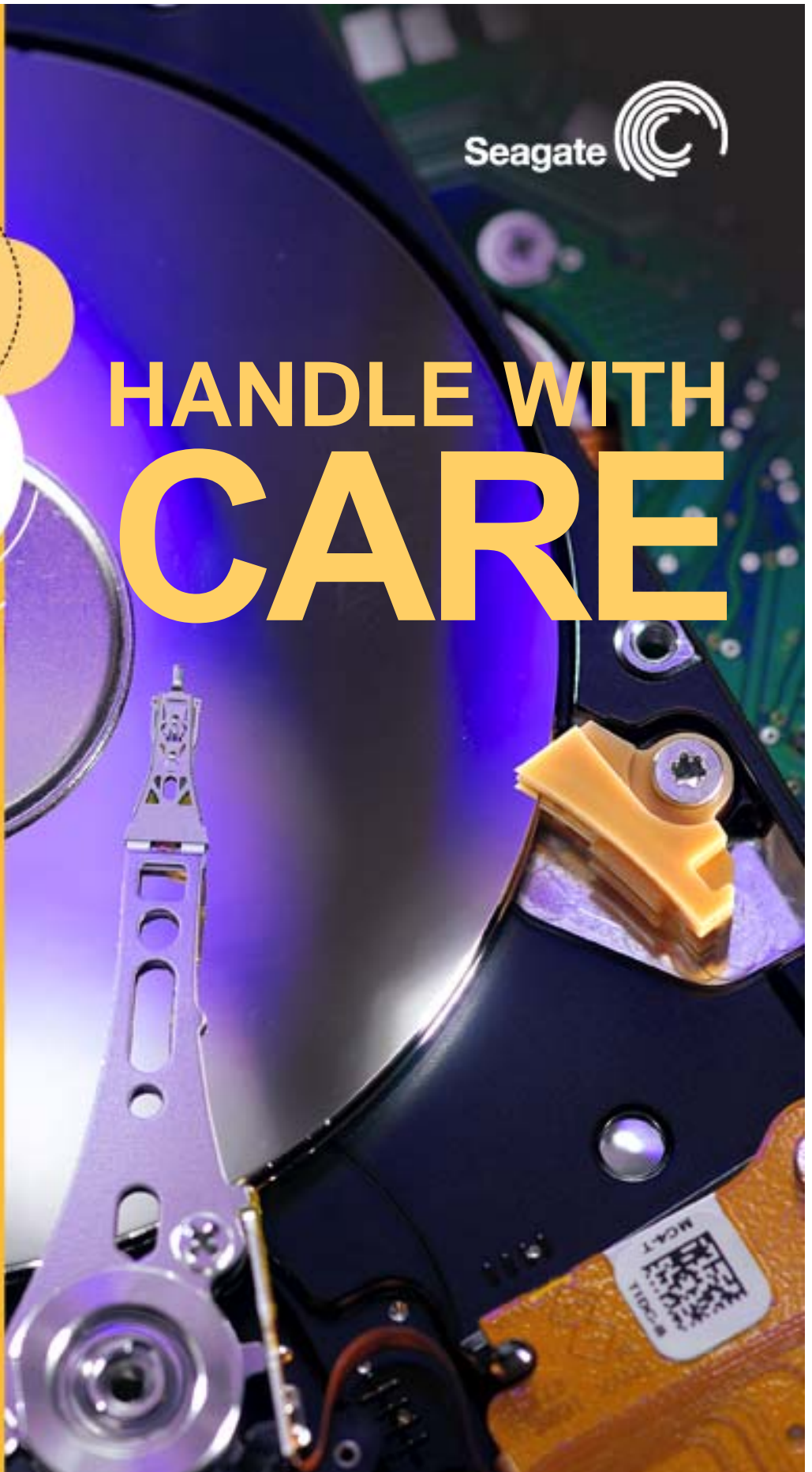




HANDLE WITH CARE

**Handling Guidelines for
Seagate Technology
Hard Drives**



Overview

Seagate hard drives are extremely precise instruments that can be damaged. This guide provides the background knowledge about how a hard drive works and the proper techniques for the storage, handling, integration and shipment to prevent damage to this essential system component.

Introduction

Seagate strives to exceed customer expectations for reliability and quality. We design and test our hard drives to meet those goals. By following the procedures detailed in this handling guide, our partners play an important role in delivering reliable products to shared customers.

When improper handling causes damage to hard drives, it is costly in terms of:

- Wasted production time and cost
- Poor reliability of product in the field
- Poor quality image and unsatisfied customers
- Fewer products available
- Return shipping and failure analysis.

