

# ESD Standards

*The following list details several major electrostatic discharge (ESD) standards and reference documents in place worldwide.*

## ESD Association Standards

**ANSI ESD S1.1:1998**—Evaluation, acceptance, and functional testing of wrist straps.  
**ANSI ESD S4.1:1997**—Work surfaces—Resistance measurements.  
**ANSI ESD STM5.1:2001**—Electrostatic discharge sensitivity testing—Human body model.  
**ANSI ESD S6.1:1999**—Grounding—Recommended practice.  
**ANSI ESD S8.1:2001**—ESD awareness symbols.  
**ANSI ESD S20.20:1999**—Standard for the development of an ESD control program.  
**ANSI ESD STM2.1:1997**—Resistance test method for electrostatic discharge protective garments.  
**ANSI ESD STM3.1:2000**—Ionization.  
**ANSI ESD STM4.2:1998**—Work surfaces—Charge dissipation characteristics.  
**ANSI ESD STM5.2:1999**—Electrostatic discharge sensitivity testing—Machine model.  
**ANSI ESD STM5.3.1:1999**—Charged device model (CDM)—Component level.  
**ANSI ESD STM9.1:2001**—Resistive characterization of footwear.  
**ANSI ESD STM11.11:2001**—Surface resistance measurement of static dissipative planar materials  
**ANSI ESD STM11.12:2000**—Volume resistance measurement of static dissipative planar materials.  
**ANSI ESD STM12.1:1997**—Seating—Resistive characterization.  
**ANSI ESD STM11.31:2001**—Evaluating the performance of electrostatic discharge shielding bags.  
**ANSI ESD STM97.1:1999**—Floor materials and footwear—Resistance in combination with a person.  
**ANSI ESD STM97.2:1999**—Floor materials and footwear—Voltage measurement in combination with a person.  
**ESD S541:2003**—Packaging materials for ESD sensitive items.  
**ESD SP9.2:2003**—Foot grounders—Resistive characterization.  
**ESD SP3.3:2000**—Periodic verification of air ionizers.  
**ESD SP10.1:2000**—Automated handling equipment.  
**ESD STM7.1:2001**—Floor materials—Resistive characterization of materials.  
**ESD STM13.1:2000**—Electrical soldering and desoldering hand tools.

## ESD Association Advisory Documents

**ESD ADV1.0:2003**—Glossary of terms.  
**ESD ADV3.2:1995**—Selection and acceptance of air ionizers.  
**ESD ADV11.2:1995**—Triboelectric charge accumulation testing.  
**ESD ADV53.1:1995**—ESD protective workstations.

## ESD Association Technical Reports

**ESD TR 01:1999**—Can static electricity be measured?  
**ESD TR 02:1999**—High-resistance ohmmeters—Voltage measurements.  
**ESD TR 03:1999**—Glove and finger cots.  
**ESD TR 04:1999**—EOS safe soldering iron requirements.  
**ESD TR 06:2000**—Static electricity hazards of triboelectrically charged garments.  
**ESD TR 07:2000**—Calculation of uncertainty associated with measurement of electrostatic discharge (ESD) current.  
**ESD TR 08:2000**—Socket device model (SDM) tester.  
**ESD TR 09:2000**—Transient-induced latch-up (TLU).  
**ESD TR 10-01**—Machine model (MM) electrostatic discharge (ESD) investigation—Reduction in pulse number and delay time.  
**ESD TR 11-04**—Electrostatic guidelines and considerations for cleanrooms and clean manufacturing.  
**ESD TR 12-01**—Survey of constant (continuous) monitors for wrist straps.  
**ESD TR 13-02**—Alternate techniques for measuring ionizer offset voltage and discharge time.  
**ESD TR 14-02**—Measurement and ESD control issues for automated equipment handling of ESD sensitive devices below 100 V.  
**ESD TR 15-02**—Survey of static control work surfaces and grounding mechanisms.  
**ESD TR 16-03**—Voltage and energy susceptible device concepts, including latency considerations.  
**ESD TR 20-20**—ESD handbook.

## Other Standards

**AATCC 134:2001**—Electrostatic propensity of carpets.  
**AFLCR 65-8:1998**—Maintenance—Engineering and supply: Electrostatic discharge (ESD) control program.  
**ANSI C37.06:2000**—American national standard for switchgear—Ac high-voltage circuit breakers rated on a symmetrical current basis—Preferred ratings and related required capabilities.  
**ANSI C37.06.1:2000**—American national standard trial-use guide for high-voltage circuit breakers rated on a symmetrical current basis—Designated “Definite purpose for fast transient recovery voltage rise times.”  
**ANSI C37.16:2000**—American national standard for switchgear—Low-voltage power circuit breakers and ac power circuit protectors—Preferred ratings, related requirements, and application recommendations.  
**ANSI C37.17:1997**—American national standard for trip devices for ac and general-purpose dc

low-voltage power circuit breakers.

