

IDEMA STANDARD
Contamination/ESD Control Committee
HDD Process General Practices for ESD Control

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- 1.1 PURPOSE:
- 1.2 This standard establishes the procedures and minimum requirements for ESD control equipment and materials and describes safe handling practices for use with Magnetoresistive (MR), Giant Magnetoresistive (GMR), Tunnel Magnetoresistive (TMR) and related new concepts in disk drive read-write head manufacturing and processing such as MAMR/HAMR .
- 1.3 This standard is based on ESD controls capable of controlling electrostatic potentials to levels on personnel lower than what can cause damage to the most sensitive parts handled. User defined lower minimums shall be used to establish electric potentials allowed in the work place. Maintaining personnel at the lowest practical resistance to ground level shall be the most important facet of this General Practices ESD Control Standard. This standard also requires implementation of methods to control electrostatic fields on the necessary non-conductors in the work area.

2.1 SCOPE:

- 2.2 This Standard applies to all MR/GMR/TMR and following new technology head's static safe workstations and the production process.

3.0 REFERENCE DOCUMENTS

Unless otherwise specified, the following document of the latest issue, revision or amendment, forms a part of this standard to the extent specified herein.

IDEMA – Glossary of Terms Used in ESD Control Documents, ESD Doc01
IDEMA – Packaging Standard for Disk Drives and Components, ESD Doc02
IDEMA – Microcontamination Standards (White Paper)

EOS/ESD ADV 1.0 EOS/ESD Association Glossary of Terms, ESD TR20.20-2016:
Handbook For The Development Of An Electrostatic Discharge Control Program For The Protection Of Electronic Parts, Assemblies, And Equipment

ANSI/ESD TR53-01-08:
Compliance Verification of ESD Protective Equipment and Materials << added

ANSI/ESD S20.20-2014:
Protection Of Electrical And Electronic Parts, Assemblies And Equipment (Excluding Electrically Initiated Explosive Devices)

ESD ADV11.2-1995:
ESD Association Advisory for the Protection of Electrostatic Discharge Susceptible Items – Triboelectric Charge Accumulation Testing

ANSI/ESD S1.1-2021:
ESD Association Standard for the Protection of Electrostatic Discharge Susceptible Items – Wrist Straps
ANSI/ESD S 6.1-2019:
ESD Association Standard for the Protection of Electrostatic Discharge Susceptible Items – Grounding
ANSI/ESD S8.1-2021:
ESD Association Standard for the Protection of Electrostatic Discharge Susceptible Items –Symbols

ANSI/ESD S11.4-2012:
ESD Association Standard for the Protection of Electrostatic Discharge Susceptible Items – Static Control Bags

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ANSI/ESD S13.1-2019:

ESD Association Standard for the Protection of Electrostatic Discharge Susceptible Items –
Electrical Soldering/Desoldering Hand Tools

ANSI/ESD S541-2019:

ESD Association Standard for the Protection of Electrostatic Discharge Susceptible Items –
Packaging Materials for ESD Sensitive Items

ANSI/ESD STM11.11-2021:

ESD Association Standard Test Method for Protection of Electrostatic Discharge Susceptible Items –
Surface Resistance Measurement of Planar Materials

ANSI/ESD STM11.12-2021:

ESD Association Standard Test Method for Protection of Electrostatic Discharge Susceptible Items –
Volume Resistance Measurement of Planar Materials

ANSI/ESD STM11.13-2021:

ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible
Items – Two-Point Resistance Measurement

ANSI/ESD STM11.31-2018:

ESD Association Standard Test Method for Evaluating the Performance of Electrostatic Discharge
Shielding Materials – Bags

ANSI/ESD STM15.1-2019:

ANSI / ESDA Methods for the Resistance Testing of Gloves and Finger Cots Revision and
Redesignation of ANSI/ESD SP15.1-2011

ANSI/ESD S541-2019:

Standard for Packaging ESD Susceptible Items

IEC 61340-5-1:2016 RLV: Redline version

Electrostatics - Part 5-1: Protection of electronic devices from electrostatic phenomena - General
requirements