Proper handling of this precision instrument is crucial to protect hard drives from damage.

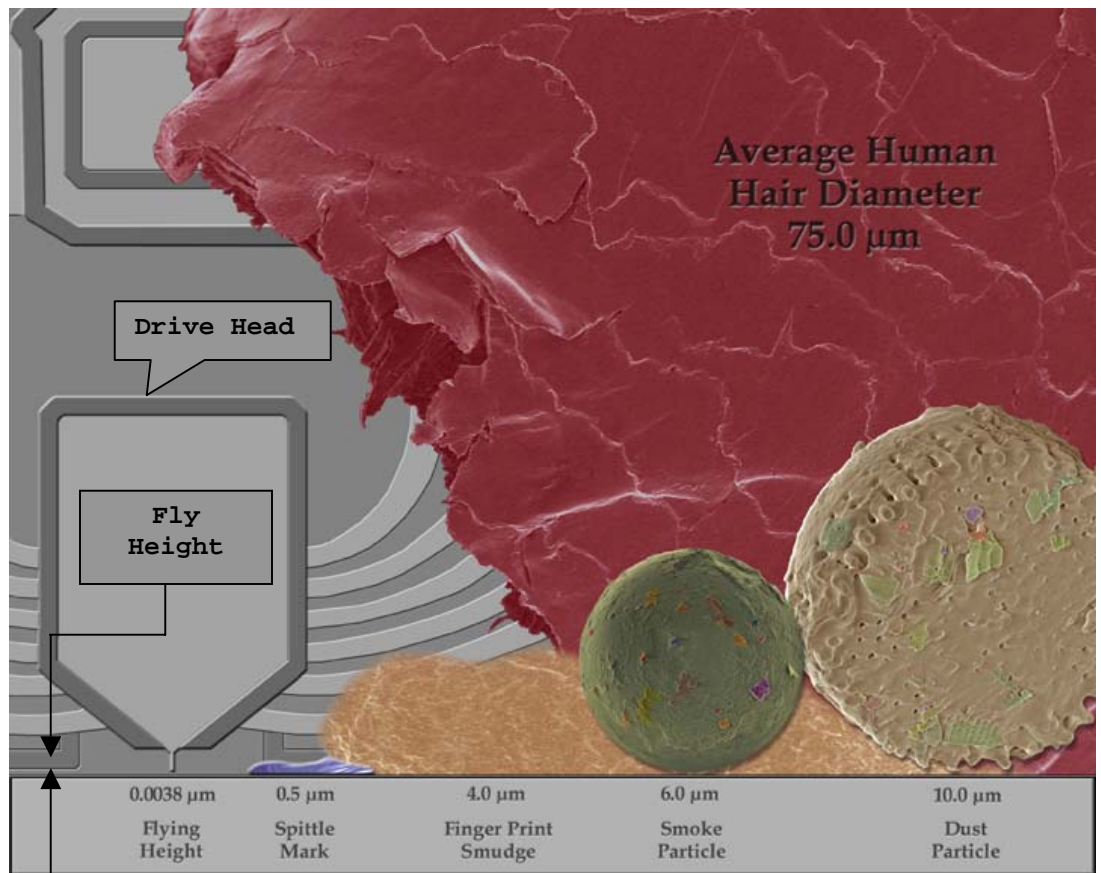
How a hard drive works

A hard drive operates by storing magnetic bits of information on the surface of spinning platters inside the drive. Precision read/write heads, mounted on actuators (swivel arms), read the information as the disc spins round, much like an old phonograph record player worked.



Modern hard drives are engineering marvels, storing hundreds of gigabytes of information and retrieving that information in just milliseconds. To achieve this performance, hard drive technology is literally pushing the limits of what is physically possible. The head reader's position is less than a micron above the surface of the disc platter, while the actuator can move from the outside to the inside of the disc in just milliseconds. Meanwhile, disc platters spin at up to 15,000 RPM. Imagine a fighter jet flying at MACH 813 just one sixty-two-seconds (1/62) of an inch above the ground, and then landing on a blade of grass—operations this precise occur many times per second in modern hard drives.

In addition to the internal moving parts, external hard drive components are delicate and require special care. Modern hard drives use more delicate, printed circuit board assemblies with thinner boards and narrower traces. These drives also have smaller connectors and surface-mount components that are vulnerable when the drive is being unpacked, handled and installed.



