## CHANGE NOTICE

Date Prepared: 2/12/02

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| The Boeing Company<br>Post Office Box 58747<br>Houston, TX 77258 | ☐ Proposed<br>☒ Approved | 2B945 | SSP 50005C |
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| ISS Flight Crew Integration Standard (NASA–STD–3000/T) | All Units |

THIS NOTICE INFORMS RECIPIENTS THAT THE DOCUMENT IDENTIFIED BY THE NUMBER (AND REVISION LETTER) SHOWN IN BLOCK 4 HAS BEEN CHANGED. THE PAGES CHANGED BY THIS CDCN BEING THOSE FURNISHED HEREWITH AND CARRYING THE SAME DATE AS THIS CDCN. THE PAGES OF THE PAGE NUMBERS AND DATES LISTED BELOW IN THE SUMMARY OF CHANGED PAGES COMBINED WITH NON–LISTED PAGES OF THE ORIGINAL ISSUE OF THE REVISION SHOWN IN BLOCK 4 CONSTITUTE THE CURRENT VERSION OF THIS DOCUMENT.

| 13. CDCN No. | 14. Pages Changed (Indicate Deletions) | S* | A* | 15. Date |
|---|---|---|---|---|
| 010 | Revision and History page | X | | 2/12/02 |
| | List of Changes | X | | |
| | Pages xiii, xiv, and xxxiv | X | | |
| | Pages 3–4, 6–6, 6–7, 6–9, 6–10, 6–11, 6–12, 6–13, and 6–14 | X | | |
| 010 | Pages 6–9a and 6–14a | | X | |
| | Order of Incorporation<br>DCN 008, 010 | | | |

| 16. Technical Concurrence (Contracting Agency) | Date |
|---|---|
| | |

* “S” indicates supersedes earlier page. “A” indicates added page.

## REVISION AND HISTORY PAGE

| REV. | DESCRIPTION | PUB. DATE |
|---|---|---|
| – | Initial Release (Reference SSCBD 000002, Dated 2–7–94) | 4–18–94 |
| A | Revision A (Reference SSCBD 000008R1, Dated 6–3–94) | 8–09–94 |
| B | Revision B incorporates ECP 145 (SSCBD 000145, Effective 10–31–95) | 11–21–95 |
| | DCN 001 incorporates ECP 258 (SSCBD 000258, Effective 08–19–98) | 11–17–98 |
| | The following DCNs have been cancelled. The content of the SSCNs authorizing release of the DCNs has been incorporated into Revision C.<br><br>DCN 002 (SSCN 000354)<br>DCN 006 (SSCN 000549)<br>DCN 005 (SSCN 000721)<br>DCN 003 (SSCN 000434)<br>DCN 004 (SSCN 000554)<br>DCN 007 (SSCN 000821) | |
| C | Revision C incorporates SSCNs 000354, 000434, 000549, 000554, 000721, 000821, and 001202. | 09–27–01 |
| | DCN 008 incorporates SSCN 002199B | 09–27–01 |
| | DCN 009 for SSCN 002446 Cancelled per SSCN 2446A | |
| | DCN 010 incorporates SSCN 005389 | 05–08–03 |

ERU: /s/ M. Hehn 05–08–03

**INTERNATIONAL SPACE STATION PROGRAM**

**FLIGHT CREW INTEGRATION STANDARD**
**(NASA–STD–3000/T)**

**LIST OF CHANGES**
**12 FEBRUARY 2002**

All changes to paragraphs, tables, and figures in this document are shown below:

| SSCBD | ENTRY DATE | PARAGRAPH | TITLE |
|---|---|---|---|
| 5839 | 2/7/02 | 6.4.3 | Electrical hazards design requirements |
| | | 6.4.3.9 | Portable equipment/power cords |
| | | 6.4.3.17 | Ground fault circuit interrupters |
| | | 6.4.3.17.1 | GFCI – portable equipment sourcing voltage |
| | | 6.4.3.18 | Leakage current design requirements |
| | | 6.4.3.18.1 | Chassis leakage current |
| | | 6.4.3.18.1.1 | Chassis leakage current – nonpatient equipment |
| | | 6.4.3.18.1.2 | Chassis leakage current – patient care equipment |
| | | 6.4.3.18.2 | Crewmember applied current |
| | | 6.4.3.18.2.3 | Health maintenance system instrumentation grounding |
| | | 6.4.3.18.2.4 | Countermeasure system |
| | | | **TABLE(S)** |
| | | None | |
| | | | **FIGURE(S)** |
| 5839 | 2/7/02 | 6.4.3–1 | Let–go current profile threshold versus frequency |
| | | 6.4.3.18–1 | Leakage current verification network |
| | | 6.4.3.18.1.1–1 | Nonpatient equipment maximum chassis leakage current |
| | | 6.4.3.18.1.2–1 | Patient care equipment maximum leakage current |
| Editorial | | 3.3.1.3–1 | Body size of 40–year–old American male and 40–year–old Japanese female for Year 2000 in one gravity conditions (Corrects hand circumference of 5th percentile female from ”17.9 inches (6.5 cm)” to ”16.6 inches (6.5 cm)”) |
| | | | **APPENDIX** |
| | | None | |

