

Technical Procedure for Friction Ridge Analysis and Comparison

1.0 Purpose – This procedure shall be followed for the analysis, chemical and physical processing, comparison, and documentation of cases submitted for friction ridge examination.

2.0 Scope – This procedure applies to all friction ridge cases in Latent Evidence.

3.0 Definitions

- **Non-porous** - Any item of evidence, or part of an item of evidence, that does not absorb fingerprint residue.
- **Porous** - Any item of evidence, or part of an item of evidence, that may absorb fingerprint residue.
- **Semi Porous/Mixed** - Any item of evidence that exhibits the qualities of both porous and non-porous evidence.
- **ACE-V** – Friction ridge comparison methodology.
- **Of Value/Sufficient** – A friction ridge impression that contains sufficient qualitative and quantitative data to be utilized for comparison purposes.
- **Identification/Individualization** – The decision by an examiner that there are sufficient features in agreement to conclude that two areas of friction ridge impressions originated from the same source. Identification of an impression to one source is the decision that the likelihood the impression was made by another (different) source is so remote that it is considered a practical impossibility.
- **Elimination/Exclusion** – A determination by a forensic scientist that there is sufficient data and disagreement present within a friction ridge impression to conclude that it was not made by the same source as a set of known exemplars.
- **Inconclusive** – An identification or exclusion cannot be determined based upon a lack of sufficient data/detail present within a set of known exemplars.

4.0 Equipment, Materials, and Reagents

4.1 Equipment and Materials

- Alternate light sources (ALS) (CrimeScope, Mini-CrimeScope, TracER Laser)
- Image Processing System
- Comparator, Magnifier, Dome
- Protective Clothing
- Gloves
- Forensic Advantage (FA)
- Scanner
- Photoshop (currently utilized version)
- SAFIS Latent Search Station
- Photographic equipment
- SAFIS/AFIT computer station
- SAFIS/AFIT printers

4.2 Reagents

4.2.1 Non-porous Processing Reagents

- 4.2.1.1 **Fingerprint Powder(s)** – Any of the commercially prepared fingerprint powders that are maintained within Latent Evidence (ex: black, bi-chromatic, magnetic, etc.).
- 4.2.1.2 **Cyanoacrylate Ester** – Any of the commercially prepared cyanoacrylate ester products that are maintained within Latent Evidence (ex: vials, HotShot, wand tips).
- 4.2.1.3 **Fluorescent Dyes** – Any of the approved fluorescent dyes currently utilized in Latent Evidence (ex: Rhodamine 6G, Ardrex, etc.).

4.2.2 Porous Processing Reagents

- 4.2.2.1 Any of the approved porous reagents currently utilized in Latent Evidence, to include:
 - 1,2 Indanedione-Zinc
 - Ninhydrin and Ninhydrin-HFE
 - Zinc Chloride and Zinc Chloride-HFE
 - DFO
 - Physical Developer

4.2.3 Adhesive Processing

- 4.2.3.1 Any of the approved blood print processing reagents currently utilized in Latent Evidence, to include:
 - Crystal Violet
 - Sticky-Side Powder
 - Tape Glo

4.2.4 Blood Print Processing

- 4.2.4.1 Any of the approved blood print processing reagents currently utilized in Latent Evidence, to include:
 - Amido Black
 - Coomassie Blue
 - Merbromin
 - LCV

4.2.5 Miscellaneous Processing Reagents

- 4.2.5.1 In some instances, reagents that are reactive to a specific medium are required. These reagents include, but may not be limited to:
 - Sudan Black (grease print processing)

- Small Particle Reagent (wet print processing)

5.0 Quality Control (Positive Controls/Test Prints)

- 5.1 Test prints, also called control samples or positive controls, shall be performed on all prepared reagents as well as during all chemical processing steps. The test print shall be prepared on a substrate similar to the actual item of evidence and shall be tested and verified at the time a specific reagent is made and contemporaneously with evidence that is to be processed utilizing that reagent. The results of the test print shall be recorded in the case record in the FA System. A positive result is defined as the presence/development of friction ridge detail within the test print.

