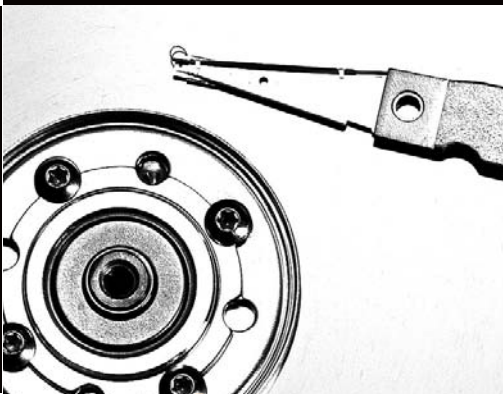
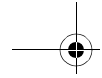


Western Digital



3.5 inch
hard drive handling

Guide

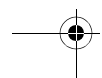
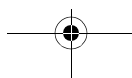
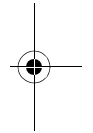
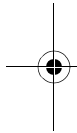


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Overview

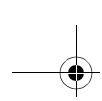
The *3.5-Inch Hard Drive Handling Guide* illustrates the proper techniques for the receipt, storage, handling, and shipment of Western Digital hard drives.

Hard drives are precision instruments that read, write, and store information on spinning magnetic disks. Special care must be used in the handling of these drives to protect them from damage.

This guide is divided into the following sections for your convenience. Read the Introduction first, as it contains important precautions and handling procedures.

- Introduction
- Receiving and Inspection of Hard Drive Shipments
- Software Load and Hard Drive Test
- Assembly of Hard Drives into Systems
- System Test
- Returning Western Digital Hard Drives
- Appendix

CAUTION: Hard drives are typically damaged because of electrostatic discharge (ESD), rough handling, or shock and vibration. Always handle with care.



Introduction

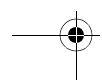
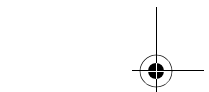
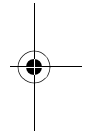
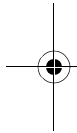
Hard drives are precision instruments that read, write, and store information on spinning magnetic disks. Special handling is required to protect hard drives from damage. Always read any section marked with a Caution note.

Electrostatic Discharge (ESD)

Hard drives are typically damaged because of rough handling, shock and vibration, or electrostatic discharge (ESD). ESD can ruin a hard drive or incur hidden damage which may not show up until after the hard drive has left your factory.

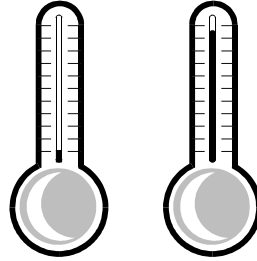
ESD is caused by a variety of environmental and human factors. Dry air is more likely to contribute to ESD than humid air. Certain materials like polyester, carpet, hard rubber and vinyl found in shoes and floors, styrofoam cups, and cellophane tape have a tendency to build up a charge. The padding in your chair can build up a charge as you sit. See "ESD Voltages Generated by Common Materials and Actions" on page 20 for voltages generated by typical activities performed during the handling of hard drives.

CAUTION: *ESD damage is usually invisible to the eye and may not be discovered until much later, either through intermittent performance or failure.* By using the proper grounding procedures outlined in this manual and testing your grounding straps daily, you can reduce hard drive damage caused by ESD.



General Handling Procedures

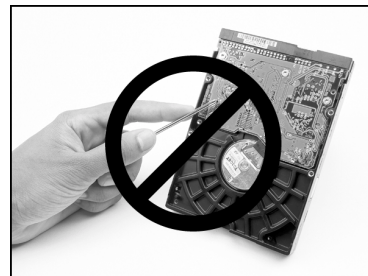
Avoid extreme temperatures.



Do not drop, bump, shake, or otherwise jar a hard drive. Hold a hard drive by the sides.

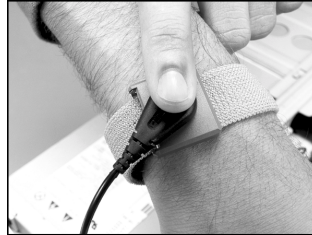


Do not touch the printed circuit board assembly with your hand or tools.

