

# How Stressors Affect Hard Drive Performance

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## Introduction

- Personal computers are used every day and all users want their computers to perform in the best way possible.
- Computer hard drives have changed greatly, from size to capacity and durability.
- Hard drives are known to be very fragile and are to be handled with care.
- Warranties can be void if hard drives undergo certain conditions, especially when opened.
- Developers have created software to understand and interpret codes that have been put out by the drives.
- Operating systems take advantage of SMART software by displaying warnings.

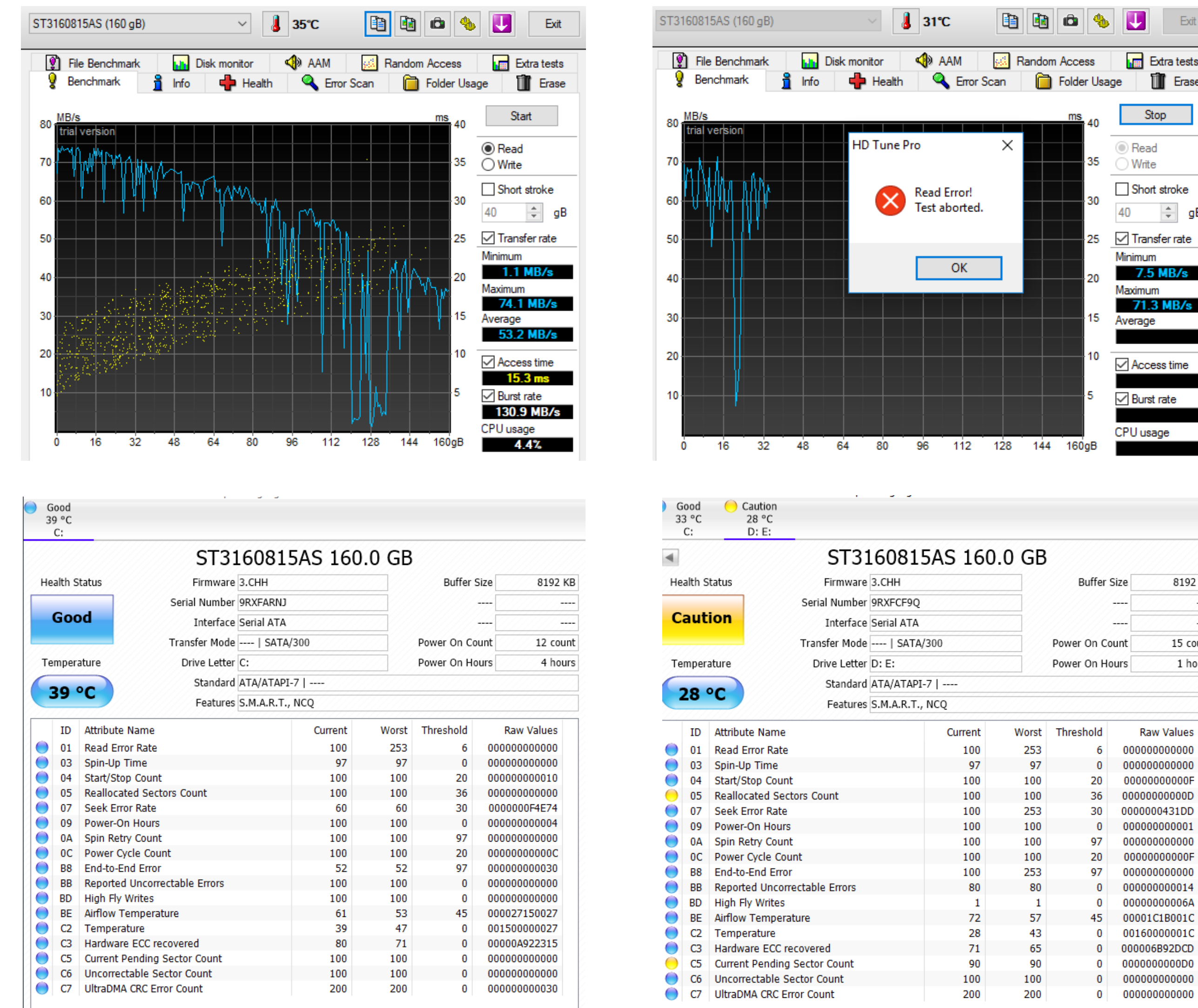
## Problem

- As technology continues to advance, computers need the best performing components to handle any form of stress that may occur.
- Have computer engineers tried to improve the durability of desktop hard drives to handle extreme stress?
- What software can be used to predict and prevent errors when under physical stress?

## Research Questions

- How fragile are hard drives?
- How are hard drives affected by physical stress?
- Do magnets break hard drives/computers?
- Does temperature make a difference with performance?
- What happens if a hard drive is dropped?
- How does impact affect performance?