Handling Guidelines - Common sources of hard drive damage

Given proper handling, installation and care, Seagate engineers its hard drives to last many years. More than any other factor, improper handling is the most frequent cause of hard drive damage. There are three main sources of handling damage:

- **Electrostatic Discharge (ESD) damage**
- **Shock / Handling damage**
- **Storage / Packaging damage**

Electrostatic Discharge (ESD)

ESD - Everyday objects can generate more than enough voltage to destroy or seriously damage sensitive circuitry inside the hard drive:

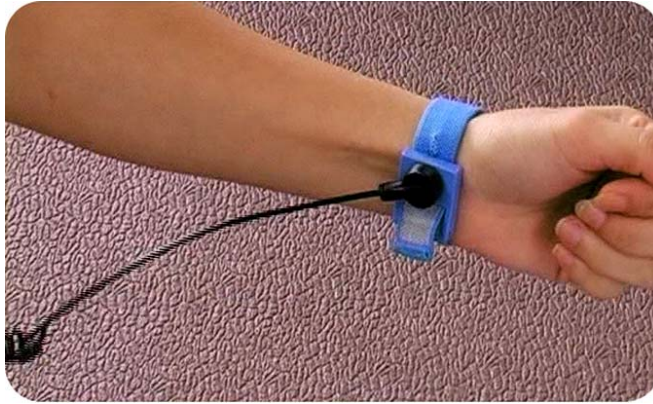
- Paper; 4,000 volts
- Styrofoam coffee cup; 5,000 volts
- Bubble-wrap; 18,000 volts
- Transparent/cellophane tape 25,000 volts
- Walking on carpet on a dry day; 35,000 volts



Typical ESD Checking Station

Commonly known as “static electricity,” ESD occurs when small amounts of voltage that build up in everyday objects follow a path of lesser resistance through the hard drive. The circuitry inside the drive has been designed to handle minute amounts of voltage—the electronic data shuttling between the hard drive and the computer—but can be easily overloaded by ESD. When overloaded, these circuits break or become damaged so as to only intermittently transfer a signal.

ESD Precautions



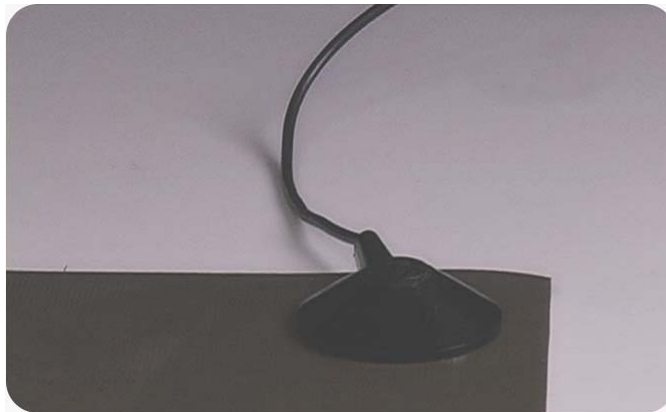
Use wrist or heel grounding straps and proper ESD clothing when handling a drive. ESD straps must be touching bare skin and be connected to an electrical- or earth-grounding point. Do not wear them over other clothing. Normal clothing will generate ESD charges. Do not allow clothing to come in contact with the printed circuit board or drive assembly.



Check grounding straps daily to insure they are functioning properly. When using foot straps, make sure both feet are grounded and at least one foot stays in constant contact with the floor at all times. When seated it is strongly recommended that a wrist strap is used.



Carts should be grounded and cushioned.



Work surfaces should also be grounded, cushioned and ESD-safe foam mats installed on tabletops and other work surfaces. See [ESD vendors link](#) for products and supplies.



Leave hard drives in ESD bags or Seagate Seashell packaging until ready for use. Open ESD bags by hand. Never use any tools to puncture the bag as this action may accidentally damage the disc drive.



Use ionizers over work areas

Shock or improper handling

Hard drive components can be damaged in a number of ways: impact by bumping, dropping or tapping with a screwdriver; contaminating the printed circuit board assembly; bending the connector pins; stacking drives; and others. Rough handling or other impacts can easily cause an actuator to hit the platter below. (Remember, the actuator hovers less than a micron above the surface of the platter.) This “head slap” gouges the platter surface and spreads debris that can cause further damage. Many handling damage issues are invisible from the outside and can only be verified with through failure analysis.

Handling precautions



Hard drives are most vulnerable during assembly and installation. To minimize risk, be sure to clear workspaces of unneeded tools and other clutter. Place essential tools to one side within easy reach.