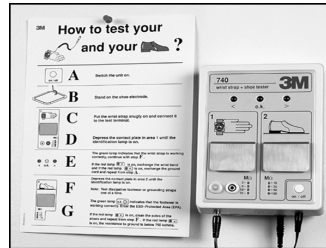


Electrostatic Discharge (ESD) Precautions

Always use proper grounding procedures. Grounding straps must be touching your skin. Do not wear them over clothing.



Check grounding straps daily to ensure proper functioning.



Keep the hard drive in the static shielding bag prior to operation and testing. Do not test or operate a drive while it is inside the static shielding bag.

To prevent damage from mechanical and electrical shock, work areas must be covered with approved anti-static mats and be properly grounded.

Gently place the hard drive on a grounded anti-static surface when it is not in its shipping container. See "ESD Products and Vendors" on page 18.



Clothing generates static electricity. Do not allow clothing to touch the hard drive or printed circuit board assembly.

4 - INTRODUCTION

4 - INTRODUCTION

Hard Drive Handling Precautions

Do not stack hard drives.



Do not stand hard drives on their sides.



Do not place anything on top of a hard drive.



CAUTION: Western Digital hard drives install easily. Never force a hard drive into a bay, hammer on the hard drive, or touch its printed circuit board assembly. Use caution when installing data and power connectors to avoid damaging pins. Double-check that all cables are properly connected.

When moving hard drives, do not roll carts over cracks or cords on the floor.



Place hard drives on the cart so that they do not come in contact with each other or the edges of the cart.



Western Digital hard drives have one to four small air filter holes on either the top or side of the drive enclosure. Do not obstruct or cover these holes with items such as stickers, and do not insert any objects into these holes.

6 - INTRODUCTION

6 - INTRODUCTION

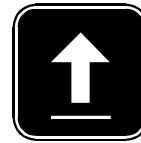
Receiving and Inspection of Hard Drive Shipments

Examine shipments carefully. Look for external damage and excessive moisture on boxes.

Box Handling

Follow guidelines for the shipping symbols on the side of the boxes.

Up Arrow - indicates the direction the top of the box must face.



Fragile Keep Dry - avoid exposing the box to moisture.



Cracked Glass - indicates the contents are breakable. Do not drop!



Umbrella - keep contents dry.



Stacking number - the maximum number of boxes to stack per pallet.



CAUTION: Stack boxes no more than five high on a single pallet. Leave the corner stiffeners on in case the pallets need to be stacked.

Pallet Handling

Transport carefully to storage area. Stack only two pallets high.

Stack Western Digital pallets together; do not stack with other manufacturers' pallets. Never walk on top of the boxes.

Leave hard drives in their original packaging until testing or assembly takes place. To avoid condensation, allow hard drives ample time to reach room temperature before unpacking. Follow the "Temperature Stabilization Chart" on page 19 for a list of temperatures and the corresponding time periods that must expire prior to unpacking the drives.

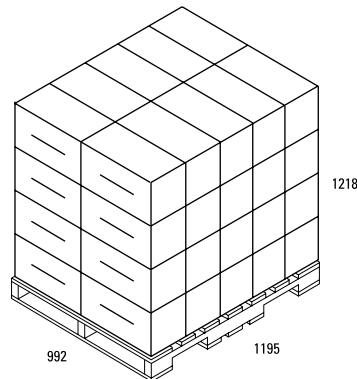
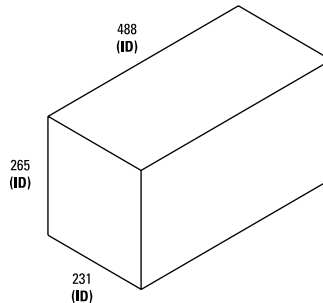
NEW 20 FLAT - 800 (mm) - 5/1/2001

GMA (Notched) 1219 x 1016 x 127

	Shipper (ID)	Shipper (OD)	Unit Load (Incl. Pal)
Ln:	488 mm	496 mm	1195 mm
Wd:	265 mm	273 mm	992 mm
Ht:	231 mm	239 mm	1218 mm
Gr:	0.000 kg		29.483 kg
Cube:	0.0299 m ³	3 0.0323 m ³	1.4439 m ³

Width Vert

Shipper:		40
Area Efficiency:	0.00 %	95.71 %
Cubic Efficiency:	0.00 %	94.50 %
Cases per layer:		10
Layers/load:		4
Pattern:		Column



8 - RECEIVING AND INSPECTION OF HARD DRIVE SHIPMENTS

8 - RECEIVING AND INSPECTION OF HARD DRIVE SHIPMENTS

Removing Hard Drives from Shipping Containers

Pick up the static shielding bag by the edge, making sure to avoid touching the hard drive inside the bag.