**ANSI C37.22:1997**—American national standard preferred ratings and related required capabilities for indoor ac medium-voltage switches used in metal-enclosed switchgear.  
**ANSI C63.14:1998**—American national standard dictionary for technologies of electromagnetic compatibility (EMC), electromagnetic pulse (EMP), and electrostatic discharge (ESD)—Dictionary of EMC/EMP/ESD terms and definitions.  
**ANSI C63.16:1993**—American national standard guide for electrostatic discharge test methodologies and criteria for electronic equipment.  
**ANSI T1.308:1996 (R2002)**—Central office equipment—Electrostatic discharge immunity requirements.  
**ASTM D257:1999**—Standard test methods for dc resistance or conductance of insulating materials.  
**ASTM D991:1989 (R2000)**—Standard test method for rubber properties—Volume resistivity of electrically conductive and antistatic products.  
**ASTM D2679:1978**—Standard test method for electrostatic charge.  
**ASTM D5077:1990 (R2003)**—Standard terminology relating to ESD packaging materials.  
**ASTM E1549:1993 (R2000)**—Standard specification for ESD-controlled garments required in cleanrooms and controlled environments for spacecraft for nonhazardous and hazardous operations.  
**ASTM E2042:2004**—Standard practice for cleaning and maintaining controlled areas and cleanrooms.  
**ASTM F150:1998**—Standard test method for electrical resistance of conductive and static dissipative resilient flooring.  
**ASTM F1812:2002**—Standard test method for determining the effectiveness of membrane switch ESD shielding.  
**BS 6654:1985 (R1996)**—Method for determination of the electrical resistivity of textile floor coverings.  
**BS EN 1149-1:1996**—Protective clothing—Electrostatic properties—Surface resistivity (test methods and requirements).  
**BS EN 1149-2:1997**—Protective clothing—Electrostatic properties—Test method for measurement of the electrical resistance through a material (vertical resistance).  
**BS EN 1718:1999**—Light conveyor belts—Test method for the measurement of the electrostatic field generated by a running light conveyor belt.  
**CECC 00015P1:1991**—Basic specification for protection of electrostatic sensitive devices.  
**DI-RELI-80669A:1992**—Electrostatic discharge (ESD) control program plan.  
**DI-RELI-80671A:1992**—Handling procedures for electrostatic discharge (ESD) sensitive items.  
**EIA 471:1996**—Symbol and label for electrostatic sensitive devices.  
**EIA 541**—Packaging material standards for ESD sensitive items.