IEC TR 61340-5-2:2018:

Electrostatics - Part 5-2: Protection of electronic devices from electrostatic phenomena - User guide

ESD TR55.0-01-04:

ESD Association Technical Report – Electrostatic Guidelines and Considerations For Cleanrooms
and Clean Manufacturing

ANSI/ESD STM2.1-2018:

ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items
– Garments – Resistive Characterization

ANSI/ESD STM3.1-2015:

ESD Association Standard Test Method For the Protection of Electrostatic Discharge Susceptible Items
– Ionization

ANSI/ESD SP3.3-2016:

ESD Association Standard Practice For the Protection of Electrostatic Discharge Susceptible Items -
Periodic Verification of Air Ionizers

ANSI/ESD SP3.4-2016:

ESD Association Standard Practice For the Protection of Electrostatic Discharge Susceptible Items
- Periodic Verification of Air Ionizer Performance Using a Small Test Fixture

ANSI/ESD SP3.5-2020:

ESD Association Standard Practice for the Protection of Electrostatic Discharge Susceptible Items -
Test Methods for Air Assist Bar Ionizers, Soft X-Ray (Photon) Ionizers, Room Ionization
Alternatives, and Non-Airflow Alpha Ionizers

ANSI/ESD STM4.1-2017:

ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible
Items – Worksurfaces – Resistance Measurements

ANSI/ESD STM4.2-2012 :

ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items
- Worksurfaces – Charge Dissipation Characteristics

ANSI/ESD SP5.1.3-2017:

ANSI/ESD SP5.1.3 Human Body Model (HBM) Testing -
Component Level - A Method for Randomly Selecting Pin Pairs

ESD SP5.2-2019:

ESD Association Standard Practice for Electrostatic Discharge Sensitivity Testing - Machine Model
(MM) - Component Level

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ANSI/ESD SP5.3.3:

ANSI/ESD SP5.3.3 - Charged Device Model (CDM) Testing – Component Level-Low-Impedance Contact CDM as an Alternative CDM Characterization Method

ANSI/ESD STM7.1-2020:

ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items – Floor Systems – Resistive Characterization

ANSI/ESD STM9.1-2014:

ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items – Footwear – Resistive Characterization

ANSI/ESD STM12.1-2019:

ESD Association Standard Practice for the Protection of Electrostatic Discharge Susceptible Items – Seating – Resistance Measurement

ESD ADV53.1-1995:

ESD Association Advisory for Protection of Electrostatic Discharge Susceptible Items -ESD Protective Workstations

ANSI/ESD STM97.1-2015:

ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items — Footwear/Flooring System – Resistance Measurement in Combination with a Person

ANSI/ESD STM97.2-2016:

ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items – Footwear/Flooring System – Voltage Measurement in Combination with a Person

ANSI/ESD SP9.2-2019:

ANSI / ESDA Foot Grounders -Resistive Characterization (excluding static control footwear)

ANSI/ESD SP10.1-2016:

ANSI / ESDA Automated Handling Equipment (AHE)

ESD SP5.6-2019:

ANSI / ESDA Human Metal Model (HMM) - Component Level

ANSI/ESDA/JEDEC JS-001-2017:

ANSI / ESDA Human Body Model (HBM) - Component Level

ANSI/ESDA/JEDEC JS-002-2018:

ANSI / ESDA Charged Device Model (CDM) - Device Level

ANSI NETA ATS-2021:

ANSI STANDARD FOR ACCEPTANCE TESTING SPECIFICATIONS for Electrical Power Equipment & Systems

4.0 WORKSTATION ESD CONTROL REQUIREMENTS FOR MR/GMR/TMR HEADS:

- 4.1 The Resistance to Ground (R_{TG}) requirements apply to static-safe workstations in cleanroom and non-cleanroom environments. This includes all aspects of the production process.
- 4.2 Access to the workstation or storage area for MR/GMR/TMR heads must be controlled at all times to limit access to trained personnel only.
- 4.3 ESD protective work surfaces must measure $<1 \times 10^9 \Omega$ from work surface to ground (R_{TG}).
- 4.4 ESD protective flooring must have a $R < 1 \times 10^9 \Omega$ from point to point & point to Groundable point

Note: Local safety ordinances should be followed to establish lower limit of resistance to ground where personnel are involved.

