactured document.
- 787 NOTE A counterfeit document is an attempt to create an exact copy of a document that exists (e.g., trying to  
 788 recreate the US passport including all security features). A fabricated document is completely fictitious (e.g.,  
 789 creating a passport from a country that is fictitious). A forged document alters or changes a genuine  
 790 document (e.g., altering the photo, name, or date on an existing passport).
- 791 **3.1.161**  
 792 **family (of type)**  
 793 A class of type designs sharing basic qualities of style and artistic expression that differentiate it  
 794 from other similar designs.  
 795 (SWGDOC E04)
- 796 **3.1.162**  
 797 **feathering**  
 798 The condition in which the writing/printing fluid spreads laterally in a pattern that usually follows  
 799 the direction of the surface fibers away from the written or printed line.
- 800 **3.1.163**  
 801 **financial document**  
 802 An obligation, security, or other document representative of value made or issued by or under the  
 803 authority of a governmental or private organization.



- 804 **3.1.164**  
805 **finding**  
806 Information concluded as a result of an examination.  
807 (ISO 21043-1:2018)
- 808 **3.1.165**  
809 **fixed pitch**  
810 Describes a character set in which all character cells are of equal width (see proportional spacing).  
811 (ASTM F1457)
- 812 **3.1.166**  
813 **fixing film**  
814 Clear plastic sheet with a pressure sensitive adhesive layer.  
815 (ANSI/ASB Std 044)
- 816 **3.1.167**  
817 **flashing**  
818 Excess material from a molding process.  
819 (SWGDOC E04)
- 820 **3.1.168**  
821 **flexography**  
822 A form of relief printing like letterpress, but using a flexible rubber or resilient photopolymer relief  
823 plate(s).
- 824 **3.1.169**  
825 **flourish**  
826 A writing movement that is designed to be ornamental.
- 827 **3.1.170**  
828 **flow back**  
829 An increase in the density of the ink line caused by excess ink running back onto the previous  
830 portion of a stroke, occurring as the pen is lifted from the paper.
- 831 **3.1.171**  
832 **fluorescence**  
833 A process by which radiant flux of certain wavelengths is absorbed and reradiated nonthermally at  
834 other, usually longer, wavelengths.  
835 (ANSI/ASB Std 035)
- 836 **3.1.172**  
837 **foil stamping**  
838 Various colored foils made of metals or other materials which are typically combined with  
839 embossing or debossing, carried on a plastic sheet, and transferred through a stamping or heated  
840 die process on to a substrate.

- 841 **3.1.173**  
 842 **forensic document examiner**  
 843 **FDE**  
 844 A forensic service provider who addresses inquiries that arise in matters where the authenticity,  
 845 genuineness, or source of a document is questioned, and does not provide personality assessment,  
 846 creation of a personality profile, or analysis, or judgment of a writer's personality or character.
- 847 **3.1.174**  
 848 **forensic science**  
 849 The application of scientific principles and techniques to matters of the law especially as relating to  
 850 the collection, examination, and analysis of physical evidence.
- 851 **3.1.175**  
 852 **forensic science practitioner**  
 853 An individual who (1) applies scientific or technical practices to the recognition, collection, analysis,  
 854 or interpretation of evidence at issue in criminal, civil, or administrative investigations and  
 855 proceedings, and (2) issues test results, provides reports, or provides interpretations, conclusions,  
 856 or opinions through testimony with respect to such evidence.
- 857 **3.1.176**  
 858 **forged document**  
 859 A document that purports to be genuine but is not, because it has been falsely altered, completed,  
 860 signed, or endorsed, or contains a false addition thereto or insertion therein, or is a combination of  
 861 parts of two or more genuine documents.  
 862 [18 USC 513 (c) (2)]  
 863  
 864 NOTE A counterfeit document is an attempt to create an exact copy of a document that exists (e.g., trying to  
 865 recreate the US passport including all security features). A fabricated document is completely fictitious (e.g.,  
 866 creating a passport from a country that is fictitious). A forged document alters or changes a genuine  
 867 document (e.g., altering the photo, name, or date on an existing passport).
- 868 **3.1.177**  
 869 **fracture pattern**  
 870 The spatial arrangement of each complementary edge formation created when a single object is  
 871 separated into two or more fragments.  
 872 (SWGDOC E11)
- 873 **3.1.178**  
 874 **fugitive ink**  
 875 An ink that will run and/or stain when it comes in contact with water or any aqueous type of  
 876 solution.
- 877 **3.1.179**  
 878 **full color copier/printer**  
 879 Office machines that can reproduce color originals containing gradations of color (see [3.1.234 laser](#)  
 880 [printer](#), [3.1.219 ink jet process](#)).
- 881 **3.1.180**  
 882 **fuser roll**  
 883 Heated roller that contacts the paper and toner directly and is part of the fuser unit.  
 884 (ASTM F1434)

885 **3.1.181**

886 **garland**

887 A rounded, trough-like stroke such as that in the u; an individual style of  
888 handwriting with a predominance of these types of strokes. May be referred to as  
889 under curve.



890 **3.1.182**

891 **gel pen ink**

892 An aqueous ink of high viscosity. Often characterized by tram lines on the outside of the ink line and  
893 a trough on the interior.

894 **3.1.183**

895 **glyphs**

896 The shapes that characters can have when they are rendered or displayed. In contrast to characters,  
897 glyphs appear on the screen or paper as particular representations of one or more characters. A  
898 repertoire of glyphs makes up a font.  
899 (Unicode 12.0.0, 2.2)

900 **3.1.184**

901 **gooping**

902 Extraneous deposits of ink on the document surface caused by built up ink on the housing of ball  
903 point pens, typically found at a point of re-direction of the written line.

904 **3.1.185**

905 **gravure**

906 An intaglio printing process in which the image area of the printing plate consists of cells or wells  
907 rather than recessed lines.

908 **3.1.186**

909 **ground truth**

910 Information that is known to be real or true, provided by direct observation and measurement (i.e.,  
911 empirical evidence) as opposed to information provided by inference.

912 **3.1.187**

913 **gripper bar**

914 **picker bar**

915 A grabbing device used in the delivery system to transport individual sheets of paper in a printer or  
916 copier.

917 **3.1.188**

918 **gripper marks**

919 Visible or latent indented features in paper resulting from gripper bars in a printing or copying  
920 system.

921 **3.1.189**

922 **guided signature**

923 A signature executed while an impaired writer's hand, arm, or writing instrument is controlled by  
924 another resulting in a distorted signature. See assisted hand signature.

- 925 **3.1.190**  
 926 **guidelines**  
 927 Lines that show a route to follow when simulating handwriting or signatures. These can exist in the  
 928 form of pencil lines or indentations or be created by the use of transmitted light shone through a  
 929 document containing the entries to be copied.  
 930 (NIST HF)
- 931 **3.1.191**  
 932 **hairline (typography)**  
 933 The thinnest line found in a specific typeface that consists of lines of varying widths, usually  
 934 common to serif typefaces.
- 935 **3.1.192**  
 936 **halftone**  
 937 Print process in which a series of dots of variable diameter and regular interdot spacing is used to  
 938 print photographs and drawings.
- 939 **3.1.193**  
 940 **hand printing**  
 941 A style of writing in which the letters are not joined and the writing instrument is lifted after most  
 942 strokes.  
 943 (SWGDOC T01)
- 944 **3.1.194**  
 945 **handwriting**  
 946 Writing in any form (such as cursive, hand printing, signatures, numbers). Although “handwriting,”  
 947 is used as a general term, it may be produced by the hand, mouth, foot, or other body part by  
 948 directly manipulating a writing instrument.
- 949 **3.1.195**  
 950 **hesitation**  
 951 A pause in the writing without the instrument being lifted.  
 952 (SWGDOC T01)
- 953 **3.1.196**  
 954 **hiatus**  
 955 In cursive writing, a space caused by lifting the writing instrument at the conclusion of  
 956 one letter, followed by the reapplication of the instrument to begin the next letter of a  
 957 word; also referred to as a break or pen lift. May be an individualized habit.
- 958 **3.1.197**  
 959 **identification document**  
 960 Made or issued by or under the authority of a governmental or private organization which, when  
 961 completed with information concerning a particular individual, is of a type intended or commonly  
 962 accepted for the purpose of identification of individuals.
- 963 **3.1.198**  
 964 **image**  
 965 A visually observable counterpart of an object produced by means of imaging technology.  
 966 (SWGDOC D01)