6.0 Evidence Processing Procedure

- 6.1 **Physical and Chemical Processing** - Processing for the presence of latent prints is broken down into three general categories: non-porous, porous, mixed/semi-porous. Additionally the evidence received may contain adhesive surfaces and/or be contaminated by blood, body fluid(s), and/or other biohazardous material. Prior to beginning any processing technique the forensic scientist shall note the category/categories of the evidence to be examined to determine the most appropriate course of action.

At any step during the course of the examination and/or processing of an item of evidence the forensic scientist shall evaluate the sufficiency of any friction ridge detail observed. If the forensic scientist deems it appropriate based on training and experience, the friction ridge detail may be documented photographically, via a scanned image, and/or lifting the ridge detail prior to proceeding to the next processing step.

Note: Forensic scientists shall wear gloves while handling all evidence that is to be physically or chemically processed for latent prints.

6.1.1 Non-porous Processing – Analytical Approach

- 6.1.1.1 Examine the item of evidence under ambient lighting conditions. Document any observations.
- 6.1.1.2 Examine the item of evidence utilizing an alternate light source, including all wavelength filters available on the chosen ALS. Document any observations.
- 6.1.1.3 Chemically process the item(s) of evidence. Document any observations.
- 6.1.1.3.1 The following is a list of the recommended and available processing procedures for non-porous items of evidence that are submitted for analysis.

Note: The forensic scientist has the authority to determine the most appropriate method by which to process a particular item based upon his or her training and experience.

- Cyanoacrylate Fuming

- Fingerprint Powder(s)
- Fluorescent Dye(s)
- Alternate Light Source (specific to fluorescent dye utilized)
- Blood Print Processing (if needed)
- Adhesive Surfaces Processing (if needed)
- Wet Item Processing (if needed)
- Grease Print Processing (if needed)

6.1.1.3.2 Based on the condition of the evidence at the time of submission, some processing steps may be omitted. If omitting the visual examination, inherent luminescence, powder processing, cyanoacrylate fuming, fluorescent dye stain, and/or post-dye alternate light source examination the Forensic Scientist shall note in the FA worksheet a reason that the step was omitted.

6.1.1.3.3 When processing items of evidence in all cases involving a death, the use of the TracER laser is required during the final ALS step. Additional alternate light sources may also be utilized and shall be documented in addition to the TracER.

6.1.2 Porous Processing – Analytical Approach

6.1.2.1 Examine the item of evidence under ambient lighting conditions. Document any observations.

6.1.2.2 Examine the item of evidence utilizing an alternate light source, including all wavelength filters available on the chosen ALS. Document any observations.

6.1.2.3 Chemically process the item(s) of evidence. Document any observations.

6.1.2.3.1 The following is a list of the recommended and available processing procedures for porous items of evidence that are submitted for analysis.

Note: The forensic scientist has the authority to determine the most appropriate method by which to process a particular item based upon his or her training and experience.

- 1,2 Indanedione Zinc
- DFO
- Ninhydrin/Ninhydrin-HFE
- Zinc Chloride/Zinc Chloride-HFE
- Alternate Light Source (specific to the fluorescent reagent utilized)
- Blood Print Processing

- Adhesive Processing
- Grease Print Processing
- Physical Developer/Modified Physical Developer

6.1.2.3.2 Based on the condition of the evidence at the time of submission, some processing steps may be omitted. If omitting the visual examination, inherent luminescence, and/or alternate light source examination the forensic scientist shall note in the FA worksheet a reason that the step was omitted.

6.1.2.3.3 When processing porous items of evidence in cases involving a death, the use of physical developer is required, providing the item of evidence is conducive to the multi-step process. If physical developer is not utilized the forensic scientist shall document the reason in FA.

6.1.3 Semi-porous/Mixed Processing – Analytical Approach

6.1.3.1 Examine the item of evidence under ambient lighting conditions. Document any observations.

6.1.3.2 Examine the item of evidence utilizing an alternate light source, including all wavelength filters available on the chosen ALS. Document any observations.

6.1.3.3 Chemically process the item(s) of evidence. Document any observations.

6.1.3.3.1 Semi-porous/Mixed items of evidence may be processed utilizing methods that are determined by the forensic scientist to be most appropriate for the surface. The method and order of processing may be determined based on the training and experience of each forensic scientist. See **6.1.1** and **6.1.2** for the steps for non-porous and porous processing.