## Methodology

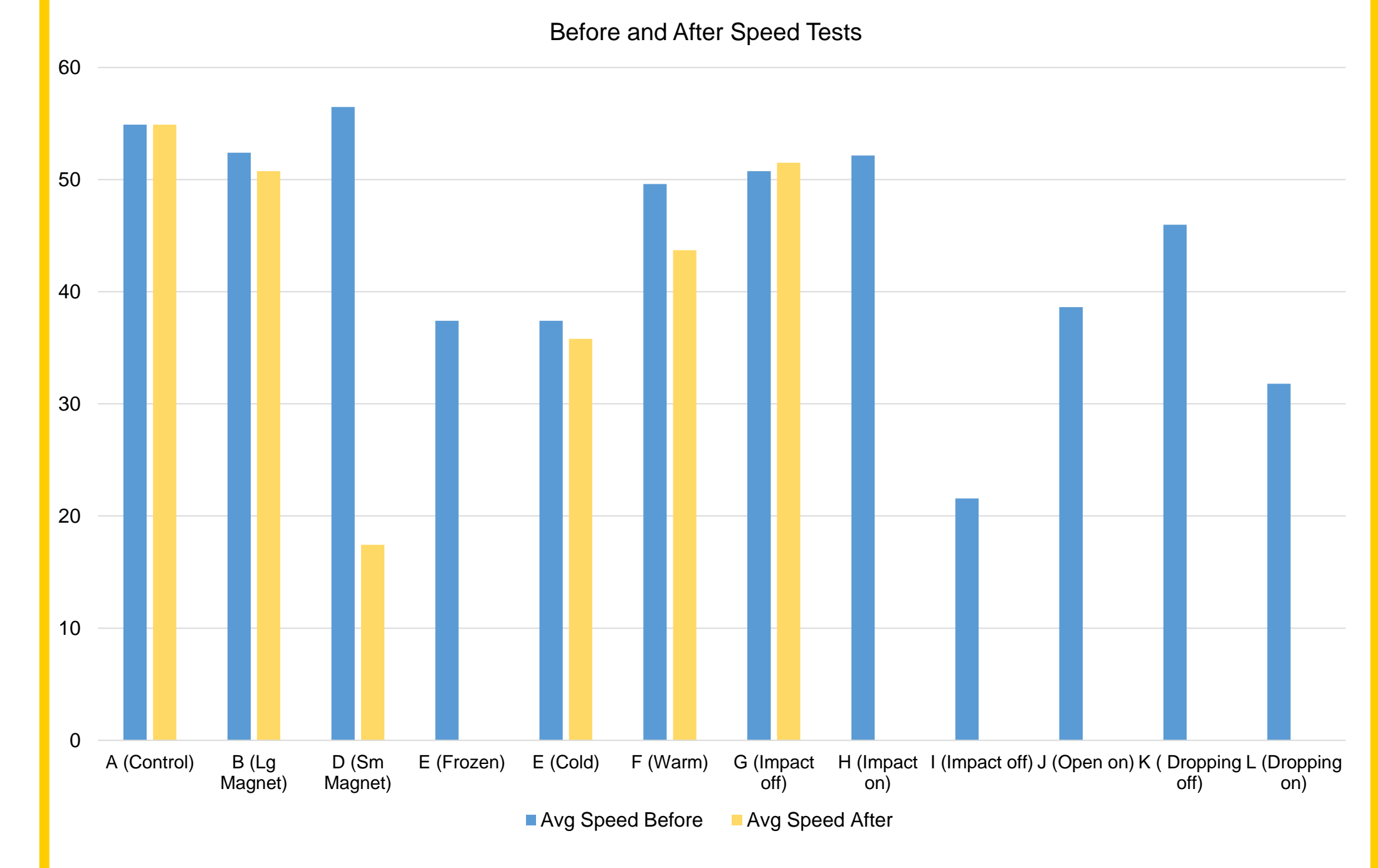


## Data

Drive	Test	Error Code	Comment
B	Large Magnet	C5	•Drive slowed down within an inch or so away •Sounded like it was "working harder" to operate HD Tune aborted each time about 3/4 way though •SMART error showed up •Drive still functional after first exposure to magnets •After the second time, the drive began to make a crunching sound and the computer wasn't responding
D	Small Magnet	C5	•Little magnets did not affect the performance at all •Large magnet got too close and the drive began to make a "sizzling" noise •Became unresponsive •Drive was not recognized when rebooted, but was
E	Cold	No Error	•Same hard drive that was frozen •Started up and performed tests just fine •Startup temp 15C, after test 25C
E	Frozen	No Error	•Started up, but turned off immediately after bootup •Drive became very wet because of condensation •(Drive did start up eventually once it dried a day later)
F	Warm	No Error	•No changes in speed •Warnings popped up once it hit 60-61C •Max heat for test 65C
H	Impact on	C5, C6	Test aborted after second impact •Opened while off, then put cover back on during operation •Drive performed normally but then began to slow down •Screen went black after testing and restarted •Stuck on Windows bootup screen •To skip disk checking, press any key" showed up
I	Open off	No Error	•Drive wouldn't boot •Exposed open drive while in operation •Began to make a click/grinding noise and wouldn't boot •Put the lid back on and it operated differently but only a cursor appeared after bootup, never worked again
J	Open on	No Error	
K	Dropping off	05, C5, C6	
L	Dropping on	No Error	•On the second drop, test completely stopped and started to make a clicking noise •Programs aren't responding but the desktop is still functional •Slow and laggy •Rebooted and only saw a cursor

Error Key	Name
01	Read Error Rate
03	Spin-Up Time
04	Start/Stop Count
05	Reallocated Sectors Count
07	Seek Error Rate
09	Power-On Hours
0A	Spin Retry Count
0C	Power Cycle Count
B8	End-to-End Error
BB	Reported Uncorrectable Errors
BD	High Fly Writes
BE	Airflow Temperature
C2	Temperature
C3	Hardware ECC recovered
C5	Current Pending Sector Count
C6	Uncorrectable Sector Count
C7	UltraDMA CRC Error Count

## Results



## Observations

- Many drives had little or no change in the average speed after the stress tests.
- The drives that experienced the most stress were unrecoverable.
- Hard drives automatically fail once opened.
- Magnets only have an effect when they physically interrupt the hardware; no data was corrupted.

## Conclusion

- Hard drives are very fragile and should not go under any form of stress if possible.
- Computer hardware engineers can use this data to help improve their products by making them more durable, especially in extreme conditions.
- Below and above average temperatures do not affect the overall performance of hard drives.

## Acknowledgements

This research was supported by the Clare Boothe Luce Foundation.