- 967 **3.1.199**  
968 **image area**  
969 That portion of the page that is printed, including the space between letters and lines.  
970 (ASTM F1457)
- 971 **3.1.200**  
972 **image enhancement**  
973 Any process intended to improve the visual appearance of an image or specific features within an  
974 image.  
975 (ASTM E2916)
- 976 **3.1.201**  
977 **image formation**  
978 The elements that comprise an image to include, but not limited to, continuous inked areas, halftone  
979 patterns, and dot characteristics.
- 980 **3.1.202**  
981 **image density**  
982 Contrast between image and background as measured by densitometer.  
983 (ASTM F221)
- 984 **3.1.203**  
985 **imaging drum**  
986 Photoreceptive drum coated with a charge-sensitive material used in the image transfer systems of  
987 toner devices.  
988 (SWGDOC E05)
- 989 **3.1.204**  
990 **imaging film**  
991 Thin transparent plastic material that covers the item during an examination using an EDD.  
992 (ANSI/ASB Std 044)
- 993 **3.1.205**  
994 **impact printer**  
995 A printer in which printing is the result of mechanical impacts (e.g., dot-matrix, typewheel printer).  
996 (SWGDOC E04)
- 997 **3.1.206**  
998 **impression**  
999 An image formed by pressure.  
1000 (SWGDOC E11)
- 1001 **3.1.207**  
1002 **impression defect**  
1003 A deviation from the intended evenness in appearance of a character over the entire impression of  
1004 the character or relative to the impression of another character (see [3.1.266 off-foot](#)).  
1005 (SWGDOC E04).

- 1006 **3.1.208**  
1007 **impression format**  
1008 The manner in which the paper is embossed or shredded.  
1009 (SWGDOC E07)
- 1010 **3.1.209**  
1011 **inconclusive opinion**  
1012 An opinion expressed when an examination has been undertaken, but the FDE is unable to make a  
1013 determination with regard to writership or source, for example because of the presence of both  
1014 similarities and dissimilarities.
- 1015 **3.1.210**  
1016 **indentations**  
1017 Latent or visible impressions and/or embossments in paper or other media. This also includes  
1018 paper fiber disturbances which do not optically appear as impressions.  
1019 (ASB S044-19)
- 1020 **3.1.211**  
1021 **indigo printing**  
1022 Created directly from digital data, charged ink particles are applied to an imaging drum and then  
1023 transferred to a print blanket.
- 1024 **3.1.212**  
1025 **indirect contact**  
1026 Two sheets of paper, one on top of the other, with one or more intervening sheets.  
1027 (SWGDOC E02)
- 1028 **3.1.213**  
1029 **individual prefix**  
1030 A prefix especially designed for a particular customer.  
1031 (SWGDOC E07)
- 1032 **3.1.214**  
1033 **individualizing characteristics**  
1034 **discriminating characteristics**  
1035 Marks or properties that serve to characterize an item(s) and distinguish it from similar item(s).
- 1036 **3.1.215**  
1037 **infrared**  
1038 **IR**  
1039 Referring to radiant flux having wavelengths longer than the wavelengths of visible light, usually  
1040 from ~700 nm to 1400 nm (~0.7 µm to 1.4 µm) as per the International Commission on  
1041 Illumination (CIE) for IR-A.  
1042 (ANSI/ASB Std 035)

- 1043 **3.1.216**  
 1044 **infrared luminescence**  
 1045 **IRL**  
 1046 The emission of radiant energy during a transition from an excited electronic state of an atom,  
 1047 molecule, or ion to a lower electronic state (fluorescence or phosphorescence, or both), where the  
 1048 spectrum of the excitation source is in the ultraviolet (UV) or visible region of the electromagnetic  
 1049 spectrum, or both, and the spectrum of the emitted energy is in the far red or infrared (IR) region of  
 1050 the electromagnetic spectrum.  
 1051 (ANSI/ASB Std 035)
- 1052 **3.1.217**  
 1053 **initial stroke**  
 1054 Written movement at the beginning of a character. (Also known as beginning or commencement  
 1055 stroke.)
- 1056 **3.1.218**  
 1057 **ink formula**  
 1058 A precise recipe or set of ingredients and their quantities that the manufacturer specifies for the  
 1059 final ink product. These ingredients are colorants (dyes and pigments) and components (volatile  
 1060 solvents, resins, etc.).  
 1061 (SWGDOC M01)
- 1062 **3.1.219**  
 1063 **ink jet process**  
 1064 A non-impact printing method in which the image is formed by projecting droplets of a liquid or  
 1065 solid printing medium onto a substrate.
- 1066 **3.1.220**  
 1067 **ink library**  
 1068 An organized collection of reference samples of inks and related materials.  
 1069 (SWGDOC M02)
- 1070 **3.1.221**  
 1071 **inked ribbon**  
 1072 A ribbon composed of a supporting substrate of film, fabric, or paper and a coating or impregnation  
 1073 of a coloring material. The coloring material is of such nature that it will transfer in part or entirely  
 1074 to a copy sheet at the point of pressure contact.  
 1075 (ASTM F221)
- 1076 **3.1.222**  
 1077 **insufficient**  
 1078 A determination made by an FDE that the material to be examined does not contain enough  
 1079 information for an examination to be conducted. This may be due to the amount, complexity,  
 1080 comparability, or line, reproduction or writing quality of the material. In many instances, FDEs  
 1081 report an inconclusive opinion, explaining limitations/insufficiency, rather than reporting an  
 1082 insufficient opinion.  
 1083 (NIST HF)

- 1084 **3.1.223**  
 1085 **intaglio printing**  
 1086 Process in which the image areas are below the non-image areas of the plate, resulting in raised  
 1087 printing on the substrate.
- 1088 **3.1.224**  
 1089 **inter-comparison**  
 1090 Comparison between two or more items to determine whether or not they share a common source.
- 1091 **3.1.225**  
 1092 **internal (intrinsic) factors**  
 1093 Conditions such as age, illness, disease, fatigue, emotional state, medication, intoxication by drugs  
 1094 or alcohol etc. that affect the handwriting movement and the resulting writing.  
 1095 (NIST HF)
- 1096 **3.1.226**  
 1097 **interpretation**  
 1098 Use of professional judgement to provide conclusions and/or opinions on hypothesis, based on  
 1099 findings and information gathered through the forensic process.  
 1100 (ISO 21043-1:2018)
- 1101 **3.1.227**  
 1102 **intra-comparison**  
 1103 Comparison within one or more items purportedly from one source, to determine whether it was  
 1104 prepared by a single source [see **common writership (authorship)**].
- 1105 **3.1.228**  
 1106 **irrelevant information**  
 1107 Not pertinent or applicable to the subject, material, or question being considered. The consideration  
 1108 may be broad (i.e., discipline level) or specific (i.e., task level).  
 1109 (NIST HF)
- 1110 **3.1.229**  
 1111 **item**  
 1112 [An] object, substance, or material that is collected, derived, or sampled as part of the forensic  
 1113 process.  
 1114 (ISO 21043-1:2018)
- 1115 **3.1.230**  
 1116 **knowledge, skills, and abilities**  
 1117 **KSA**  
 1118 The level of information, qualifications, and experience needed to perform assigned tasks.  
 1119 Knowledge refers to acquired principles and practices related to a particular job; skills refer to  
 1120 acquired psychomotor behaviors; and abilities are talents, observable behaviors, or acquired  
 1121 dexterity.
- 1122 **3.1.231**  
 1123 **known**  
 1124 Of established origin associated with the matter under investigation.  
 1125 (SWGDOC E01) (ASTM E1732)



