
TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE.....	1
1.1 PURPOSE	1
1.2 SCOPE	1
1.3 APPLICATION	2
2.0 REFERENCED PUBLICATIONS.....	2
3.0 DEFINITIONS.....	3
4.0 PERSONNEL SAFETY	4
5.0 GENERAL USE OF THIS TECHNICAL REPORT	4
5.1 GENERAL TROUBLESHOOTING	5
6.0 TEST EQUIPMENT	5
6.1 CHARGED PLATE MONITOR (CPM)	5
6.2 CIRCUIT TESTER	5
6.3 CLAMP/ELECTRODES	5
6.4 CONCENTRIC RING ELECTRODE ASSEMBLY.....	5
6.5 CONTACT VOLTMETER	6
6.6 DC OHMMETER	6
6.7 ELECTROSTATIC FIELD METER	6
6.8 FOOT ELECTRODE	6
6.9 HAND-HELD ELECTRODE.....	6
6.10 INSULATIVE SUPPORT SURFACE	6
6.11 INTEGRATED CHECKER	6
6.12 NON-CONTACT VOLTMETER.....	7
6.13 RESISTANCE MEASUREMENT APPARATUS	7
6.14 RESISTANCE MEASUREMENT ELECTRODE(S)	7
6.15 TEST LEAD(S).....	7
6.16 TWO-POINT PROBE ASSEMBLY.....	7
7.0 COMPLIANCE VERIFICATION OF ESD CONTROL ITEMS	8
7.1 GROUNDING/EQUIPOTENTIAL BONDING SYSTEMS.....	8
7.1.1 <i>Equipment Grounding Conductor</i>	9
7.1.2 <i>Auxiliary Ground</i>	10
7.1.3 <i>Equipotential Bonding</i>	11
7.1.4 <i>Troubleshooting</i>	12
7.2 PERSONNEL GROUNDING	12
7.2.1 <i>Wrist Strap System Resistance</i>	12
7.2.2 <i>Groundable Static Control Garment System Resistance</i>	14
7.2.3 <i>Footwear/Flooring System Resistance</i>	16
7.3 ESD PROTECTED AREAS (EPAS).....	20

7.3.1	<i>Insulators</i>	20
7.3.2	<i>Isolated Conductors</i>	24
7.3.3	<i>Worksurfaces</i>	27
7.3.4	<i>Wrist Straps</i>	28
7.3.5	<i>Wristbands</i>	28
7.3.6	<i>Personnel Ground Wrist Strap Connection (Non-Monitored)</i>	29
7.3.7	<i>Footwear</i>	29
7.3.8	<i>Foot Grounders</i>	29
7.3.9	<i>Flooring</i>	30
7.3.10	<i>Seating</i>	30
7.3.11	<i>Ionization</i>	31
7.3.12	<i>Shelving (When Used to Store Unprotected ESDS Items)</i>	35
7.3.13	<i>Mobile Equipment (Working Surfaces)</i>	37
7.3.14	<i>Electrical Soldering/Desoldering Hand Tools</i>	38
7.3.15	<i>Continuous Monitors</i>	40
7.3.16	<i>Static Control Garment</i>	41
7.3.17	<i>Groundable Static Control Garment</i>	43
7.4	<i>PACKAGING</i>	45
7.4.1	<i>Resistance Point-to-Point (Resistance Measurement Electrodes)</i>	45
7.4.2	<i>Resistance Point-to-Groundable Point (Resistance Measurement Electrodes)</i>	46
7.4.3	<i>Resistance Point-to-Point (Two-Point Probe Assembly)</i>	47
7.4.4	<i>Surface Resistance (Concentric Ring Electrode Assembly)</i>	48
7.4.5	<i>Volume Resistance (Concentric Ring Electrode Assembly)</i>	49
7.4.6	<i>Troubleshooting</i>	50

ANNEXES

Annex A (Informative):	Gloves and Finger Cots.....	51
Annex B (Informative):	Verification of Charged Plate Monitor.....	53
Annex C (Informative):	Verification of Contact Voltmeter.....	54
Annex D (Informative):	Verification of DC Ohmmeter	55
Annex E (Informative):	Verification of Electrostatic Field Meter	56
Annex F (Informative):	Verification of Non-Contact Voltmeter	58
Annex G (Informative):	Verification of Resistance Measurement Apparatus	59
Annex H (Informative):	Bibliography.....	60
Annex I (Informative):	Revision History for ESD TR53-01	61