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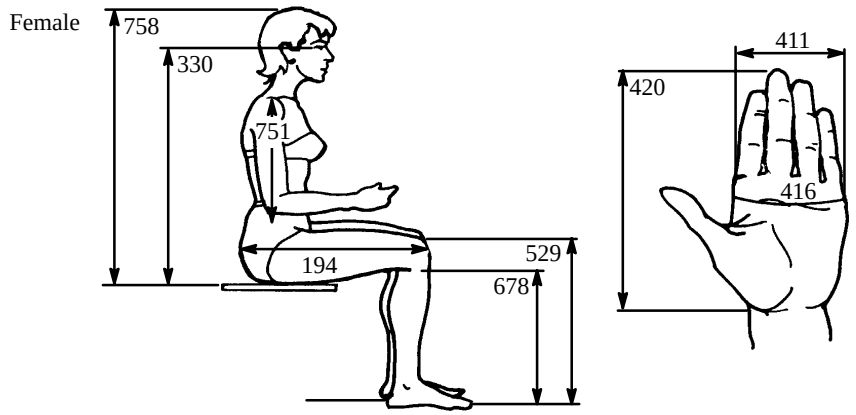
**FIGURES**




| Notes | No. | Dimension | 5th Percentile cm (inches) | 50th Percentile cm (inches) | 95th Percentile cm (inches) |
|---|---|---|---|---|---|
| 1, 2 | 758 | Sitting height | 78.3 (30.8) | 84.8 (33.4) | 91.2 (35.9) |
| 1, 2 | 330 | Eye height, sitting | 68.1 (26.8) | 73.8 (29.1) | 79.8 (31.4) |
| 4 | 529 | Knee height, sitting | 41.6 (16.4) | 45.8 (16.4) | 49.5 (19.5) |
| | 678 | Popliteal height | 34.7 (13.6) | 38.3 (15.1) | 41.9 (16.5) |
| | 751 | Shoulder–elbow length | 27.2 (10.7) | 29.8 (11.7) | 32.4 (12.8) |
| | 184 | Buttock–knee length | 48.9 (19.2) | 53.3 (21.0) | 57.8 (22.7) |
| | 420 | Hand length | 15.8 (6.2) | 17.2 (6.8) | 18.7 (7.3) |
| | 411 | Hand breadth | 6.9 (2.7) | 7.8 (3.1) | 8.6 (3.4) |
| | 416 | Hand circumference | 16.6 (6.5) | 17.9 (7.0) | 19.3 (7.6) |

General Notes:

(a) Gravity conditions – the dimensions apply to a 1–G condition only. Dimension expected to change significantly due to microgravity are marked.

(b) Measurement data – the number adjacent to each of the dimension are reference codes. The same codes are in NASA RP 1024, Volume 2. NASA RP 1024, Volume 2 provides additional data for these measurements plus an explanation of the measurement technique.

Notes for application of dimensions to microgravity conditions:

(1) Stature increases approximately 3 percent over the first 3 to 4 days in weightlessness (See NASA–STD–3000, Volume I, Figure 3.2.3.1–2, for information). Almost all of this change appears in the spinal column and thus affects (increases) other related dimensions, such as sitting height (buttock–vertex), shoulder height –sitting, eye height, sitting, and all dimensions that include the spine.

(2) Sitting height would be better named as buttock–vertex in microgravity conditions, unless the crewmember were measured with a firm pressure on shoulders pressing him or her against a fixed, flat ‘‘sitting” support surface. All sitting dimensions (vertex, eye, shoulder, and elbow) increase in weightlessness by two changes:

(a) Relief of pressure on the buttock surfaces (estimated increase of 1.3 to 2.0 cm (0.5 to 0.8 inches).

(b) Extension of the spinal column as explained in note (1) above (3 percent of stature on ground).