- 1126 **3.1.232**  
 1127 **known writing**  
 1128 Of established origin used for comparison with questioned writing. Known writing may be collected  
 1129 or requested and can consist of exemplars or purported writing.
- 1130 **3.1.233**  
 1131 **landscape mode**  
 1132 A horizontal orientation of a document or image.
- 1133 **3.1.234**  
 1134 **laser printer**  
 1135 Nonimpact printer that uses a laser light source driven by digital signals to create images on a  
 1136 photoconductor (see 3.1.143 **electrophotography**).  
 1137 (ASTM F909)
- 1138 **3.1.235**  
 1139 **leg**  
 1140 A large appendage typically on the right side of such characters as “R” and “K”, usually formed with a  
 1141 downward movement.
- 1142 **3.1.236**  
 1143 **letterpress**  
 1144 Relief printing using cast metal type, molded duplicate plates, or photo-polymer plates, which the  
 1145 imaged areas are raised above the non-printing areas, resulting in characters impressed into the  
 1146 substrate.
- 1147 **3.1.237**  
 1148 **lift**  
 1149 A product of an EDD examination. The developed image on the imaging film is preserved by  
 1150 applying fixing film to create a lift.  
 1151 (ANSI/ASB Std 044)
- 1152 **3.1.238**  
 1153 **liftoff**  
 1154 The removal of one or more images of copy from the substrate by transferring to an intermediate  
 1155 member.  
 1156 (ASTM F221)
- 1157 **3.1.239**  
 1158 **liftoff correction**  
 1159 The removal of a typed character by restriking with the same character while interposing an  
 1160 adhesive coated tape or sheet, thereby causing the imprinted character to adhere to the coating and  
 1161 be stripped from the record medium; then the intended character or space is placed therein.
- 1162 **3.1.240**  
 1163 **ligature**  
 1164 In printing or writing, two or three characters linked to create a single letterform such  
 1165 that the terminal stroke of the first is the initial stroke of the second.



- 1166 **3.1.241**  
1167 **limitation**  
1168 A constraint to the examination, comparison, or opinion formation process (e.g., non-original  
1169 documents, insufficient quantity or quality of material).
- 1170 **3.1.242**  
1171 **line continuity**  
1172 Uninterrupted writing. Discontinuity may be in the form of pen lifts, pen stops, hesitations, or  
1173 patching.
- 1174 **3.1.243**  
1175 **line quality**  
1176 The appearance of the written stroke caused by the basic movements and the manner of  
1177 manipulating the writing instrument. Results from the combination of such factors as speed,  
1178 rhythm, shading, and smoothness of movement. It may vary from good line quality that is smooth  
1179 and fluent to poor line quality that is tremulous and erratic.
- 1180 **3.1.244**  
1181 **line spacing**  
1182 The distance between successive lines of text, which for machine-generated documents is usually  
1183 measured from baseline to baseline.
- 1184 **3.1.245**  
1185 **Linear Sequential Unmasking**  
1186 **LSU**  
1187 A procedure that specifies the optimal order in which forensic experts examine submitted  
1188 documents in order to conduct a comparison and minimize the risk of bias.
- 1189 **3.1.246**  
1190 **liquid toner**  
1191 Material composed of carbon particles or colorants suspended in a liquid carrier.  
1192 (SWGDOC E05)
- 1193 **3.1.247**  
1194 **lithography**  
1195 The process of planographic printing in which the image to be printed is ink receptive/water  
1196 repellent, and the non-image area is ink repellent/water receptive.
- 1197 **3.1.248**  
1198 **loop**  
1199 A formation that curves and crosses itself.  
1200 (SWGDOC T01)
- 1201 **3.1.249**  
1202 **luminescence**  
1203 The emission of radiant energy during a transition from an excited electronic state of an atom,  
1204 molecule, or ion to a lower electronic state.  
1205 (ASTM E131)

- 1206 **3.1.250**  
1207 **manual typewriter**  
1208 A typewriter whose operation depends solely upon the mechanical action powered by the operator.  
1209 (SWGDOC E04)
- 1210 **3.1.251**  
1211 **manuscript**  
1212 (See [3.1.193 hand printing.](#))  
1213 (SWGDOC T01)
- 1214 **3.1.252**  
1215 **match between ink samples**  
1216 The inability to distinguish between ink samples at a given level of analysis.  
1217 (SWGDOC M01)
- 1218 **3.1.253**  
1219 **match between samples**  
1220 The inability to distinguish between two or more samples or items at a given level of analysis.  
1221 (SWGDOC M01)
- 1222 **3.1.254**  
1223 **medium**  
1224 Substance(s) used to create an image or text.
- 1225 **3.1.255**  
1226 **metadata**  
1227 Information stored inside an electronic document or image that provides information which may  
1228 include authorship, editing details, and the computer on which the document was created or  
1229 modified.
- 1230 **3.1.256**  
1231 **metamers**  
1232 **(optical and instrumental examination, ink and paper)**  
1233 Specimens differing in spectral reflectance but having colors that match in light of one spectral  
1234 composition, when viewed by one observer, but may not match in light of other spectral  
1235 compositions, or when viewed by another observer.  
1236 (ASTM E284)
- 1237 **3.1.257**  
1238 **model signature**  
1239 A signature that is used as a prototype for a simulation or copy, by manual, electronic, or other  
1240 means.
- 1241 **3.1.258**  
1242 **natural variation**  
1243 Those deviations among repetitions of the same handwriting characteristic(s) that are normally  
1244 demonstrated in the habits of a writer.

- 1245 **3.1.259**  
 1246 **natural writing**  
 1247 Any specimen of writing executed without an attempt to control or alter its usual quality of  
 1248 execution.  
 1249 (SWGDOC E01)
- 1250 **3.1.260**  
 1251 **no conclusion**  
 1252 An opinion expressed due to insufficiency of material, significantly limiting factors, or the presence  
 1253 of both similarities and dissimilarities (it may also be expressed as Inconclusive, Indeterminate or  
 1254 Insufficient) (see [3.1.209 inconclusive opinion](#)).
- 1255 NOTE In handwriting, this can be the presence of disguise in the questioned and/or known writing or a lack  
 1256 of comparable writing.
- 1257 **3.1.261**  
 1258 **non-original**  
 1259 Reproduction of a document, e.g., photocopied, faxed, scanned, photographed.  
 1260 (NIST HF)
- 1261 **3.1.262**  
 1262 **non-ballpoint pen ink**  
 1263 Writing or marking media intended for use in a writing or marking instrument other than a  
 1264 ballpoint pen, including a dip or fountain pen, porous point pen, roller pen, marking instrument, etc.  
 1265 Typically, a thin, low viscosity ink with a water or solvent base (it may also be expressed as fluid pen  
 1266 ink).
- 1267 **3.1.263**  
 1268 **nonimpact printer**  
 1269 A printer in which image formation is not the result of mechanical impacts (e.g., thermal printer,  
 1270 electrostatic printer, electrophotographic printer, ink jet printer).
- 1271 **3.1.264**  
 1272 **observation**  
 1273 Recognizing and noting an occurrence.
- 1274 **3.1.265**  
 1275 **observational drawing**  
 1276 A visuomotor task in which visual information (an object, a photograph, handwriting) has to be  
 1277 translated into marks on the paper so that the copy ideally matches the original. Also known as  
 1278 sketching.
- 1279 **3.1.266**  
 1280 **off-foot**  
 1281 The lack of desired and optimum uniformity of contact between the typeface  
 1282 and the substrate. Also known as “off its feet”.  
 1283 (SWGDOC E04)