Hold the bag below the V-notch with one hand and tear off the top at the V-notch with the other hand.



Remove the hard drive by grasping it by its sides. Do not touch the circuit boards.

Carefully place the hard drive on approved anti-static padding only. See "ESD Products and Vendors" on page 18.

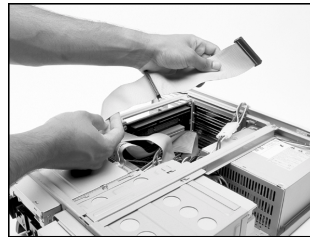


CAUTION: Leave the hard drive in its anti-static bag until it is ready to be installed.

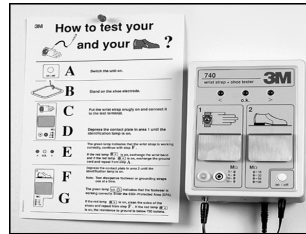
Installation

Observe the following precautions and procedures when installing hard drives.

The parallel IDE cable length should not exceed 18 inches (45.72 cm). Serial ATA cable length should not exceed 39.37 inches (1 m). Check that the cable is in good physical condition.



Test the grounding device and straps daily.



Testing

Do not use test racks with wheels as they are subject to movement.



Always use stationary racks or benches. When a system is on, avoid bumping or moving the test racks. This can cause head media damage.



Remove the hard drive from the static shielding bag using the procedure outlined in the Electrostatic Discharge (ESD) Protection section. Do not test or operate a hard drive while it is inside the static shielding bag.

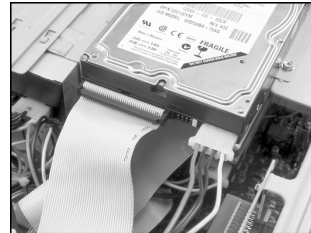
Confirm that the system power is off.



CAUTION: Always use surge suppressors at test stations. Confirm that system power is off.

Carefully insert power and data connectors. Avoid excessive force.

Do not turn the system on until all power and connector cables are properly attached.



If the hard drive fails, make sure the failure is not due to faulty connections by replacing the connector and power cables and testing the hard drive again.

After turning the system off, **wait 10 seconds** for the hard drive to spin down and the heads to park before moving the hard drive. If not installing the hard drive immediately, return it to its static shielding bag.

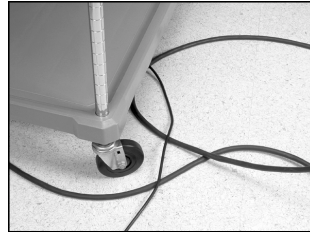


CAUTION: Do not use excessive force when installing data and power connectors.

Hard Drive Transportation in Manufacturing Facility

If using a cart, use ESD foam rubber on cart shelves. When positioning hard drives on the cart, do not allow them to touch or bump the sides of the cart or each other.

When moving the hard drives, do not run the cart over cracks or cables on the floor.



If using the original shipping container to move the hard drives, leave the hard drives in their static shielding bags for protection.



NEVER stand a hard drive on its side or end.



NEVER stack hard drives.



NEVER set anything on top of a hard drive.



Assembly tools must be well-maintained and properly calibrated. Use only low impact (non-ratcheting) power drivers for assembly. Screw torque specifications and examples of low impact tools are in the Appendix of this guide.



When installing into a hard drive bracket, avoid sudden, jerky movements. Also, do not force the hard drive in any way (no bumping, shoving, slapping, pounding, or other forms of coercion). Western Digital hard drives install easily.

CAUTION: NEVER force a hard drive into a bay, hammer on the hard drive, or touch its printed circuit board assembly. Double-check that all cables are properly connected.