- 4.5 It is *recommended* to identify workstations with a unique serial number and to conduct periodic verification tests for resistance to ground and other attributes as established by the end user.

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5.0 Grounding

- 5.1 The MR/GMR/TMR head static-safe workstation shall use a common point grounding System as described in ANSI/EOS/ESD S 6.1. This allows the workstation, operators, and tooling to maintain the same electrical potential.

6.0 Personnel Grounding Requirements

- 6.1 A continuous wrist strap monitoring system is recommended, with a dual-conductor resistance or voltage monitoring type being preferred. All seated operators must wear approved wrist or other approved personnel grounding systems that are compatible with the monitoring system in use. Resistance to ground of seated personnel shall be $< 1 \times 10^9$ ohm
- 6.2 ESD protective footwear heel straps or conductive shoes shall
- Provide a continuous electrical path from the user directly to the ESD protective flooring or floor mat.
 - Be worn on both feet.
 - Limit current to less than **0.5 mA** at the highest power supply voltage that may be encountered
 - Not to be relied upon for grounding of seated personnel.
 - Resistance to ground as measured through the factory floor shall be less than $3.5 \times 10^7 \Omega$ when the floor and footwear are used as the primary grounding system for personnel.

- 6.3 ESD wrist strap / footwear acceptance limits:

Technical requirement	Product Qualification		Compliance verification	
	Test Method(s)	Required Limit(s)	Test Method(s)	Required Limit(s)
Wrist strap system	ANSI/ESD S1.1 (Section 6.11)	$< 3.5 \times 10^7$ Ohms	ESD TR53 Wrist Strap Section	$< 3.5 \times 10^7$ Ohms
Footwear / Flooring System – (Both limits must be met)	ANSI/ESD STM97.1	$< 1.0 \times 10^8$ Ohms	ESD TR53 Footwear Section Use Integrated Checker	$< 1.0 \times 10^8$ Ohms
	ANSI/ESD STM97.2	< 100 volts Peak	ESD TR53 Flooring Section	$< 1.0 \times 10^9$ Ohms

- 6.4** Smocks and Cleanroom garments, when used, shall *be evaluated using the referenced test method documents to user defined values.*

7.1 IONIZATION

- 7.2** Ionization will be used at MR/GMR/TMR head workstations when the removal of all static generators is not possible.
- 7.3** All ionizers used within the MR/GMR/TMR head workstation will meet the offset voltage level required to maintain the workstation at or below the user established voltage level.
- 7.4** Specifications for ionization discharge time in user environments will be established by the end user.

8.0 SPECIAL TOOLS REQUIREMENT

- 8.1** Hand tools and manufacturing aides used at the MR/GMR and TMR head static-safe workstation should be evaluated and approved for use with MR/GMR and TMR heads, including the following examples:

- Hand Tools
- Gloves
- Tweezers
- Swabs

9.0 TEST EQUIPMENT

- 9.1** All test equipment used at or in close proximity to workstations where GMR and TMR heads are assembled or tested shall be verified for suitability of use from an ESD perspective.

10.0 HANDLING PRACTICES

- 10.1** The single most important handling practice for MR/GMR/TMR head assembly from an ESD protection viewpoint is to limit the electrical potential across the head element during all phases of assembly. Each operation should be evaluated with this principle in mind.

Some examples of critical processes are:

Most critical area/process (Highest ESD sensitive parts handling area);

- SliderProcess
- Charge generation levels at wire bonding
- HGA handling area (including test)
- Hot plugging at test

2nd critical area/process (Medium ESD sensitive parts handling area);

- HSA Asm (completed products) handling area (including test)
- HDE handling area with HSA completed
- PCBA handling area