- 1284 **3.1.267**  
 1285 **offset**  
 1286 Press design in which an image is transferred from a plate to a rubber blanket that moves the image  
 1287 to the press sheet; offset principle allows plates to be right reading and generally gives a better-  
 1288 quality image than do direct transfers.
- 1289 **3.1.268**  
 1290 **offset lithography**  
 1291 A rotary planographic process, which yields a flat printed image, producing both the image and non-  
 1292 image areas of the plate chemically on one plane, creating the flat printing result. This process  
 1293 utilizes viscous inks based on a mixture of oils and/or resins, containing pigments and additives.
- 1294 **3.1.269**  
 1295 **offsite technical training**  
 1296 Information, knowledge, or training gained by interaction with or demonstration by pertinent  
 1297 manufacturers, businesses, and laboratories (e.g., paper mill, copier manufacturer) by going to a  
 1298 particular location away from the usual training or work site.
- 1299 **3.1.270**  
 1300 **opacity**  
 1301 The property of paper that prevents the transmission of light.  
 1302 (SWGDOC M03)
- 1303 **3.1.271**  
 1304 **open top**  
 1305 A letter formation such as the handwritten “a” or “o” in which the top has not been closed.
- 1306 **3.1.272**  
 1307 **opinion**  
 1308 Conclusion, judgment– a coherent, scientifically sound expression(s) that takes into consideration  
 1309 task-relevant information in addition to observations, data, calculations and interpretations.
- 1310 **3.1.273**  
 1311 **original typed text**  
 1312 Typed text imprinted onto the surface of a record medium as the result of the impact of a typeface  
 1313 striking directly or through a ribbon.  
 1314 (SWGDOC E11)
- 1315 **3.1.274**  
 1316 **originating document**  
 1317 The document or other substrate with the handwriting, machine, or other markings that caused  
 1318 indentation(s) on a document(s) or other substrate beneath it (the recipient document).  
 1319 (ANSI/ASB Std 044)
- 1320 **3.1.275**  
 1321 **overprint correction**  
 1322 The removal of a typed character from the text by restriking with the same character while  
 1323 interposing a tape or sheet coated with an opaque coating material, thereby causing the imprinted  
 1324 character to be covered by the coating.  
 1325 (SWGDOC E11)

- 1326 **3.1.276**  
 1327 **overspray**  
 1328 Type of extraneous or undesirable ink dot(s) near the printed zones which originate from the  
 1329 printhead.
- 1330 **3.1.277**  
 1331 **paper fiber impression**  
 1332 The imprint of a paper fiber in the ribbon substrate.  
 1333 (SWGDOC E11)
- 1334 **3.1.278**  
 1335 **paraph**  
 1336 A writing movement sweeping over or under a signature in a stylistic  
 1337 manner, and is considered to be a part of the signature. 
- 1338 **3.1.279**  
 1339 **parylene processing**  
 1340 The deposition of a clear polymer coating on a document(s) within a vacuum chamber to  
 1341 strengthen and stabilize the document(s).  
 1342 (ANSI/ASB Std 127)
- 1343 **3.1.280**  
 1344 **patching**  
 1345 Returning to a portion of the writing for the retouching of a stroke, letter, or character.
- 1346 **3.1.281**  
 1347 **payee perforator**  
 1348 An optional device on a check writer that perforates or shreds a pattern above the numeric  
 1349 impression region for the purpose of protecting the payee entry from alteration.  
 1350 (SWGDOC E07)
- 1351 **3.1.282**  
 1352 **pen emphasis**  
 1353 The act of forcing the pen against the paper surface with increased pressure. When the pen point  
 1354 has flexibility, this emphasis produces shading; but with more rigid writing points such as ball point  
 1355 pens, heavy pen emphasis can occur without any evidence of shading.
- 1356 **3.1.283**  
 1357 **pen direction**  
 1358 The direction the pen moves to produce a character, connection, or signature.  
 1359 (NIST HF)
- 1360 **3.1.284**  
 1361 **pen lift**  
 1362 An interruption in a stroke caused by removing the writing instrument from the writing surface.
- 1363 **3.1.285**  
 1364 **pen nib**  
 1365 The writing portion of a dip pen or fountain pen.

- 1366 **3.1.286**  
 1367 **pen position**  
 1368 The relationship of the writing instrument to the writing surface.
- 1369 **3.1.287**  
 1370 **pen pressure**  
 1371 The force with which the writing instrument contacts the paper.  
 1372 (SWGDOC T01)
- 1373 **3.1.288**  
 1374 **perforation**  
 1375 A small hole or a group of small holes punched in a sheet of paper.
- 1376 **3.1.289**  
 1377 **phosphorescence**  
 1378 Any delayed emission of optical radiation which appears 10 ns or longer after the excitation.  
 1379 (CIE S 017/E:2011 ILV)
- 1380 **3.1.290**  
 1381 **photoluminescence**  
 1382 Luminescence produced by the absorption of radiant flux; distinguished from ordinary reflection by  
 1383 a time delay and, usually, a shift toward longer wavelengths (see fluorescence and  
 1384 phosphorescence).  
 1385 (CIE S 017/E:2011 ILV)
- 1386 **3.1.291**  
 1387 **piezoelectric**  
 1388 Ink jet technology where the electrically stimulated deformation of a crystal causes the expulsion of  
 1389 the droplets from the ink chamber.  
 1390 (SWGDOC E06)
- 1391 **3.1.292**  
 1392 **pitting**  
 1393 Small defects in the surface of the photoreceptor that produce spots or voids on the printout.  
 1394 (ASTM F1457)
- 1395 **3.1.293**  
 1396 **pixel**  
 1397 Small single-colored square display elements that comprise a bitmap.
- 1398 **3.1.294**  
 1399 **pixelation**  
 1400 A grainy or blurry effect caused by displaying a bitmap or a section of a bitmap at such a large size  
 1401 that individual pixels are visible.
- 1402 **3.1.295**  
 1403 **pixels per inch**  
 1404 **PPI**  
 1405 The measure of resolution in a digital image or video display.

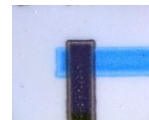
- 1406 **3.1.296**  
 1407 **planchettes**  
 1408 Small discs randomly distributed within the fibers or on the surface of security paper during the  
 1409 paper manufacturing process.
- 1410 **3.1.297**  
 1411 **planographic printing**  
 1412 A method in which the image and non-image areas of the printing plate are on the same plane.
- 1413 **3.1.298**  
 1414 **platen**  
 1415 A flat or rounded surface with a variety of functions in printing or manufacturing. It can be a flat  
 1416 metal (or earlier, wooden) plate pressed against a medium (such as paper) to cause an impression  
 1417 in letterpress printing. May also refer to a typewriter roller, the glass surface of a copier, or an EDD  
 1418 vacuum bed.
- 1419 **3.1.299**  
 1420 **polyester film encapsulation**  
 1421 A process whereby a document(s) or fragments of a document are sealed between two sheets of  
 1422 polyester film to preserve, stabilize, and facilitate handling.
- 1423 **3.1.300**  
 1424 **portrait mode**  
 1425 A vertical orientation of a document or image.
- 1426 **3.1.301**  
 1427 **prefix**  
 1428 The portion of the check writer impression located immediately to the left of the numeric value.  
 1429 (SWGDOC E07)
- 1430 **3.1.302**  
 1431 **primary image**  
 1432 The first instance in which an image is recorded onto any media that is a separate, identifiable  
 1433 object (for example, a digital image recorded on flash media).  
 1434 (SWGDOC D01)
- 1435 **3.1.303**  
 1436 **primary indentation**  
 1437 An impression on a document(s) or other substrate(s) beneath the originating document caused by  
 1438 the act of writing or other dynamic actions.  
 1439 (ANSI/ASB Std 044)
- 1440 **3.1.304**  
 1441 **principal trainer**  
 1442 Person with the primary responsibility for the training program administered to an individual.
- 1443 **3.1.305**  
 1444 **printer**  
 1445 Output device that produces a hardcopy record of data in the form of a sequence of discrete  
 1446 graphics belonging to a predetermined character or image set.