6.1.4 Adhesive Processing – Analytical Approach

6.1.4.1 Adhesive surfaces are often found in conjunction with standard porous and/or non-porous surfaces. In the instances where adhesive surfaces are present, it is prudent to process the porous/non-porous surfaces first. Additionally, the use of adhesive processing reagents on the non-adhesive portion of tape may lead to further development of friction ridges.

6.1.4.2 Chemically process the adhesive surfaces utilizing Crystal Violet, Sticky-Side Powder, or Tape Glo. The Forensic Scientist has the authority to determine which processing technique to use. The method and order of processing may be determined based on the training and experience of each forensic scientist. Document any observations. See **6.1.1** and **6.1.2** for the steps for non-porous and porous processing.

6.1.5 Blood Print Processing - Analytical Approach

6.1.5.1 Surfaces contaminated with blood or other biohazardous materials are often found in conjunction with standard porous and/or non-porous surfaces. It is at the discretion of the forensic scientist, based on his or her training and experience, as to the order by which the item will be processed. See **6.1.1** and **6.1.2** for the steps for non-porous and porous processing.

6.1.5.2 Chemically process the item(s) of evidence utilizing Amido Black, Coomassie Blue, Merbromin, or LCV. Document any observations.

Note: It has been noted that Ninhydrin-HFE is also effective at developing friction ridge detail in blood or other biohazardous material on porous surfaces. Ninhydrin may be utilized in conjunction with other blood print processing methods.

6.1.6 Miscellaneous Processing - Analytical Approach

6.1.6.1 At times items of evidence are submitted that have unique processing needs. Items that have been submerged in water and items that contain greasy friction ridge stains (ex: soda or greasy food residue stains) require special processing considerations. When it becomes apparent that either of these circumstances exists it is at the discretion of the forensic scientist, based on his or her training and experience, as to the most prudent processing technique to be utilized. See **6.1.1** and **6.1.2** for the steps for non-porous and porous processing.

6.1.6.2 Examine the item of evidence under ambient lighting conditions. Document any observations.

6.1.6.3 Examine the item of evidence utilizing an alternate light source, including all wavelength filters. Document any observations.

6.1.6.4 Wet Items – Chemically process the item(s) of evidence utilizing Small Particle Reagent.

6.1.6.4.1 When processing items that are submitted to the laboratory submerged in water a visual examination, ALS examination, and the use of Small Particle Reagent shall be required. Additional processing steps are at the discretion of the forensic scientist, based on his or her training and experience.

6.1.6.5 Sticky and/or Greasy Items – Chemically process with Sudan Black.

6.1.6.5.1 In instances where Sudan Black is utilized it is also prudent to process the item(s) of evidence utilizing non-porous and/or porous processing techniques. It is at the discretion of the forensic scientist, based on his or her training and experience,

as to the order by which the item will be processed. See **6.1.1** and **6.1.2** for the steps for non-porous and porous processing.

7.0 Foundations for Comparison

7.1.1 All comparisons performed within the Latent Evidence discipline shall be independent with conclusions based on scientifically sound premises. The Laboratory recognizes the following concepts:

7.1.1.1 No two individuals have been found to have the same fingerprint.

7.1.1.2 The fingerprint does not change naturally from before birth until after death, barring scars or mutilation.

7.1.1.3 An identification is effected when sufficient unique identifying characteristics are present in both the known and questioned impressions without any unexplained differences.

7.1.1.4 There is no scientific requirement of a minimum number of identifying characteristics in order to effect a positive identification.

8.0 Friction Ridge Comparison Procedure – Analytical Approach

8.1 Friction ridge impression comparisons in Latent Evidence are conducted utilizing the Analysis, Comparison, Evaluation, and Verification (ACE-V) methodology. All ACE-V examinations involve the gathering and use of both qualitative and quantitative data present within a friction ridge impression in order to reach a conclusion. These examinations include comparisons of developed impressions captured photographically or via a scanner, impressions submitted on latent lifts, impressions submitted in photographs, impressions submitted via digital media (CDs, DVDs, and portable storage devices), SAFIS and reverse SAFIS hits, as well as CODIS verifications.

8.2 Forensic scientists in Latent Evidence have multiple tools available for conducting comparative examinations. Based on the training and experience of each individual forensic scientist an optical comparator, any of the various magnifying magnifiers/glasses available, and/or a comparison on a computer may be used.