## ESD Standards

**EIA 545:1989**—Electromechanical switch test method for electrostatic discharge (ESD).  
**EIA 625:2000**—Handling electrostatic discharge sensitive (ESDS) devices.  
**EN 61340-5-1:2001**—Protection of electronic devices from electrostatic phenomena—General requirements.  
**EN 61340-5-2:2001**—Protection of electronic devices from electrostatic phenomena—User guide.  
**EOS/ESD EP102:1988**—Electrostatic discharge and electronic equipment: A practical guide for designing to prevent ESD problems.  
**EOS/ESD EP103:1990**—ESD program management: A realistic approach to continuous, measurable improvement in static control.  
**EOS/ESD EP105:1995**—ESD in silicon integrated circuits.  
**FTS 101C 4046**—Electrostatic properties of materials.  
**IDEMA ESD1-00**—MR and GMR heads—General practices for ESD control.  
**IEC 60255-22-2:Edition 2.0**—Electrical relays—Part 22: Electrical disturbance tests for measuring relays and protection equipment—Section 2: Electrostatic discharge tests.  
**IEC 60297-5-103:1999**—Plug-in unit electrostatic discharge protection for subtracks and associated plug-in units with extended features added to IEC 60297-3 and IEC 60297-4.  
**IEC 60455-3-11:1988**—Solventless polymerizable resinous compounds used for electrical insulation—Specification for individual materials—Epoxy resin-based coating powders.  
**IEC 60748-2-8:1993**—Specification for harmonized system of quality assessment for electronic components—Semiconductor devices—Integrated circuits—Blank detail specification: integrated circuit static read/write memories.  
**IEC 60801-2:1991**—Electromagnetic compatibility for industrial-process measurement and control equipment—Electrostatic discharge requirements.  
**IEC 61000-4-2:1995 (R2001)**—Electromagnetic compatibility (EMC)—Part 4: Testing and measurement techniques—Section 2: Electrostatic discharge immunity test.  
**IEC 61340-2-2:2000**—Electrostatics—Part 2-2: Measurement methods—Measurement of chargeability.  
**IEC 61340-2-3:2000**—Electrostatics—Part 2-3: Methods of test for determining the resistance and resistivity of solid planar materials used to avoid electrostatic charge accumulation.  
**IEC 61340-3-1:2002**—Electrostatics—Part 3-1: Methods for simulation of electrostatic effects—Human body model (HBM)—Component testing (IEC/101/33/CD).  
**IEC 61340-3-2:2002**—Electrostatics—Part 3-2: Methods for simulation of electrostatic effects—Machine model (MM)—Component testing (IEC/101/34/CD).  
**IEC 61340-4-1:1995**—Electrostatics—Part 4-1: Standard test methods for specific applications—Section 1: Electrostatic behavior of floor coverings and installed floors.  
**IEC 61340-4-3:2001**—Test method for the characterization of electrostatic protective footwear (IEC document 101/62/CD).  
**IEC 61340-5-1:1998**—Electrostatics—Part 5-1: Protection of electronic devices from electrostatic phenomena—General requirements.  
**IEC/TS 61340-5-2:1999**—Electrostatics—Part 5-2: Protection of electronic devices from electrostatic phenomena—User guide.  
**IEC/PAS 62162:2000**—Field-induced charged-device model test method for electrostatic discharge withstand thresholds of microelectronic components.  
**IEC/PAS 62179:2000**—Electrostatic discharge (ESD) sensitivity testing human body model (HBM).  
**IEC/PAS 62180:2000**—Electrostatic discharge

(ESD) sensitivity testing machine model (MM).  
**IEEE 142:1991 (R1996)**—IEEE Green Book (IEEE recommended practice for grounding of industrial and commercial power systems).  
**IEEE 1291:1993 (R1998)**—IEEE guide for partial discharge measurement in power switchgear.  
**IEEE 1325:1996 (R2002)**—IEEE recommended practice for reporting field failure data for power circuit breakers.  
**IEEE C37.04:2003**—IEEE standard rating structure for ac high-voltage circuit breakers.  
**IEEE C37.010:1999**—IEEE application guide for ac high-voltage circuit breakers rated on a symmetrical current basis.  
**IEEE C37.011:1994**—IEEE application guide for transient recovery voltage for ac high-voltage circuit breakers rated on a symmetrical current basis.  
**IEEE C37.013:1997**—IEEE standard for ac high-voltage generator circuit breaker rated on a symmetrical current basis.  
**IEEE C37.081:1981 (R1988)**—IEEE guide for synthetic fault testing of ac high-voltage circuit breakers rated on a symmetrical current basis; Supplement 081a:1997 to IEEE C37.081:1981.  
**IEEE C37.09:1999**—IEEE standard test procedure for ac high-voltage circuit breakers rated on a symmetrical current basis.  
**IEEE C37.10:1995 (R2002)**—IEEE guide for diagnostics and failure investigation of power circuit breakers.  
**IEEE C37.11:2003**—IEEE standard requirements for electrical control for high-voltage circuit breakers rated on a symmetrical current basis.  
**IEEE C37.13:1990 (R1995)**—IEEE standard for low-voltage ac power circuit breakers used in enclosures.  
**IEEE C37.14:2002**—IEEE standard for low-voltage dc power circuit breakers used in enclosures.  
**IEEE C37.18:2003**—IEEE standard for enclosed field discharge circuit breakers for rotating electric machinery.  
**IEEE C37.20.1:2002**—IEEE standard for metal-enclosed low-voltage power circuit breaker switchgear.  
**IEEE C37.20.2:1999**—IEEE standard for metal-clad and station-type cubicle switchgear.  
**IEEE C37.20.3:2001**—IEEE standard for metal-enclosed interrupter switchgear.  
**IEEE C37.20.4:2001**—IEEE trial-use standard for indoor ac medium-voltage switches for use in metal-enclosed switchgear.  
**IEEE C37.20.6:2003**—IEEE standard for 4.76 to 38 kV rated grounding and testing devices used in enclosures.  
**IEEE C37.21:1985 (R1998)**—IEEE standard for control switchboards.  
**IEEE C62.11:1999**—IEEE standard for metal-oxide surge arresters for ac power circuits (>1 kV).  
**IEEE C62.22:1997**—IEEE guide for the application of metal-oxide surge arresters for alternating-current systems.  
**IEEE C62.23:1995 (R2001)**—IEEE standard draft application guide for surge protection of electric generating plants.  
**IEEE C62.31:1987 (R1998)**—IEEE standard test specifications for gas-tube surge-protective devices.  
**IEEE C62.32:1981 (R1998)**—IEEE standard test specifications for low-voltage air gap surge protective devices (excluding valve and expulsion type devices).  
**IEEE C62.33:1982 (R2000)**—IEEE standard test specifications for varistor surge-protective devices.  
**IEEE C62.34:1996 (R2001)**—IEEE standard for performance of low-voltage surge-protective devices (secondary arresters).  
**IEEE C62.35:1987 (R2000)**—IEEE standard test specifications for avalanche junction semiconductor surge-protective devices.