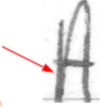


- 1447 **3.1.306**  
1448 **printer output area**  
1449 Maximum area on the page to which the printer will print.  
1450 (ASTM F1457)
- 1451 **3.1.307**  
1452 **printhead**  
1453 Printing device of an ink jet or thermal printing system.
- 1454 **3.1.308**  
1455 **printing element**  
1456 The parts of the total checkwriter impression that are not parts of the prefix which may encompass  
1457 the currency type, decimal points, and commas.  
1458 (SWGDOC E07)
- 1459 **3.1.309**  
1460 **printing medium**  
1461 A substance used to create an image, such as printing ink, toner, or wax.
- 1462 **3.1.310**  
1463 **printing module**  
1464 Those components in the laser printer that together drive the laser scanner, create the image on the  
1465 page, and deliver the page to the stacker.
- 1466 **3.1.311**  
1467 **processed image**  
1468 Any image that has undergone enhancement, restoration, or other operation.  
1469 (SWGDOC D01)
- 1470 **3.1.312**  
1471 **proportions**  
1472 Relative size of characters, elements of characters, or of words.
- 1473 **3.1.313**  
1474 **proportional spacing**  
1475 A system of printing where the character spacing is set in accordance with the character width (see  
1476 [3.1.165 fixed pitch](#)).  
1477 (SWGDOC E04)
- 1478 **3.1.314**  
1479 **proposition (forensic)**  
1480 A statement or assertion about the origin or nature of the materials under examination, which is  
1481 either true or false.
- 1482 **3.1.315**  
1483 **purported writing**  
1484 Known writing not witnessed by the forensic document examiner.

- 1485 **3.1.316**  
 1486 **qualified sources**  
 1487 Organizations or individuals that provide, sponsor, or otherwise arrange for credible training or  
 1488 instruction on forensic document examination specific topics. These sources support, either  
 1489 through reflection in their policies or by the individual presenting the training, the type of training  
 1490 and required minimum criteria provided in American National Standards.
- 1491 **3.1.317**  
 1492 **questioned**  
 1493 Associated with the matter under investigation about which there is some dispute or query,  
 1494 including, but not limited to, whether two or more items have a common source.
- 1495 **3.1.318**  
 1496 **questioned writing**  
 1497 **also Q**  
 1498 Handwriting about which the authenticity or writership is in doubt.  
 1499 (NIST HF)
- 1500 **3.1.319**  
 1501 **rainbow printing**  
 1502 A printing technique that combines different color inks to produce a subtle transition between  
 1503 colors.
- 1504 **3.1.320**  
 1505 **random error**  
 1506 A component of error whereby replicate measurements vary in an unpredictable way. Sources of  
 1507 random error are usually unexplained and therefore difficult to control.  
 1508 (NIST HF)
- 1509 **3.1.321**  
 1510 **randomly acquired characteristic**  
 1511 **RAC**  
 1512 A feature or defect that can occur in the manufacturing process or from individual usage occurring  
 1513 after manufacture (for example, wear and damage defects such as cuts and gouges, reproducible  
 1514 blemishes, impression voids, improper and extraneous inking, or coincidental peripheral printing).  
 1515 The position, orientation, size and shape of these characteristics are features that are part of the  
 1516 information a FDE uses to form an opinion about the probability of items being generated by the  
 1517 same or different source.
- 1518 **3.1.322**  
 1519 **range of variation**  
 1520 The accumulation of deviations among repetitions of respective handwriting characteristics that are  
 1521 typically demonstrated in the writing habits of an individual (see [3.1.421 variation](#)).
- 1522 **3.1.323**  
 1523 **raster output scanner**  
 1524 Output peripheral, either stand alone or within a printer, that converts computer data into a  
 1525 bitmapped image, which is sent to the host for storage or a printer for output.

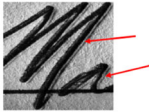
- 1526 **3.1.324**  
 1527 **rebound**  
 1528 A double impression of a typed character, the second lighter than and overlapping the first.  
 1529 (SWGDOC E04)
- 1530 **3.1.325**  
 1531 **recipient document**  
 1532 The document or other substrate that received indentations, other paper fiber disturbances, or  
 1533 other markings.  
 1534 (ANSI/ASB Std 044)
- 1535 **3.1.326**  
 1536 **record medium**  
 1537 A piece of material, usually paper, on which an image or information is recorded.
- 1538 **3.1.327**  
 1539 **reference collection**  
 1540 An assemblage of established materials, substances, objects or artefacts of known properties or  
 1541 origin that may be used in the determination of the properties or origins of unknown items.
- 1542 **3.1.328**  
 1543 **relevant information**  
 1544 Pertinent and applicable to the subject, material, or question being considered; the consideration  
 1545 may be broad (i.e., discipline level) or specific (i.e., task level).
- 1546 **3.1.329**  
 1547 **reliability**  
 1548 Consistency of results as demonstrated by reproducibility or repeatability.
- 1549 **3.1.330**  
 1550 **relief printing**  
 1551 A method in which the image areas are above the non-image areas of the printing  
 1552 plate.
- 1553 **3.1.331**  
 1554 **repeatability**  
 1555 A measure of reliability using the same FDE and the same instrument/method under exactly the  
 1556 same conditions to arrive at the same conclusion or result.  
 1557 (NIST HF)
- 1558 **3.1.332**  
 1559 **reproducibility**  
 1560 A measure of reliability using different FDEs and/or differing conditions with the same  
 1561 measurement instrument/method to arrive at the same conclusion or result.  
 1562 (NIST HF)
- 1563 **3.1.333**  
 1564 **reproduction quality**  
 1565 Extent to which a non-original document accurately replicates the features of the original  
 1566 document.



- 1567 **3.1.334**  
 1568 **requested writing**  
 1569 Handwriting samples prepared by a particular person specifically for the purpose of comparison,  
 1570 usually to questioned material.
- 1571 **3.1.335**  
 1572 **result**  
 1573 The product of the forensic service provider. This term is broad and may include observations, data,  
 1574 calculations, interpretations, findings, and opinions.
- 1575 **3.1.336**  
 1576 **retouching**  
 1577 Adding handwritten lines or strokes in order to correct, improve, distort, or alter.
- 1578 **3.1.337**  
 1579 **retrace**  
 1580 A stroke written over the preceding stroke, typically in reverse direction. 
- 1581 **3.1.338**  
 1582 **review, administrative**  
 1583 An assessment of the non-technical content associated with an examination and report.
- 1584 NOTE This commonly includes, but may not be limited to, the verification of the presence of all documents  
 1585 listed in the request for examination and the report, the verification of the appropriate marking of all  
 1586 documents, the documentation of chain of custody, case notes, and typographical or other clerical errors.
- 1587 **3.1.339**  
 1588 **review, technical**  
 1589 An assessment by another qualified forensic document examiner to review the method(s) and  
 1590 result(s) of the examiner of record to ensure the conclusion(s) rendered are supported.
- 1591 NOTE A technical review commonly includes, but may not be limited to, the adequacy of technical notes, the  
 1592 verification of method(s) used, the determination of the adequacy or limitations of the evidence, the proper  
 1593 use of equipment, whether all pertinent examinations were performed, whether the findings are consistent  
 1594 with the observations noted/recorded during the examination, the applicable nature of any references, and  
 1595 documentation of the performance of the review.
- 1596 **3.1.340**  
 1597 **ribbon shift**  
 1598 The movement of a multicolored inking ribbon allowing for a change in color to manifest itself in an  
 1599 impressed character.  
 1600 (SWGDOC E07)
- 1601 **3.1.341**  
 1602 **roller device**  
 1603 Wheel-type components designed to grab and transport paper into and through printers and  
 1604 copiers.

