



Scientific Working Group on Digital Evidence

Best Practices for Handling Damaged Digital Storage Devices

14-F-001-2.0

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1. Purpose

The purpose of this document is to describe the best practices for handling magnetic media hard drives when the data cannot be accessed via the guidelines provided in the *SWGDE Best Practices for Computer Forensics*.

2. Scope

This document provides basic information on the handling of damaged digital storage devices. While there are many digital devices that store data, this document is only addressing spinning disk hard drives (HDD), solid state drives (SSD), NVMe, and NAND-based thumb drives or cards (SD, MicroSD, etc.) and the expectations of the technician responsible for media recovery. The intended audience is examiners in a cleanroom lab setting and personnel who collect digital evidence in the field.

This document is not intended to be used as a step-by-step guide for conducting data recovery on digital media nor should it be construed as legal advice.

3. Limitations

This document only discusses those devices currently available at the time of writing and does not exhaustively cover all media types (e.g., optical media, magnetic tape, mobile devices). Emerging technologies will be addressed in future revisions.

Hard drive data recovery techniques should only be conducted by properly trained personnel. Performing traditional computer forensic imaging techniques on a failed or failing hard drive may cause evidentiary data to be destroyed. Traditional computer forensic examiners should never open the drive chassis cover or attempt to disassemble the original evidence unless they have been properly trained and in an approved environment.

4. Evidence Collection of Known Damaged Digital Media

General guidelines concerning the collection and handling of known damaged digital media are provided below. For all damaged media consider the following:

- The technician responsible for damaged media recovery should consult with the investigator to determine the details of the case and potential scenarios where recovery services are required. When possible and allowed by an organization's documentation requirements, any evidence being submitted for recovery service should include a cover sheet indicating the type of damage (if known). The recovery technician can utilize that knowledge to take immediate actions to mitigate possible continuing damage. The cover sheet should also include what steps, if any, have been taken to recover the drive by the submitting agency or a commercial recovery service.



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- Occasionally, there may be a need to conduct traditional forensic processes on media (e.g., DNA, latent prints). The processes are case dependent and should be discussed with the investigator to determine the need for such processing as well as the order in which the processes should be performed.

4.1 Liquid Damage

If a hard drive was recovered from water or other liquids, DO NOT attempt to power.

Shipping or transporting of liquid damaged media:

- If the drive is known to have been submerged in any non-flammable liquid, DO NOT package it in the original liquid. Utilize a vacuum sealer to remove the air from the packaging containing the drive and seal. This process will draw the moisture from the drives chassis and limit the air in the package to reduce further oxidation. Ensure the drive is protected on all sides by at least 3 inches of padding.
- If the drive is known to have been submerged in any dangerous substance great care should be taken during packaging and additional safety requirements should be utilized to protect the packager and device from injury and damage from the volatile substance.
- Liquid damaged items need to be shipped to the recovery service immediately. Additionally, a notification should be made to the technician responsible for media recovery. If restrictions and/or regulations prevent shipping in the manner described above, contact the recovery examiner for other options.

4.2 Dropped

If a hard drive was dropped or known to have fallen, DO NOT power-on the drive. With any dropped evidence being submitted for recovery service, include on the cover sheet (see Section 4) that the drive has been dropped and if the drive was known to have been powered on after the drive had been dropped.

4.3 Fire Damage

Any spinning disks that are known to have been subjected to a fire or extreme heat should not be powered on even if the external chassis and printed circuit board (PCB) appears in pristine condition. Temperatures above 150° Fahrenheit can melt or deform internal plastics in the drive and cause catastrophic damage if the drive is powered. Solid state devices should also be inspected by a qualified technician before powering to ensure that soldered contacts were not melted or chips deformed.

If a hard drive was in a fire that was extinguished with water, package the drive in an anti-static bag and utilize a vacuum sealer to remove the air then seal the package and ensure the drive is



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protected on all sides by at least 3 inches of padding. Once the exhibit is packaged, ship as soon as possible and notify the technician responsible for media recovery.

4.4 Unknown Drive Failure

Certain circumstances may arise when a drive is collected into evidence and shows no physical signs of damage. An indication of drive failure is typically experienced when the drive is powered on and emits unanticipated audible sounds while also being non-addressable by host. The drive should then be immediately powered-off and sent to the technician responsible for damaged digital media recovery.

If the drive fails to power-on, or there are burn marks on the PCB, then the drive should be sent to the technician responsible for damaged media recovery.

4.5 Broken Pieces

If a piece of media has any pieces broken, attempt to collect as many pieces as possible and send all pieces with the media to the technician responsible for damaged media recovery.

- It is especially important to recover any electronic components that belong to a PCB.
- Attempt to recover and keep intact any labels or other components with identification markings.

5. Qualifications for a Technician Performing Damaged Media Recovery

The following are basic qualifications for a technician performing media recovery:

- Meets SWGDE/SWGIT Guidelines & Recommendations for Training in Digital & Multimedia Evidence
- A technician performing media recovery should have experience and/or training that culminate in a competency in all the following areas:
 - advanced imaging techniques applicable to the recovery of media with problematic sectors
 - advanced soldering techniques applicable to circuits (e.g., Surface Mount Technology (SMT))
 - cleaning, repairing, and replacing of media components to include the head stack assembly (HSA), the spindle motor, and the transplanting of platters for HDDs
 - accessing, manipulating, and correcting digital media firmware
 - imaging on failed or failing media and data reconstruction with accordance to the *SWGDE Best Practices for Computer Forensics*



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6. Evidence Packaging/Transport

- Digital media damaged from water, fire, and/or blunt force impact should be handled and packaged in accordance with the recommendations outlined in Section 4 and Section 5 of this document.
- Refer to *SWGDE Best Practices for Computer Forensics*.
- External drives should be packaged with all components (power supply, PCB boards, special connectors, etc.). Each item should be individually wrapped with at least 3 inches of padding used to separate the items from each other and the exterior of the packaging.

7. Additional Resources

- Scientific Working Group on Digital Evidence. *Best Practices for Computer Forensics*.
- Scientific Working Group on Digital Evidence. *Data Integrity within Computer Forensics*. SWGDE 06-F-001-1.0. SWGDE, 2006, <https://www.swgde.org/06-f-001/>.
- Scientific Working Group on Digital Evidence. *Guidelines & Recommendations for Training in Digital & Multimedia Evidence*. SWGDE 10-Q-002-3.0. SWGDE, 2024, <https://www.swgde.org/10-q-002/>.

Access the most current versions of these documents at Scientific Working Group on Digital Evidence, <https://www.swgde.org>.

8. History

Revision	Issue Date	History
1.0	1/16/2014	Original working draft created.
1.0	2/6/2014	Formatting and technical edit.
1.0	6/6/2014	Voted for release as a Draft for Public Comment.
1.0	6/11/2014	Formatting and technical edit completed for release as a Draft for Public Comment.
1.0	8/28/2014	No changes made; voted to publish as an Approved document.

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1.0	9/5/2014	Section 3 (Definitions) removed from document and added to Glossary. Formatting and technical edits performed for release as an Approved document.
1.0	1/15/2015	Replaced the term, "Data Recovery Examiner," with the description, "technician responsible for/performing media recovery," throughout the document. No content changes.
2.0	9/18/2024	Grammatical updates throughout. Included updated storage devices (e.g., NVMe, SSD, NAND). Overall update in the process of shipping and packaging procedures. Changed name of document to reflect other digital storage devices rather than just hard drives.
2.0	11/6/2024	SWGDE voted to approve as Draft for Public Comment.
2.0	11/6/2024	Formatted for release as a Draft for Public Comment.

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