**IEEE C62.36:2000**—IEEE standard test methods for surge protectors used in low-voltage data, communications, and signaling circuits.  
**IEEE C62.37:2002**—IEEE standard test specification for thyristor diode surge-protective devices.  
**IEEE C62.38:1994**—IEEE guide on electrostatic discharge (ESD)—ESD withstand capability evaluation methods (for electronic equipment subassemblies).  
**IEEE C62.41:1991 (R1995)**—IEEE recommended practice on surge voltages in low-voltage ac power circuits.  
**IEEE C62.42:1992 Draft (R1999)**—IEEE guide for the application of gas tube and air gap arrester low-voltage (equal to or less than 1000 V rms or 1200 V dc) surge-protective devices.  
**IEEE C62.43:1999**—IEEE guide for the application of surge protectors used in low-voltage (equal to or less than 1000 V rms or 1200 V dc) data, communications, and signaling circuits.  
**IEEE C62.47:1992 (R1997)**—IEEE guide on ESD—Characterization of the ESD environment.  
**IEEE C62.48:1995 (R2000)**—IEEE guide on interactions between power system disturbances and surge-protective devices.  
**IEEE C62.62:2000**—IEEE standard test specifications for surge-protective devices for low-voltage ac power circuits.  
**IEEE C62.64:1997**—IEEE standard specifications for surge protectors used in low-voltage data, communications, and signaling.  
**IEEE C62.92.1:2000**—IEEE guide for the application of neutral grounding in electrical utility systems—Part 1: Introduction.  
**IEEE C62.92.2:1989 (R2000)**—IEEE guide for the application of neutral grounding in electrical utility systems—Part 2: Grounding of synchronous generator systems.  
**IEEE C62.92.3:1993 (R2000)**—IEEE guide for the application of neutral grounding in electrical utility systems—Part 3: Generator auxiliary systems.  
**IEEE C62.92.4:1991 (R2002)**—IEEE guide for the application of neutral grounding in electric utility systems—Part 4: Distribution.  
**ISO/DIS 10605:2000**—Road vehicles—Test methods for electrical disturbances from electrostatic discharge.  
**ISO/TR 10605:1994**—Road vehicles—Electrical disturbances from electrostatic discharge.  
**JESD 22-A114B:2000**—Electrostatic discharge (ESD) sensitivity testing human body model (HBM).  
**JESD 22-A115A:1997**—Electrostatic discharge (ESD) sensitivity testing machine model (MM).  
**JESD 22-C101C:2004**—Field-induced charged-device model test method for ESD withstand thresholds of microelectronic components.  
**MIL-B-81705D:1998**—Barrier materials, flexible, electrostatic protective, heat sealable.  
**MIL-PRF-87893B:1997**—Workstation—Electrostatic discharge (ESD) control.  
**MIL-STD 883F:2004**—Electrostatic discharge sensitivity classification.  
**MIL-STD-1686C:1995**—Electrostatic discharge control program for protection of electrical and electronic parts, assemblies, and equipment (excluding electrically initiated explosive devices).  
**QPL-87893-1:1995**—Workstation electrostatic discharge (ESD) control.  
**RAC SOAR 6:1986**—ESD control in the manufacturing environment.  
**SEMI E78-0998**—Electrostatic compatibility—Guide to assess and control electrostatic discharge (ESD) and electrostatic attraction (ESA) for equipment.  
**SEMI E043-0301**—Guide for measuring charge on objects and surfaces.  
**Telcordia GR-1421-CORE:1995**—Generic requirements for ESD-protective circuit packet containers. ■