- 1605 **3.1.342**  
 1606 **roller marks**  
 1607 Visible or latent indented features in paper resulting from transport rollers in a printing or copying  
 1608 system.
- 1609 **3.1.343**  
 1610 **rollerball pen**  
 1611 A writing instrument that uses a tiny, revolving ball to dispense liquid ink onto paper. Gel and  
 1612 ballpoint pens use the same ball mechanism to deposit their ink but use gel- and oil-based ink,  
 1613 respectively.
- 1614 **3.1.344**  
 1615 **rubber stamp**  
 1616 (See [3.1.376 stamping device](#).)
- 1617 **3.1.345**  
 1618 **sample**  
 1619 Subset of a group (i.e., the totality of items under consideration) made up of one or more items (i.e.,  
 1620 the individual parts into which that group is divided).
- 1621 NOTE A group may be real and finite, real and infinite, or completely hypothetical.
- 1622 **3.1.346**  
 1623 **satellites**  
 1624 Extraneous or undesirable toner particles or ink droplets (see spatter, spray).
- 1625 **3.1.347**  
 1626 **screen printing**  
 1627 A method in which the image areas are on fine mesh screen through which ink can penetrate and  
 1628 the non-image areas are a stencil over the screen.
- 1629 **3.1.348**  
 1630 **secondary indentation**  
 1631 **secondary impression**  
 1632 Fiber disturbance(s) not caused by the act of writing or other dynamic actions, rather caused by  
 1633 dynamic contact with the embossed side of an indentation(s) or other raised surface.  
 1634 (ANSI/ASB Std 044)
- 1635 **3.1.349**  
 1636 **set off**  
 1637 The unintentional transfer of part of an image or ink from its intended location to another surface.  
 1638 (ASTM F221)
- 1639 **3.1.350**  
 1640 **shading**  
 1641 Variations in the line width or density resulting from changes in the pressure of the writing  
 1642 instrument on the document; also associated with variations in pressure when using a split nib pen.  
 1643 Also referred to as stress.

- 1644 **3.1.351**  
 1645 **side lighting**  
 1646 Illumination from a light source at a low angle of incidence, or even parallel, to the surface of the  
 1647 item. Syn. *oblique lighting, grazing illumination, raking lighting*.  
 1648 (ANSI/ASB Std 044)
- 1649 **3.1.352**  
 1650 **signature style**  
 1651 1) Text-based (all allographs legible),  
 1652 2) Mixed style (two or more allographs are legible),  
 1653 3) Stylized (one or no allographs are legible).  
 1654 (NIST HF)
- 1655 **3.1.353**  
 1656 **significant difference**  
 1657 A feature that is structurally divergent between items or groups of items, is outside the observed  
 1658 range of variation of at least one of them, and that cannot be reasonably explained.
- 1659 **3.1.354**  
 1660 **significant similarity**  
 1661 A repeated distinguishing characteristic that is structurally similar between items or groups of  
 1662 items and is within their observed range of variation (e.g., consistent height ratio, consistent pen  
 1663 lift).
- 1664 **3.1.355**  
 1665 **similarity**  
 1666 A feature or characteristic observed in one item or group of items that is also observed in the same  
 1667 form in a comparable item or group of items.
- 1668 **3.1.356**  
 1669 **simplistic writing**  
 1670 Characterized by non-complex characters or strokes.  
 1671 (NIST HF)
- 1672 **3.1.357**  
 1673 **simulation**  
 1674 An attempt to copy or reproduce handwriting (e.g., tracing, free hand, non-spurious).
- 1675 **3.1.358**  
 1676 **single element typewriter**  
 1677 A typewriter that generates text via interchangeable “elements” that each contain a full set of  
 1678 characters.  
 1679 (SWGDOC E04)
- 1680 **3.1.359**  
 1681 **single strike film ribbon**  
 1682 An inked ribbon wherein the substrate is a plastic film material such as polyethylene, where each  
 1683 area of the ribbon is capable of producing only one image.  
 1684 (ASTM F221)

- 1685 **3.1.360**  
 1686 **single strike paper ribbon**  
 1687 An inked ribbon wherein the substrate is paper, where each area of the ribbon is capable of  
 1688 producing only one image.  
 1689 (ASTM F221)
- 1690 **3.1.361**  
 1691 **sister lines**  
 1692 Sporadic inkless or partially inkless indented lines in a writing surface that are  
 1693 produced by the annular rim of a ball pen during the process of writing or making  
 1694 other markings, and which precisely run parallel to the primary ink line laid down  
 1695 by the ball pen. 
- 1696 **3.1.362**  
 1697 **skill**  
 1698 How well an individual is able to produce and repeat the formation of handwritten characters.  
 1699 (NIST HF)
- 1700 **3.1.363**  
 1701 **slant**  
 1702 **slope**  
 1703 The angle or inclination of the axis of letters relative to the baseline.  
 1704 (NIST HF)
- 1705 **3.1.364**  
 1706 **slit glass**  
 1707 Alternate scanning surface found in some digital photocopiers used in conjunction with an  
 1708 automatic document feeder.  
 1709 (SWGDOC E06)
- 1710 **3.1.365**  
 1711 **smudge**  
 1712 A handwritten or machine printed character smeared or streaked, unintentionally, onto an adjacent  
 1713 area.
- 1714 **3.1.366**  
 1715 **source (of optical radiation)**  
 1716 Object that produces light or other radiant flux.  
 1717 (CIE S 017/E:2011 ILV)
- 1718 **3.1.367**  
 1719 **spacing**  
 1720 The distance between characters, words, or lines.
- 1721 **3.1.368**  
 1722 **spatter**  
 1723 Type of extraneous or undesirable ink droplet originating when a portion of an ink droplet strikes  
 1724 the intended area and is deflected to an unintended area.  
 1725 (ASTM F1857)

- 1726 **3.1.369**  
 1727 **spectroscopy**  
 1728 The study of the absorption or emission of electromagnetic energy by a chemical species as a  
 1729 function of the energy incident upon that species; this analytical technique is used to identify  
 1730 elements and/or atomic and molecular structure by measurement of the radiant energy absorbed  
 1731 or emitted by a substance in any of the wavelengths of the electromagnetic spectrum.
- 1732 **3.1.370**  
 1733 **specular reflection**  
 1734 **regular reflection**  
 1735 A mirror-like reflection of waves, such as light, that is reflected at a definite angle from a surface.
- 1736 **3.1.371**  
 1737 **speed of execution**  
 1738 The swiftness with which a body of writing or signature is prepared. With the exception of some  
 1739 digitally captured writing, it cannot be measured precisely, but can be interpreted in broad terms  
 1740 such as slow, moderate, or rapid.
- 1741 **3.1.372**  
 1742 **spur**  
 1743 A small, angled appendage at the beginning or end of a stroke revealing an abrupt  
 1744 change of direction of the writing instrument. Also called hook or tick. 
- 1745 **3.1.373**  
 1746 **squeegee effect**  
 1747 The heavier concentration of ink on the edge of the ink line due to the ink being  
 1748 squeezed outward by the pressure used in the relief printing process. 
- 1749 **3.1.374**  
 1750 **staff**  
 1751 The vertical strokes of letters, such as "B", "T", and "P", that have a main stroke  
 1752 connecting to the baseline. 
- 1753 **3.1.375**  
 1754 **standard**  
 1755 (See [3.1.74 collected writing](#), [3.1.327 reference collection](#).)
- 1756 **3.1.376**  
 1757 **stamping device**  
 1758 A hand-marking device capable of making an inked impression using a variety of die materials that  
 1759 include, but are not limited to, vulcanized rubber, laserable rubber, photopolymer, gel, and metal.  
 1760 Synonyms: hand stamp, self-inking stamp, pre-inked stamp, flat-die, cachet.  
 1761 (ANSI/ASB Std 117)
- 1762 **3.1.377**  
 1763 **stem - primary and secondary**  
 1764 In typography, vertical or full-length angled strokes. Where there is a difference in the  
 1765 stroke thicknesses in printed characters with more than one stroke connecting to the  
 1766 baseline, the primary stem is thicker, and the secondary stem is thinner. 