Do not stack hard disk drives, even in ESD bags, as they can cause damage to the electrical components on the PCBA.



Do not stand drives on their sides as they can easily be tipped over.



Remove the disc drive from the bag, and touch only the sides - do not touch the printed circuit board assembly. Gently lay the drive flat on ESD-safe foam mat. Never place anything on top of a hard drive.

Assembly Precautions

Impacts from a shock or bump are a leading cause of drive failure. Falls from any distance can cause serious hard drive damage. The typical hard drive shock rating is 350 Gs, less than what is caused by a drop onto a hard surface of only 1/2 an inch!

Take care that tools do not contact PCBA as they can damage solder/trace connections causing shorts.

Tip: If a small object (for example, a mounting screw) is dropped onto the PCBA, turn the drive over to remove the object. Do not force drives into a chassis or assembly. Hand start screws and proper mounting hardware. Use care when inserting or removing shunts.

Be sure to report any potentially damaged or mishandled drive to your supervisor. Attention at the assembly stage can prevent defective products from shipping and helps maintain customer satisfaction



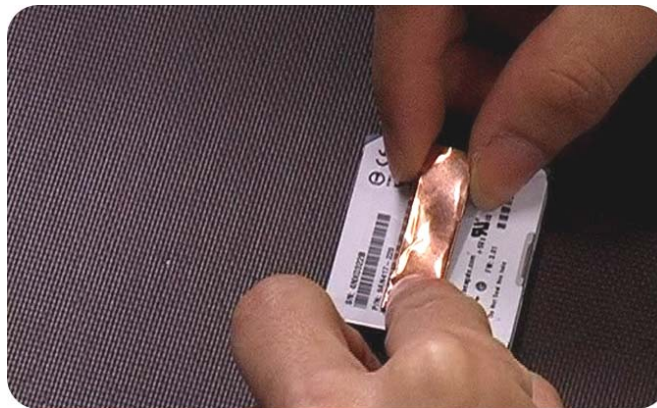
Place drives on work surfaces or on padded carts so they do not come in contact with each other or are near tabletop edges where they can be easily knocked off the table.



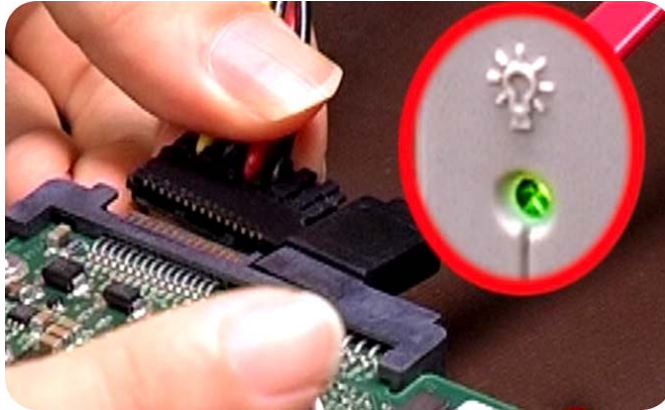
Insert/Remove connectors straight - do not use a rocking motion as this can easily break the connector housing or solder joints.



Do not touch the PCBA. Doing so could cause electrical and mechanical damage. Skin oil and other contaminants on the hands can also damage printed circuit board assemblies



Always handle drives by the sides. Handle only one drive at a time. Avoid excess pressure when applying labels, bumpers or shields to the drive covers.



Never connect or disconnect drive cables with the Power On unless the drive is designed for being hot plug. Always wait at least 30 seconds after removing power from a drive or system before removing it. This allows the drive to safely spin down and park in a safe position.



Drives often have "breather holes". Never cover breather holes with labels or insulators.

Packaging/Handling/Storage Issues

Pallet Receiving and Storing



Handle with Care
Indicates the contents are delicate



ESD Sensitive
Electrostatic Discharge (ESD) sensitive parts



This End Up
Indicated direction that the top of the box must face



Moisture Sensitive
Keep contents dry



Fragile
Handle contents with care

Hard drives must be shipped in specially designed packaging. Equally important is handling hard drives in receiving and storage areas.

Fork lift drivers must carefully follow handling and stacking instructions on boxes. Do not stack pallets or move unbound pallets. Hard drives should be left in their shipping cartons and stored away from high-traffic areas.

Staging and unpacking

Inspect pallets for fork lift damage before dismantling. Boxes should be inspected for punctures, bent corners, or water stains—any damage should be immediately reported to a supervisor.