FIGURES

Figure 1:	Equipment Grounding Conductor Symbol.....	8
Figure 2:	Auxiliary Ground Symbol	8
Figure 3:	ESD Grounding/Bonding Reference Point Symbol	9
Figure 4:	Equipment Grounding Conductor Wiring Orientation using a Circuit Tester.....	9
Figure 5:	Equipment Grounding Conductor to Auxiliary Ground using a DC Ohmmeter	10
Figure 6:	Resistance Between Common Connection Point and ESD Control Item (Examples) 12	
Figure 7:	Wrist Strap System Resistance using an Integrated Checker	13

Figure 8: Wrist Strap System Resistance using a Resistance Measurement Apparatus.....	14
Figure 9: Groundable Static Control Garment System Resistance using an Integrated Checker	15
Figure 10: Groundable Static Control Garment System Resistance using a Resistance Measurement Apparatus	16
Figure 11: Footwear System Resistance using an Integrated Checker	17
Figure 12: Footwear System Resistance using a Resistance Measurement Apparatus	18
Figure 13: Flooring Resistance to Ground.....	19
Figure 14: Electrostatic Field at ESDS Item Location using an Electrostatic Field Meter	21
Figure 15: Electrostatic Field at ESDS Item Location using an Electrostatic Field Meter (Top View – X and Y Direction).....	21
Figure 16: Electrostatic Field at ESDS Item Location using an Electrostatic Field Meter (Front View – Z Direction)	22
Figure 17: Surface Voltage of an Insulator using a Non-Contact Voltmeter.....	23
Figure 18: Electrostatic Field of an Insulator using an Electrostatic Field Meter.....	24
Figure 19: Voltage Potential of an Isolated Conductor using a Contact Voltmeter	25
Figure 20: Surface Voltage of an Isolated Conductor using a Non-Contact Voltmeter	26
Figure 21: Electrostatic Field of an Isolated Conductor using an Electrostatic Field Meter	27
Figure 22: Worksurface Resistance to Ground.....	28
Figure 23: Personnel Ground Wrist Strap Connection (Non-Monitored) Resistance to Ground..	29
Figure 24: Seating Resistance to Ground.....	31
Figure 25: Benchtop Ionizer - Top View	33
Figure 26: Benchtop Ionizer - Side View	33
Figure 27: Overhead Ionizer -Top View.....	34
Figure 28: Overhead Ionizer - Side View.....	34
Figure 29: Compressed Gas Ionizer (Gun or Nozzle) - Side View	35
Figure 30: Shelving (When Used to Store Unprotected ESDS Items) Resistance to Ground	36
Figure 31: Mobile Equipment (Working Surfaces) Resistance to Ground	37
Figure 32: Electrical Soldering/Desoldering Hand Tools Tip to Ground Resistance using an Integrated Checker	39
Figure 33: Electrical Soldering/Desoldering Hand Tools Tip to Ground Resistance using a DC Ohmmeter.....	39
Figure 34: Electrical Soldering/Desoldering Hand Tools Tip to Groundable Point Resistance using a DC Ohmmeter	40
Figure 35: Static Control Garment Resistance Point-to-Point using a Resistance Measurement Apparatus	42
Figure 36: Static Control Garment Resistance Point-to-Point using the Hanging Clamp Method	43
Figure 37: Groundable Static Control Garment Resistance to Groundable Point	44
Figure 38: Packaging Resistance Point-to-Point (Resistance Measurement Electrodes)	46
Figure 39: Packaging Resistance Point-to-Groundable Point (Resistance Measurement Electrodes).....	47
Figure 40: Packaging Resistance Point to Point (Two Point Probe Assembly).....	48
Figure 41: Packaging Surface Resistance (Concentric Ring Electrode Assembly)	49
Figure 42: Packaging Volume Resistance (Concentric Ring Electrode Assembly).....	50
Figure 43: Gloves In-use System Resistance using an Integrated Checker	51

Figure 44: Gloves In-use System Resistance using a Constant Area and Force Electrode (CAFE)	52
Figure 45: Isolated Ion Collection Plate Verification	53
Figure 46: Contact Voltmeter Measurement Capabilities	54
Figure 47: DC Ohmmeter Measurement Capabilities.....	55
Figure 48: Electrostatic Field Meter Measurement Capabilities	57
Figure 49: Non-Contact Voltmeter Measurement Capabilities	58
Figure 50: Resistance Measurement Apparatus Measurement Capabilities	59