8.3 All comparisons shall be documented in the Comparison Log tab in FA and the Latent Evidence ACE-V worksheet. The ACE-V worksheet shall be retained in the case record.

8.4 ACE-V

8.4.1 **Analysis** includes the assessment of each individual friction ridge impression to determine its suitability/sufficiency for comparison. The assessment includes examination and documentation of the matrix (if known), substrate (if known), and the presence of level 1, level 2, and if present, level 3 detail. The forensic scientist may document any additional relevant information that is deemed pertinent to the comparison, to include, but not limited to: impression type (finger, palm, and

impression), scars, creases, distortion, movement, pressure differentials, and background interference.

During the analysis phase the forensic scientist shall determine and document if the friction ridge impression is sufficient (of value) for comparison purposes. Any friction ridge impression that is determined to be insufficient for comparison (not of value) will end the ACE-V process for that particular impression.

The analysis phase is completed prior to entering the comparison phase.

- 8.4.2 Comparison** of a friction ridge impression is a side-by-side, direct comparison of the impression with a known standard. Known standards may be submitted by a law enforcement agency and/or obtained via SAFIS/AFIT. See segment **9.0** below for instructions on how to obtain known exemplars via SAFIS/AFIT.

Forensic scientists shall conduct the comparison in order to determine if the quantitative and qualitative data observed in the friction ridge impression agrees with the quantitative and qualitative data present within a known standard. The forensic scientist examines the latent and the known exemplar simultaneously for the presence and agreement of unique identifying characteristics, in the same relative position, and containing the same spatial relationship to each other. Each friction ridge impression that is deemed “of value” shall be compared to all available known exemplars.

- 8.4.3 Evaluation** is when the forensic scientist compiles all data that was observed in the analysis and comparison phases and then reaches a conclusion. The conclusions that may be reached are elimination, identification, and inconclusive due to a lack of sufficient detail in the available known exemplars. All conclusions shall be documented in the Comparison Log tab within Forensic Advantage. Forensic scientists may also elect to document conclusions in the ACE-V worksheet.

Additionally, in each comparison case one friction ridge impression that was determined to be “of value” shall be charted and imported into the ACE-V worksheet. If an identification was effected the friction ridge impression and the corresponding known impression shall be charted and imported into the ACE-V worksheet. In instances where multiple identifications are made to multiple known individuals one identification for each individual shall be charted and imported into the ACE-V worksheet. The charting of an identification shall satisfy the requirement of having one charted “of value” impression entered into the ACE-V worksheet.

- 8.4.4 Verification** is an independent application of the analysis, comparison, and evaluation phases of ACE-V by another qualified examiner. All friction ridge impression identifications shall be verified. Additionally, in cases involving a death all determinations of value, eliminations, and inconclusive results shall be verified.

A verification review shall be scheduled and completed in FA prior to scheduling any additional reviews. The forensic scientist acting as the verifier shall document the verification on the individual item(s) of evidence, the known exemplars, as well as by completing the verification review. For all identification verifications the verifier shall indicate the number of identifications verified, the date of the verification, and his or

her initials on the item(s) of evidence prior to returning the evidence to the assigned examiner.

Conflicts of opinion between the assigned forensic scientist and the verifying forensic scientist shall be resolved as provided in the lab-wide **Procedure for Reviewing Laboratory Reports**.

9.0 State Automated Fingerprint Identification System (SAFIS) and Advanced Fingerprint Identification Technology (AFIT) Searches