- 1767 **3.1.378**  
1768 **stochastic screening**  
1769 An alternative to traditional halftone dots, this random-placement dot strategy uses frequency  
1770 modulation (FM) to render enlarged images on large format printing devices. Unlike halftone, the  
1771 dots are of a uniform size with darker areas having more dots packed closer together.
- 1772 **3.1.379**  
1773 **stroke**  
1774 A single written line, either ascending, descending, or lateral in the formation of a letter or any of its  
1775 parts.  
1776 (H&H Glossary)
- 1777 **3.1.380**  
1778 **structural features**  
1779 Characteristics relating to the construction of handwriting (e.g., number, position, order, and  
1780 direction of strokes) (see [3.1.136 ductus](#)).
- 1781 **3.1.381**  
1782 **style (design)**  
1783 The general category of allograph (letter form) that is employed to execute writing, e.g., cursive or  
1784 hand printing.  
1785 (NIST HF)
- 1786 **3.1.382**  
1787 **submersion**  
1788 The process of placing a document(s) into a liquid that is appropriate to facilitate cleaning,  
1789 unfolding, or separating the document(s).
- 1790 **3.1.383**  
1791 **substrate**  
1792 A material or surface that is written on, usually paper.
- 1793 **3.1.384**  
1794 **sufficient quantity (general)**  
1795 The amount of material required to assess the distinguishing features of the questioned item(s) or  
1796 known item(s) based on the expert's professional judgement.
- 1797 **3.1.385**  
1798 **sufficient quantity (handwriting)**  
1799 The amount of writing required to assess the writer's distinguishing features and range of variation  
1800 based on the expert's professional judgement.
- 1801 **3.1.386**  
1802 **suitability**  
1803 Sufficient quantity, quality, and complexity for comparison purposes.

- 1804 **3.1.387**  
 1805 **systematic error**  
 1806 A component of error whereby replicate measurements remain constant or vary in a predictable  
 1807 way - for example an uncalibrated instrument would produce a constant systematic error.  
 1808 (NIST HF)
- 1809 **3.1.388**  
 1810 **task-irrelevant information**  
 1811 Information that is not pertinent or applicable to the subject, material, or question being  
 1812 considered. The consideration may be broad (i.e., case or discipline level) or specific (i.e., task level)  
 1813 (see [3.1.32 bias](#), [3.1.33 bias cognitive](#), [3.1.34 bias confirmation](#), [3.1.35 bias contextual](#)).
- 1814 **3.1.389**  
 1815 **task-relevant information**  
 1816 Information that is pertinent and applicable to the subject, material, or question being considered.  
 1817 The consideration may be broad (i.e., case or discipline level) or specific (i.e., task level) (see [3.1.32](#)  
 1818 [bias](#), [3.1.33 bias cognitive](#), [3.1.34 bias confirmation](#), [3.1.35 bias contextual](#)).
- 1819 **3.1.390**  
 1820 **technical visit**  
 1821 Travel for the purpose of obtaining information, knowledge, or training, including interaction with  
 1822 or demonstration by pertinent manufacturers, businesses, and laboratories.  
 1823 (SWGDOC G02)
- 1824 **3.1.391**  
 1825 **terminal stroke**  
 1826 The final stroke of a character or word.
- 1827 **3.1.392**  
 1828 **thermal imaging transfer ribbon**  
 1829 Plastic film or other material, upon which a dye or pigmented coating is applied; imaging results  
 1830 when a thermal printhead transfers the coating onto a suitable substrate or receptor media.  
 1831 (ASTM F1623)
- 1832 **3.1.393**  
 1833 **thermal impulse**  
 1834 Ink jet technology where the rapid expansion of a bubble in the ink created by localized electrical  
 1835 heating expels the droplets from the ink chamber.  
 1836 (SWGDOC E06)
- 1837 **3.1.394**  
 1838 **thermal paper printing**  
 1839 A non-impact method in which the image is formed by the action of heat on a treated substrate.
- 1840 **3.1.395**  
 1841 **thermal print head**  
 1842 Mechanism for printing with a temperature-sensitive substance; heat transfer is affected by  
 1843 touching heated pin tips to the material to cause a reaction.

- 1844 **3.1.396**  
 1845 **thermal ribbon**  
 1846 Plastic film or other material, upon which a dye or pigmented coating is applied; imaging results  
 1847 when a thermal printhead transfers the coating onto a suitable substrate or receptor media.
- 1848 **3.1.397**  
 1849 **thermal transfer printing**  
 1850 A non-impact method in which the image is created by the action of a heated print head through a  
 1851 medium coated ribbon. This includes wax transfer, dye sublimation, and thermal fusion methods.
- 1852 **3.1.398**  
 1853 **thermography**  
 1854 A two-stage printing method in which a resinous powder adheres to wet ink. After heating, the  
 1855 compound rises to resemble raised or engraved printing.
- 1856 **3.1.399**  
 1857 **thimble element**  
 1858 An element used in an impact printing device in which the fully formed characters are located on  
 1859 the ends of finger-like devices that are similar to a daisy wheel except that the device is formed to  
 1860 produce a cup-like or thimble structure.  
 1861 (SWGDOC E04-13)
- 1862 **3.1.400**  
 1863 **thread count (in typewriter/printer ribbons)**  
 1864 The total number of horizontal and vertical threads per in.<sup>2</sup> of fabric.
- 1865 **3.1.401**  
 1866 **tooth**  
 1867 Quality of paper, or other writing surface that causes drag or resistance to the pen. A smooth, slick  
 1868 surface with no tooth can result in thick hairlines and lack of control in writing. Medium tooth  
 1869 causes just enough drag on the pen to facilitate control, produce fine hairlines and allow the writing  
 1870 process to be rhythmical. Too much tooth impedes ink flow and progress of the pen.
- 1871 **3.1.402**  
 1872 **tracing**  
 1873 Handwriting prepared by drawing the image of a genuine writing on a target document, which may  
 1874 be produced with the aid of carbon paper, transmitted light, or indented lines.
- 1875 **3.1.403**  
 1876 **training**  
 1877 The formal, structured process through which a person progresses from their current level of  
 1878 knowledge and expertise to the level of competency required to conduct specific tasks in  
 1879 accordance with American National Standards.
- 1880 **3.1.404**  
 1881 **tram lines**  
 1882 An accumulation of ink found on both sides of an ink line, typically caused by  
 1883 squeegee effect from a gel ink pen.