Returning Western Digital Hard Drives

CAUTION: Be sure to handle a failed hard drive as carefully as you would an operational one by strictly following proper handling procedures. By using these procedures, Western Digital can better determine the cause of the hard drive's failure.

The following guidelines provide general information for Western Digital hard drive returns. For further information on returning hard drives, request the How to Return Western Digital Hard Drives Information Sheet, Literature Order Number S0198, from the Western Digital Literature Distribution Center.

If a hard drive is faulty and is under warranty, you can return it by first obtaining a Return Material Authorization (RMA) number and instructions for product return from Western Digital. The returned hard drive must meet the required conditions in order to return it to Western Digital for repair. The drive must be under warranty. It must not show signs of tampering. Moreover, it cannot arrive damaged upon its return to Western Digital because it was not properly repackaged according to the following repackaging guidelines.

Once you have determined that you can return the hard drive to Western Digital, you must be sure to package the hard drive according to Western Digital approved standards.

Repackaging Guidelines

1. Remove and keep all add-on items, such as cables and brackets, that are not included on the RMA. Western Digital is not responsible for them and cannot return them to you. Only items specified on the RMA are returned to you.
2. Handle the hard drive with care, holding it by the sides only.
3. Be sure it is a Western Digital hard drive. Check the hard drive label on the top surface of the hard drive.
4. Place the hard drive in the original static shielding bag prior to shipment. If the original bag is not available, please use an

equivalent static shielding bag. Do not place anything inside the bag with the hard drive. If you need to attach a note, place it on the outside of the static shielding bag.

5. Use the original Western Digital packaging when available. If you do not have the original Western Digital packaging, use an outer carton made of corrugated cardboard. Do not use chipboard because it is not strong enough to withstand the rigors of transit.
6. Make sure the corrugated carton used is free from defects, structurally sound, and able to withstand the rigors of transit.
7. To protect the hard drive from shock, use a cushioning material. Foam is best and should be used on all sides of the hard drive inside the corrugated carton. You can substitute any of the following if foam is not available:
 - Bubble wrap - wrap completely around the hard drive.
 - Shredded newspaper - pack box full.

Packaging a single hard drive in one carton: Firmly cushion the hard drive on all sides to ensure that it cannot move inside the corrugated carton. This helps protect the hard drive in case it is dropped during shipping.

Packaging more than one hard drive in a carton: Make sure that all hard drives are cushioned individually and do not touch the sides of the box or each other. If using foam, surround the hard drives with a minimum of two inches of foam. Do not use peanuts or flowables as they do not support the hard drives from all sides during shipping.

8. Seal the carton firmly using adhesive back tape. Make sure all corrugated carton edges are sealed to prevent tearing.

For more repackaging information, visit the Western Digital Web site at support.wdc.com.

Appendix

Power Supply Requirements

It is recommended that the power supply have a current rating for each output that is 5 percent greater than the maximum requirements of the drive in use.

Voltage	Ripple	Frequency
+12 VDC $\pm 10\%$	200 mV (peak to peak) max.	0 to 30 MHz
+5 VDC $\pm 5\%$	100 mV (peak to peak) max.	0 to 30 MHz

Electrical Specifications—7200 RPM Hard Drives

Current Requirements and Power Dissipation

Operating Mode	RMS Current		Power, Average ¹
	12 VDC	5 VDC	
Spinup	1.3A max	675 mA	19.0W
Read/Write	380 mA	800 mA	8.25W
Seek	675 mA	825 mA	12.25W

Power Management Commands

Operating Mode	RMS Current ¹		Power, Average ¹
	12 VDC	5 VDC	
Idle (E1H)	370 mA	750 mA	8.25W
Standby (E0H)	15 mA	180 mA	1.10W
Sleep (E6H)	15 mA	75 mA	0.6W

¹ All values are typical (25°C, 5.0V, and 12V input) except where specified as maximum.

Note: Current measurements cut off frequency at 1 kHz.