- 9.1 The SAFIS/AFIT computer interfaces are tools by which forensic scientists can perform state-wide and national searches of unknown/unidentified fingerprints and palmprints (SAFIS only) as well as search for and obtain known exemplars that are available through the state fingerprint database. The systems are maintained by the North Carolina State Bureau of Investigation Criminal Information and Identification Section (CIIS) and the manufacturer MorphoTrak.
- 9.2 When SAFIS/AFIT is requested, the forensic scientist shall determine, based upon his or her training and experience, which friction ridge impressions are suitable for search on the SAFIS/AFIT.
- 9.3 Detailed instructions as to the operation and functionality of the SAFIS/AFIT computer terminal may be found in the **Digital/Latent Procedure for SAFIS/AFIT**.
- 9.4 Guidelines for SAFIS searches may be found in the **Digital/Latent Procedure for SAFIS Searches and Property Crimes**.
- 9.5 Copies of known exemplars may be obtained through the SAFIS system, via communication with the CIIS, and/or via the most current method available for requesting fingerprint cards from the Federal Bureau of Investigation. All communication regarding the request of known exemplars and/or State Identification Numbers (SID) shall be documented in the case record in FA.
- 9.6 Steps for retrieving known exemplars from SAFIS/CIIS:
 - 9.6.1 When the copy of the known exemplars is received, enter the fingerprint card as an item of evidence in FA. Adhere to the State Crime Laboratory **Procedure for Evidence Management** for marking and identifying evidence.
 - 9.6.2 Compare applicable identifiable latent impressions to the known exemplar images as necessary and prepare the required notes and reports.
 - 9.6.3 Enter a scanned copy of the known exemplars with all markings by the Forensic Scientist into the Case Record Object Repository.
 - 9.6.4 Package the known exemplars in an envelope, mark the envelope with the appropriate identifiers and return to the submitting agency with all other evidence.
 - 9.6.5 When the Forensic Scientist receives known exemplars for CODIS verifications, the known exemplars shall be destroyed upon the release of the CODIS case record (see

Digital/Latent Evidence Section Technical Procedure for CODIS Fingerprint Verification).

10.0 Recording of All Analytical Data

10.1 Information required in Every Case File:

10.1.1 All examination activities.

10.1.2 Activities include the development techniques applied, control or reagent checks used in development techniques, photography/digital imaging used, Image Processing history logs, any SAFIS/AFIT searches conducted, known exemplar capture and/or retrieval, comparisons conducted, and conclusions reached.

10.1.3 Examination documentation shall also acknowledge the existence and disposition of any captured latent prints which are not analyzed, compared or evaluated. This includes any photographs or scans taken where the friction ridges were later determined to be not “of value.”

10.1.4 When an individualization or identification is made, a legible digital copy of the latent print and the known exemplar used shall be retained on the Latent Evidence Image Processing System (LEIPS). The images shall remain on the hard drive until archived by the key operator. If the LEIPS is not in service for an extended period of time, the images shall be retained in the case record object repository with the stipulation that the images are of comparison quality (identifiable for comparison purposes).

10.2 Comparison cases and known exemplars:

10.2.1 If the known exemplar is retrieved from the CIIS Fingerprint Repository, then the Comparison Log shall be annotated with the SID, the date of arrest of the known exemplar used (if indicated) and the date the known exemplar was retrieved or printed. A copy of the known exemplar shall be scanned into the Case Record Object Repository. The copy must be comparison quality.

10.2.2 If the known exemplar was submitted as evidence, then a copy shall be scanned into the Case Record Object Repository if it was utilized for comparison purposes. The copy must be comparison quality.

10.3 Latent lifts, photographs/digital images, and/or legible copies of friction ridge impressions:

10.3.1 All photographs, digital images, or legible copies of all latent prints shall be retained in the case record object repository or the LEIPS. The case record includes associated LEIPS entries.

10.3.1.1 All friction ridge impressions determined to be “of value” shall be retained in the LEIPS.

10.3.1.2 Documentation copies of all latent lifts, photographs, or scans of friction ridge impressions determined not to be “of value” shall be retained in the case record object repository.

10.3.2 Legible copies of any annotations made on sub-item evidence, such as latent print lifts or photographs/digital images of latent prints, shall be retained as examination documentation in the Case Record Object Repository.

10.4 Databases which generate lists that are reference materials include the following: SAFIS and the AFIT. If a search results in identification, the physical fingerprint card shall be printed and retained as described in section **9.0**.

10.5 SAFIS Match Reports shall be entered into the Case Record Object Repository.

10.6 A full case review shall be conducted on all cases involving deaths (**see Digital/Latent Evidence Section Technical Procedure for Conducting Reviews**). The completed Full Case Review form shall be imported into the Case Record Object Repository.

11.0 Results Statements

11.1 Results statements shall include an accurate interpretation of the actual results of the examination; this interpretation may include one or more of the following statements or a variation approved during the technical review process.