(4) Knee height–sitting may increase slightly in microgravity due to relief of the pressure on the heel which it occurs when it is measured on the ground. The increase is probably not more than 2 to 3 mm (0.1 inch).

**FIGURE 3.3.1.3–1 BODY SIZE OF 40–YEAR–OLD AMERICAN MALE AND 40–YEAR–OLD JAPANESE FEMALE FOR YEAR 2000 IN ONE GRAVITY CONDITIONS (PAGE 1 OF 1)**

**DCN 010**

## 6.4 ELECTRICAL HAZARDS

### 6.4.1 INTRODUCTION

This paragraph is not applicable for this document.

### 6.4.2 ELECTRICAL HAZARDS DESIGN CONSIDERATIONS

This paragraph is not applicable for this document.

### 6.4.3 ELECTRICAL HAZARDS DESIGN REQUIREMENTS

A. Equipment design shall protect the crewmembers from electrical hazards.

B. In designing to minimize electrical shock hazards, if the worst case credible failure for nonpatient equipment can result in a crewmember exposure that: **DCN 010**

(1) is below the threshold for electrical shock, that is, no internal voltage exceeding 30 volts rms, no controls shall be required; **DCN 010**

(2) exceeds the threshold for shock and is below the threshold of let–go (critical hazard) as defined in Figure 6.4.3–1, two independent controls (e.g., a safety (green) wire; bonding; insulation; leakage current levels below maximum requirements as described in Figure 6.4.3.18.1.1–1) shall be required such that no single failure, event, or environment can eliminate more than one control; or, **DCN 010**

(3) equals or is greater than the threshold of let–go as defined in Figure 6.4.3–1 (catastrophic hazardous event), three independent controls shall be required such that no single failure, event, or environment can eliminate more than one control. **DCN 010**

| Frequency (Hz) | Threshold of Let–Go (milliamperes) **DCN 010** (Based on 99.5 Percentile Rank of Adults) Maximum Total Peak Current (ac + dc components combined) |
|---|---|
| dc | 40.0 |
| 15 | 8.5 |
| 2000 | 8.5 |
| 3000 | 13.5 |
| 4000 | 15.0 |
| 5000 | 16.5 |
| 6000 | 17.9 |
| 7000 | 19.4 |
| 8000 | 20.9 |
| 9000 | 22.5 |
| 10000 | 24.3 |
| 50000 | 24.3 |

**FIGURE 6.4.3–1 LET–GO CURRENT PROFILE THRESHOLD VERSUS FREQUENCY**

C. If two independent controls are provided, the physiological effect of the combination of the highest internal voltage applied to or generated within the equipment and the frequency and wave form associated with a worst case credible failure that can be applied to the crewmember shall be below the threshold of let–go.

D. Deleted. **DCN 010**

E. If the hazard classification between critical and catastrophic is marginal or unclear, three independent hazard controls shall be required to protect the crewmember from exposure to electrical shock. **DCN 010**

F. For nonpatient equipment, a crew electrical shock hazard protection system utilizing design to minimum risk criteria when approved by the Safety Review Panel may be used in lieu of the fault tolerance approach described within this paragraph.

#### 6.4.3.1 GROUNDING

A. All electrical powered equipment external, nonisolated metal parts subject to user contact shall be at ground potential.

B. A permanent bonding means shall be provided to facilitate the connection of metal parts to ground prior to the connection of any electrical signals or power.

C. A permanent bonding means shall be provided to facilitate the removal of all electrical signals and power prior to the removal of metal parts from ground.

D. Grounding conductors internal to an Orbital Replaceable Unit (ORU) shall be secured internally to the ORUs metal enclosure by means of a fastening technique unlikely to be removed during any servicing operation.

E. Solder alone shall not be used for securing the grounding conductor.

F. Each grounding or bonding means shall be capable of conducting the maximum ground fault current amplitude and duration which might occur as the result of discharges (static, plasma, etc.), induced RF voltages, internal power–faulted equipment, and accidental short circuits.

G. All grounding shall conform to SSP 30240.

##### 6.4.3.1.1 HINGED OR SLIDE MOUNTED PANELS AND DOORS GROUNDING

A. Hinges or slides shall not be used for grounding paths.

B. A ground shall be considered satisfactory if the electrical connection between the conductive door or panel, in both the open and closed position, and the equipment tie point exhibits a resistance of less than 0.1 ohms and has sufficient ampacity to insure the reliable and immediate tripping of associated equipment over–current protection devices.