- 1884 **3.1.405**  
 1885 **transmitted lighting**  
 1886 Illumination that passes through a document.  
 1887 (ANSI/ASB Std 035)
- 1888 **3.1.406**  
 1889 **tremor**  
 1890 Shaky, irregular handwriting movements that are slowly executed or written by a person suffering  
 1891 from advanced age, nervousness, drug/alcohol influence, or physical/mental infirmities. These  
 1892 features can also be characteristic of unnaturally slow pen movements due to conscious attention to  
 1893 letterforms in deliberate drawings, rather than spontaneous writings.
- 1894 **3.1.407**  
 1895 **trough**  
 1896 The lighter or non-inked furrow between the tram lines typically seen in  
 1897 gel pen writing.
- 1898 **3.1.408**  
 1899 **type of writing**  
 1900 Refers to hand printing, cursive writing, numerals, symbols, or combinations thereof, and  
 1901 signatures.  
 1902 (SWGDOC E01)
- 1903 **3.1.409**  
 1904 **type slug**  
 1905 The block (usually metal) attached to the end of the typebar that bears the typeface.  
 1906 (SWGDOC E04)
- 1907 **3.1.410**  
 1908 **typebar**  
 1909 A bar, mounted on a typewriter, that holds a type slug(s).  
 1910 (SWGDOC E04)
- 1911 **3.1.411**  
 1912 **typeface**  
 1913 The portion of the element or type slug that projects from the body and contacts the surface of the  
 1914 substrate to form the character.  
 1915 (SWGDOC E04)
- 1916 **3.1.412**  
 1917 **typeface defect**  
 1918 Deviation from the intended appearance of a character due to physical damage to the typeface or its  
 1919 malformation in manufacture.  
 1920 (SWGDOC E04)
- 1921 **3.1.413**  
 1922 **typestyle**  
 1923 A particular variant of a type design.  
 1924 (SWGDOC E04)



- 1925 **3.1.414**  
 1926 **typestyle classification scheme**  
 1927 Hierarchical taxonomic schematic, key, or computer database that can be used to determine the  
 1928 source of a particular typestyle.  
 1929 (SWGDOC E04)
- 1930 NOTE These schemes are only an aid for searching a typestyle library and are not a substitute for actual  
 1931 reference materials in the typestyle library.
- 1932 **3.1.415**  
 1933 **typestyle library**  
 1934 An organized collection of reference samples of typestyles and related materials.  
 1935 (SWGDOC E04)
- 1936 NOTE Reference materials can also include information such as typestyle catalogs, treatises relative to  
 1937 typography and the design of typestyles used on typewriters and other printing systems, typewriters, type  
 1938 slugs, type elements, actual strike-ups, and instruction and repair manuals.
- 1939 **3.1.416**  
 1940 **typewriter**  
 1941 A self-contained machine for character-by-character direct writing by means of keyboard operated  
 1942 typefaces.  
 1943 (SWGDOC E04)
- 1944 **3.1.417**  
 1945 **typewriter grid**  
 1946 **schneeberger grid**  
 1947 A network of uniformly spaced horizontal and perpendicular lines, generally on a glass or acetate  
 1948 surface, used to check the alignment characteristics of typewriting or printing. The grids come in  
 1949 varying sizes and are physically placed on top of the document for measuring. Computer  
 1950 technology allows for these to be created in any spacing desired and overlaid on an image that has  
 1951 been imported into the computer.
- 1952 **3.1.418**  
 1953 **ultraviolet**  
 1954 **UV**  
 1955 **ultraviolet radiation**  
 1956 **UVR**  
 1957 Radiation for which the wavelengths are shorter than those for visible radiation.
- 1958 NOTE 1 The range between 100 nm and 400 nm is commonly subdivided into:  
 1959 UV-A: 315 nm to 400 nm;  
 1960 UV-B: 280 nm to 315 nm;  
 1961 UV-C: 100 nm to 280 nm.
- 1962 NOTE 2 A precise border between “ultraviolet” and “visible” cannot be defined, because visual sensation at  
 1963 wavelengths shorter than 400 nm is noted for very bright sources.  
 1964 (CIE S 017/E:2011 ILV)

- 1965 **3.1.419**  
 1966 **unaccustomed hand**  
 1967 The opposite hand (or other body part) from that normally used for writing.  
 1968 (SWGDOC T01)
- 1969 **3.1.420**  
 1970 **unnatural writing**  
 1971 A writing movement not typical in day-to-day writing that may be the result of intent, or internal/  
 1972 external factors.  
 1973  
 1974 NOTE Some characteristics of unnatural writing movements include slow speed, poor line quality, poor line  
 1975 continuity with stops or hesitations in the pen line, and blunt commencement and termination strokes. This is  
 1976 often seen in disguised or simulated writing.
- 1977 **3.1.421**  
 1978 **variation (handwriting)**  
 1979 One or more forms (constructions) of a character or word in a naturally produced sample of  
 1980 handwriting. These deviations among repetitions of the same handwriting characteristic(s) are  
 1981 normally demonstrated in the habits of each writer.
- 1982 **3.1.422**  
 1983 **variation (typewriters and printers)**  
 1984 Imprecise duplication in multiple impressions from the same machine. The cause of this may be  
 1985 manifested due to wear and tear in a machine part(s).
- 1986 **3.1.423**  
 1987 **verification**  
 1988 The subsequent independent examination by another trained and competent examiner to either  
 1989 support or refute the conclusions of the original examiner. Verification for some laboratories may  
 1990 require that original items need to be examined.
- 1991 **3.1.424**  
 1992 **visible radiation**  
 1993 Any optical radiation capable of causing a visual sensation directly.  
 1994  
 1995 NOTE There are no precise limits for the spectral range of visible radiation since they depend upon the  
 1996 amount of radiant power reaching the retina and the responsivity of the observer. The lower limit is generally  
 1997 taken between 360 nm and 400 nm and the upper limit between 760 nm and 830 nm.  
 (CIE S 017/E:2011 ILV)
- 1998 **3.1.425**  
 1999 **watermark**  
 2000 A translucent design, pattern, or symbol created in paper by varying the opacity or distribution of  
 2001 fibers within an area of the paper to identify the manufacturer, brand, or customer. It is best seen  
 2002 when held up to light.
- 2003 **3.1.426**  
 2004 **writer**  
 2005 The individual who applies handwritten markings with a writing instrument on a substrate.

- 2006 **3.1.427**  
2007 **writing instrument**  
2008 Any tool used to create handwritten markings on a substrate. Typically used to describe the use of a  
2009 pen, pencil, crayon, or other marker.
- 2010 **3.1.428**  
2011 **writing movement**  
2012 A pattern of the action of a writing instrument. These movements may be described as garland,  
2013 arcade, angular, or indeterminable.
- 2014 **3.1.429**  
2015 **writing surface**  
2016 The underlying plane on which the substrate, or the writing itself, is placed.  
2017

DRAFT

**Annex A**  
(informative)

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<sup>b</sup> Available from: <http://www.asbstandardsboard.org/published-documents/forensic-document-examination-published-documents/>

<sup>c</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org).



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<sup>d</sup> Available from: <http://eily.cie.co.at/termlist>

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<sup>f</sup> Available from: <https://www.iso.org/obp/ui/#iso:std:iso:3534:-1:ed-2:v2:en>

<sup>g</sup> Available from: <https://www.iso.org/obp/ui#iso:std:iso:21043:-1:ed-1:v1:en>

<sup>h</sup> Available from: <http://swgdoc.org/index.php/standards/published-standards>.

- 2071 d) SWGDOC E04-13 — Standard for Examination of Typewritten Items
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2073 Technology
- 2074 f) SWGDOC E06-13 — Standard for Examination of Documents Produced with Liquid Ink Jet  
2075 Technology
- 2076 g) SWGDOC E07-13 — Standard for Examination of Mechanical Checkwriter Impressions
- 2077 h) SWGDOC E08-13 — Standard for Examination of Dry Seal Impressions
- 2078 i) SWGDOC E10-13 — Standard for Examination of Rubber Stamp Impressions
- 2079 j) SWGDOC E11-13 — Standard for Examination of Fracture Patterns and Paper Fiber  
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- 2083 l) SWGDOC M01-13 — Standard for Test Methods for Forensic Writing Ink Comparison
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- 2089 13] NIST HF - Forensic Handwriting Examination and Human Factors: Improving the Practice  
2090 Through a Systems Approach; The Report of the Expert Working Group for Human Factors in  
2091 Handwriting Examination, NISTIR 8282, FEBRUARY, 2020<sup>i</sup>.
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<sup>i</sup> Available from: <https://doi.org/10.6028/NIST.IR.8282>



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