11.1.1 There were no latent prints noted or developed on Item (Item number).

11.1.2 There were no latent prints noted on Item (Item number).

11.1.3 There were no identifiable latent prints noted or developed on Item (Item number).

11.1.4 There were no identifiable latent prints noted on Item (Item number).

11.1.5 (Number of identifiable latent prints) identifiable latent (fingerprint(s)/palmprint(s)/impression(s)) was/were noted/developed on Item (Item number).

11.1.6 The identifiable latent (fingerprint(s)/palmprint(s)/impression(s)) was/were compared to Item (Item number) and was/were excluded as having been made by the same source.

11.1.7 The identifiable latent (fingerprint(s)/palmprint(s)/impression(s)) was/were compared to Item (Item number) and was/were identified as having been made by the (finger of subject).

An identification is defined as the decision by an examiner that there are sufficient features in agreement to conclude that two (2) areas of friction ridge impressions originated from the same source. Identification of an impression to one source is the decision that the likelihood the impression was made by another (different) source is so remote that it is considered a practical impossibility.

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- 11.1.8** No known inked palmprint impressions were submitted; therefore, no comparison with Item (Item number) could be conducted.
- 11.1.9** A search of the SBI Identification Files (or AFIT), based on the information provided, failed to disclose known inked impressions of (subject's name); therefore, no comparison could be conducted between this individual and the (number) identifiable latent (fingerprint(s)/palmprint(s)/impression(s)) noted on Item (Item number).
- 11.1.10** The identifiable latent (fingerprint(s)/palmprint(s)/impression(s)) was/were compared to (Item number) and was/were identified as having been made by (subject):
- 11.1.10.1** (Number) by the (finger identified)
- 11.1.10.2** For identifications to multiple fingers and/or multiple subjects, a list format may be used.

Identification is defined as “the decision by an examiner that there are sufficient features in agreement to conclude that two areas of friction ridge impressions originated from the same source. Identification of an impression to one source is the decision that the likelihood the impression was made by another (different) source is so remote that it is considered a practical impossibility.”

- 11.1.11** The identifiable latent/inked (fingerprint(s)/palmprint(s)/impression(s)) was/were of sufficient value for entry into the State Automated Fingerprint Identification System (SAFIS) [or the Advanced Fingerprint Identification Technology (AFIT)].
- 11.1.12** The identifiable latent/inked (fingerprint(s)/palmprint(s)/impression(s)) was/were of insufficient value for entry into the State Automated Fingerprint Identification System (SAFIS) [or the Advanced Fingerprint Identification Technology (AFIT)].
- 11.1.13** The identifiable latent (fingerprint(s)/palmprint(s)/impression(s)) was/were searched on the SAFIS (AFIT) with (results of search).
- 11.1.14** The (number) identifiable latent/inked (fingerprint(s)/palmprint(s)/impression(s)) was/were entered into and searched by the SAFIS with no identification being effected.

Due to no elimination prints being submitted for comparison purposes, the (number) identifiable latent/inked (fingerprint(s)/palmprint(s)/impression(s)) was/were not retained in the SAFIS database. Elimination prints must be submitted before a subsequent search will be conducted.

- 11.1.15** The identifiable latent (fingerprint(s)/palmprint(s)/impression(s)) was/were compared to Item (Item number) with no identification(s) being effected. However, the known inked impressions submitted on or on file for (subject) are of insufficient detail to conduct a conclusive comparison; therefore, this cannot be considered a conclusive comparison with the unidentified latent (fingerprint(s)/palmprint(s)/impression(s)). Major case inked impressions, with emphasis on (area needed), will be required to conduct a conclusive comparison.

11.1.16 The identifiable latent (fingerprint(s)/palmprint(s)/impression(s)) remain(s) unidentified.

11.1.17 A records check through the Administrative Office of the Courts (AOC) database and a check with the submitting agency on (date) indicate that this case has been dispositioned. The evidence in this case is being returned unworked. If you have any questions concerning this action, please contact the Forensic Scientist listed below.

11.1.18 Pursuant to a request from (officer and date), no further analysis was conducted on the above listed evidence.

12.0 Records

- ACE-V Worksheet

13.0 Attachments – N/A

| Revision History | | |
|-------------------------|----------------|-----------------------|
| Effective Date | Version Number | Reason |
| 07/01/2016 | 1 | Original ISO Document |
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