

Technical Procedure for the Examination of Headlight and Bulb Evidence

- 1.0 Purpose** – This technical procedure shall be followed for the examination of headlights and other bulb evidence.
- 2.0 Scope** – This procedure applies to all bulbs submitted to determine functionality and/or whether they were on or off during a collision.
- 3.0 Definitions** – N/A
- 4.0 Equipment, Materials, and Reagents**
- Camera
 - Stereomicroscope
 - Multi-meter
 - SEM-EDS
- 5.0 Procedure**
- 5.1 Analytical Approach**
- 5.1.1** Review the request for analysis.
- 5.1.2** Open evidence container and describe the bulb and note any manufacturer markings on the bulb.
- 5.1.3** Perform a visual and microscopic examination of the bulb, noting any of the following characteristics:
- 5.1.3.1** Black or multicolored discoloration of filaments.
 - 5.1.3.2** Black or pale yellow oxidation on filaments, hoods, filament posts, glass, or other parts.
 - 5.1.3.3** Unusual distortion of filaments.
 - 5.1.3.4** Glass beads or particles fused to the filament surface.
 - 5.1.3.5** If the filament is broken, note whether the ends are melted, beaded, or fractured.
- 5.1.4** If filament is intact, test circuits with a multi-meter to determine continuity.
- 5.1.4.1** Set the meter to 200 Ohms, the setting with the audible alert.
 - 5.1.4.2** Hold leads apart to make sure that there is no continuity when there is a break in the circuit. There should be no audible alert.
 - 5.1.4.3** Cross the positive and negative leads to make sure that when the circuit is complete there is continuity. There should be an audible alert.

5.1.4.4 If the multi-meter fails to work properly as stated in **5.1.4.2** or **5.1.4.3**, the multi-meter shall not be used until maintenance is performed to correct the issue. Once the multi-meter works properly, it may be used for examinations.

5.1.4.5 Test the filament in the bulb. If there is no audible alert, the filament does not have continuity. If there is an audible alert, the filament has continuity.

5.1.5 Photograph the evidence.

5.1.6 Portions of the filament may be removed for SEM analysis if higher magnification is needed. See the Trace Evidence Section [Technical Procedure for SEM-EDX for non-GSR Casework](#).

5.1.6.1 Confirms the presence of fused glass by both microscopic and elemental analysis

5.1.6.2 Gives a higher magnification image of the filament break.

5.2 Guidelines for Light Bulb Examination Result Statements

5.2.1 Bulb was On at Time of Break/Damage

5.2.1.1 Criteria: any combination of the following conditions: oxidized filament, beaded filament ends, some degree of filament distortion, signs that glass was fused to the filament, and/or oxidation on bulb components.

5.2.1.1.1 Example: Examination of Item A revealed the presence of fused glass, black oxidation, filament elongation, and end melt. It is the opinion of this Forensic Scientist that the bulb was on at the time of an impact.

5.2.2 Bulb was Not On at Time of Break/Damage

5.2.2.1 Criteria: any combination of the following conditions: no oxidized filament, no beaded filament ends, slight filament distortion, no signs that glass was fused to the filament, and/or fractured ends.

5.2.2.1.1 Example: Examination of Item A revealed the presence of end fractures. It is the opinion of this Forensic Scientist that the bulb was off at the time of the filament breaking.

5.2.3 Inconclusive

5.2.3.1 This report shall be used when no damage was observed or conflicting information was observed in examination.

- 5.2.3.1.1** Example: Examination of Item A failed to show any filament deformation. Therefore, no opinion could be rendered as to whether the bulb was on or off at the time of an impact.

5.3 Standards and Controls – N/A

5.4 Calibrations – No additional calibrations or performance checks are required. See associated technical procedures for instrumental performance checks.

5.5 Maintenance – No additional maintenance is required. See associated technical procedures for instrumental maintenance procedures.

5.6 Sampling and Sample Selection

5.6.1 No sampling is performed. When sample selection occurs, it shall be based on the Forensic Scientist's training and experience.

5.6.2 All bulbs submitted for filament examinations shall be analyzed.

5.7 Calculations – N/A

5.8 Uncertainty of Measurement – N/A

6.0 Limitations – N/A

7.0 Safety

7.1 Broken bulbs have very sharp edges and can produce severe cuts.

7.2 Electrical circuits may be energized and could produce electrical shocks.

7.3 Care shall be exercised when using the above-listed items or procedures.

8.0 References

Baker, J.S., et al. *Lamp Examination for On or Off in Traffic Accidents*, Northwestern University Center for Public Safety, 2003.

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Fries, T.R. and R.O. Lapp. "Accident Reconstruction - Response of Halogen Light Filaments during Vehicle Collisions." *Society of Automotive Engineers* 890856.

Kawakami, A., H. Sekimori, and A. Shinohara. "Accident Information for Traffic Accident Reconstruction - The Role of the Automobile Lamp Filament." *Society of Automotive Engineers* 930661.

Keskin, A.T., W.S. Reed and R.L. Friedrich. "Brake Light Filament Deformation Analysis for Vehicular Collisions." *Society of Automotive Engineers* 880233.

Severy, D.M. "Headlight-Tailight Analysis from Collision Research." *Society of Automotive Engineers* 660786.

Stone, I.C. "Forensic Laboratory Support to Accident Reconstruction." *Society of Automotive Engineers* 870427.

8.1 Books

Noon, R.K. *Engineering Analysis of Vehicular Accidents*. Boca Raton: CRC Press, 1994, pp. 83-90.

8.2 Journal Articles

Dolan, D.N. "Vehicle Lights and Their Use as Evidence." *Journal of the Forensic Science Society* 2.2 (1971).

Haas, M.A., M.J. Camp and R.F. Dragen. "A Comparative Study of the Applicability of the Scanning Electron Microscope and the Light Microscope in the Examination of Vehicle Light Filaments." *Journal of Forensic Sciences* 20 (1975): 91-102.

Hagstrom, A.L. and S. Soder. "Light Filaments of Incandescent Lamps Studied by Auger Electron Microscopy." *Journal of Forensic Sciences* 25.1 (1980): 103-112.

9.0 Records – N/A

10.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
09/17/2012	1	Original ISO Document