Electrical Specifications—5400 RPM Hard Drives

Current Requirements and Power Dissipation

Operating Mode	RMS Current		Power, Average ¹
	12 VDC	5 VDC	
Spinup	1.410A max	440 mA	14.0W
Read/Write	237 mA	650 mA	6.09W
Seek	600 mA	700 mA	10.7W

Power Management Commands

Operating Mode	RMS Current ¹		Power, Average ¹
	12 VDC	5 VDC	
Idle (E1H)	220 mA	600 mA	5.64W
Standby (E0H)	28 mA	160 mA	1.21W
Sleep (E6H)	28 mA	100 mA	0.85W

¹ All values are typical (25°C, 5.0V, and 12V input) except where specified as maximum.

Note: Current measurements cut off frequency at 1 kHz.

Recommended Hard Drive Mounting Screw Information

Screw Type	Recommended Torque
6-32 screws	5 in./lb, MAX 10

Examples of Low-Impact (non-ratcheting) Torque Screwdrivers

Electric Screwdrivers	<p>Maker - Densei</p> <p>Model DLV-7339 (ESD Version)</p> <p>Distributor: Ingersoll-Rand</p> <p>(562) 777-0808</p>
-----------------------	--

ESD Products and Vendors

ESD Product	Vendor
<p>ESD Protective Padding</p> <p>Micastat® Pads</p> <p>P/N 10385 or 10387)</p> <p>1/8-inch Pad</p>	<p>SVS Static Control Products</p> <p>231 Charcot Ave.</p> <p>San Jose, CA 95131</p> <p>(800) 870-8827</p>
<p>Metal Out Shielding Bag</p> <p>ESD Shielded Anti-static Bag</p> <p>P/N 13035 or 13230 (zipper)</p>	
<p>Highland™ Wrist Strap</p> <p>With Ground Cord</p> <p>P/N 2272</p>	<p>3M</p> <p>6801 Riverplace Blvd.</p> <p>Austin, TX 78726-9000</p> <p>(800) 328-1368</p>
<p>Heel Grounding Assembly</p> <p>P/N 2059</p>	

Temperature Stabilization Chart

Move the hard drive shipping containers into a temp-controlled area (with a room temperature between 55-90° F and allow time for the temperature of the hard drives to stabilize before unpacking. Unpacking hard drives at or below 50° F (10° C) can result in damage due to condensation. Use the following chart as a guideline.

Outside/Storage Temperature	Hours Required Before Unpacking/Testing
+40° F, +4.44° C	13
+30° F, -1.11° C	15
+20° F, -6.67° C	16
+10° F, -12.22° C	17
0° F, -17.78° C	18
-10° F, -23.33° C	20
-20° F, -28.89° C	22
-30° F, -34.44° C	27

ESD Voltages Generated by Common Materials and Actions

ESD Voltages		
Means of ESD Generation	10 to 20 % Relative Humidity	65 to 90 % Relative Humidity
Walking across carpet	35,000	1,500
Walking over vinyl floor	12,000	250
Worker at bench	6,000	100
Common poly bag picked up from the bench	20,000	1,200
Work chair padded with polyurethane foam	18,000	1,500
Packing drives in foam lined box	21,000	1,200

Drop Height Table

The shock rating of a hard drive is typically 200Gs (when the drive is in a non-operational state). The following table depicts the drop height versus Gs onto selected surfaces.

Drop Height	Gs - Force			
	Granite Surface	Concrete Floor	Formica Table	Anti-Static Foam
.5 in. / 12.7 mm	387	217	200	26
1.0 in. / 25.4 mm	595	457	310	37
2.0 in. / 50.8 mm	1,133	600	680	70
4.0 in. / 101.6 mm	1,795	1,040	1,050	267

Connector Mating Cycles

To avoid intermittent electrical connection problems, monitor and change the interface test cables on a regular basis. To maximize the number of reliable mating cycles, select extended life connectors where possible.

The following table shows connector life expectancy. Please note that these figures are just guidelines. Actual mating cycle life depends on specific connector materials, internal contact geometry, and other factors. Consult your connector vendor for specifications.

Connectors Plating and Configuration	Typical Mating Cycle Life Expectancy
Tin/Lead Plating	10 to 25 Connections
Standard Gold Plating (15 μ - 40 μ in.)	100 to 200 Connections
Extended Life with Thick Gold Plating (50m in. plus typical)*	500 to 1000 Connections

* Typically available only from connector direct suppliers as special orders.

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