Examples of Shipping/Packaging damage

Avoid temperature changes greater than 20 degrees Fahrenheit when moving drives from storage to staging. To avoid condensation, leave drives at room temperature for 24 hours before opening packaging (See graph – Reference section). Leave hard drives in their shipping cartons until needed.

Use both hands to carry one multipack box of hard drives. If using roll-racks, gently place box on racks and be careful to avoid collision of boxes.

Handling field-replacement drives/returns

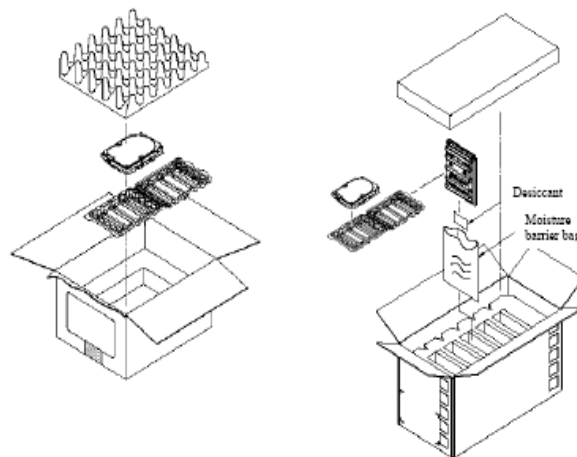
Hard drives handled and installed outside the factory—whether as add-ons, upgrades or replacements—should be given the same level of care as those installed by the system manufacturer. Handling and packaging rules defined above and below in this guide apply to field personnel and the end user.

Proper handling is even more important outside the factory because there may not be testing facilities available to identify damage before an end user puts the hard drive into service.

Repackaging and shipping of rejected or failed drives

The same high level of care must be provided to rejected hard drives to be returned to Seagate. Damage caused by improper handling can prevent Seagate from diagnosing and correcting the cause of the original failure. Handling damage also voids the hard drive warranty.

Always use Seagate approved material when shipping Seagate hard drives. Non-ESD bubble wrap can generate high levels of electrostatic shock, while boxes that are too big allow shifting and bouncing of drives during transport. Seagate approved boxes have been specially designed and tested to protect drives during transport. Multipack boxes are also suitable for partial quantity shipment if the instructions written on the boxes are correctly followed.



For proper packaging instruction, please refer to Seagate's packaging guide. (see References section)

CARE Reminders



CARE – Check surroundings

- Proper ESD work areas and tools
- No loose tools or materials
- Follow ESD guidelines for clothing and safety precautions

CARE – Avoid

- No stacking of drive or placing them on their sides
- No connections of drive with Power On unless it is designed for hot plug
- Never press on pcba or top cover– only handle drives by the sides
- No covering breather holes

CARE – Remember

- Use ESD precautions
- Handle one disk at a time
- Remove connectors straight – never use excessive force
- Wait 30 seconds after removing power before disconnecting drives
- Report any potential damage or defect drives to your supervisor

CARE – Ensure

- Check for any handling or packaging damage
- Always use Seagate approved packaging material for storage and shipment

References

G- Force Test

The shock ratings of Seagate drives vary by product, but typical specifications in a non-operational state are:

350 Gs for 3.5" products
900 Gs for 2.5" products
1500 Gs for 1.8" and 1" products

The following table depicts a drop height versus G force onto common surfaces:

Drop Height	Gs - Force			
	Granite Surface	Concrete Floor	Formica Table	Anti-Static Mat
.5 in / 12 mm	397	217	200	26
1 in. / 25 mm	600	457	310	37
2 in. / 50 mm	1,133	600	680	70
4 in / 100 mm	1,800	1,040	1,000	260

Temperature Stabilization Chart

CAUTION READ BEFORE UNPACKING			
Removing hard drives from sealed ESD bag at or below 50°F (10°C) may result in damage due to condensation. Allow proper time for drives to stabilize following the chart below. To shorten stabilization time, remove cartons from loaded pallet configuration			
Outside/storage temperature		Hours required to stabilize at 68°F (20°C) before opening ESD bags	
Fahrenheit	Celsius	Pallet Load	Single Carton
40	5	9	3
30	0	15	4
20	-6	19	5
10	-12	25	6
0	-18	29	7
-10	-23	32	8
-20	-28	35	9
-30	-34	38	10

Additional training and handling documentation is available for customer use including:

- * Training videos
- * Operator Certification Tests
- * Handling Posters for use in factory areas
- * Packaging / Shipping Material information

Contact your local Seagate Sales or factory support contact for details (LCO CQE team).