#### 6.4.3.2 ELECTRICAL BONDING

On–orbit electrical bonding shall meet the requirements of SSP 30245 to prevent damage to the vehicle or injury to crewmembers due to discharges (static, plasma, etc.), induced RF voltages, internal power–faulted equipment, and accidental short circuits. Each independent bonding path is considered a hazard control for electrical shock.

### 6.4.3.9 PORTABLE EQUIPMENT/POWER CORDS

A. Nonbattery powered portable equipment and portable equipment power cords with internal voltages exceeding 30 volts rms shall incorporate a three–wire power cord; i.e., a power supply lead (+), a power supply return lead (–), and a safety (green) wire with one end connected to the portable equipment chassis (and all exposed conductive surfaces of the portable equipment) and the other end connected to the electrical power source structure. **DCN 010**

B. Deleted. **DCN 010**

C. Portable equipment power cords with internal voltages exceeding 30 volts rms shall provide a second independent ground between the portable equipment exposed electrically conductive surfaces and the portable equipment power source structure (i.e., cable shield or wire connected to conductive backshells of power cord where the cable shield or wire has sufficient ampacity to clear a worst case credible fault), or provide a double insulation enclosure isolating all electrically conductive surfaces likely to come in contact with crewmembers. **DCN 010**

### 6.4.3.10 MOISTURE PROTECTION

Equipment shall be designed so that moisture collection will not present a safety hazard to the crew.

### 6.4.3.11 STATIC DISCHARGE PROTECTION

Equipment shall be designed so that the crewmembers are protected from static charge buildup.

### 6.4.3.12 OVERLOAD PROTECTION

A. The functioning of an overload protective device shall not result in a fire, electric shock, or crewmember injury.

B. An overload protective device shall not be accessible without opening a door or cover, except that the operating handle or operating button of a circuit breaker, the cap of an extractor–type fuseholder, and similar parts may project outside the enclosure.

C. The arrangement of extractor–type fuseholders shall be such that the fuse shall not be positively held or gripped by any part of the fuseholder while energized parts are exposed at any time during replacement.

The load shall be connected to the fuseholder terminal that terminates the removable cap assembly.

D. Overload protection (fuses and circuit breakers) intended to be manually replaced or physically reset on–orbit shall be located where they can be seen and replaced or reset without removing other components.

E. Each overload protector (fuses and circuit breakers) intended to be manually replaced or physically reset on–orbit shall be readily identified or keyed for its proper value.

F. Overload protection shall be designed and rated for on–orbit use including the maximum environmental range expected as the result of contingencies.

### 6.4.3.13 BATTERIES

A. Unless intentionally designed for the purpose, batteries shall not be connected to or disconnected from a current drawing load. Batteries and their utilization will conform to the requirements of JSC 20793 and JPL 86–14.

B. Batteries/battery packs with potentials above 30 volts dc shall provide hazard controls as specified in 6.4.3.

#### 6.4.3.13.1 NONORU BATTERIES

A. Batteries not configured as ORUs shall be located so that they can be easily disconnected and removed without special equipment.

B. Mounting provisions shall ensure retention for all service conditions.

C. Polarity of the battery terminals shall be prominently marked or battery terminal connections be polarized to mitigate erroneous installation.

#### 6.4.3.14 MECHANICAL ASSEMBLY

A. A switch, fuseholder, lampholder, attachment plug receptacle, or other energized component that is handled by a crewmember shall not rely on friction alone to prevent turning in its mounting panel.

B. The mounting of components to a printed wiring board and the mounting of the printed wiring board itself shall be such that any forces that might be exerted on the components or board will not displace the components or deflect the board so as to produce an electric shock or fire.

#### 6.4.3.15 SWITCHES/CONTROLS

A. Switches/controls shall be designed such as to prevent hazardous unexpected manual or automatic operation.

B. Switches/controls which provide automatic starting after an overload initiated shutdown shall not be employed.

#### 6.4.3.15.1 POWER SWITCHES/CONTROLS

A. Switches/controls performing ON/OFF power functions shall open or dead–face all supply circuit conductors except the power return and the equipment grounding conductor while in the power OFF position.

B. Power OFF markings and/or indications shall only be used if all parts, with the exception of overcurrent devices and associated electromagnectic interference filters, are disconnected from the supply circuit.

C. STANDBY, CHARGING, or other appropriate nomenclature shall be used to indicate that the supply circuit is not completely disconnected for this power condition.

#### 6.4.3.16 DELETED

#### 6.4.3.17 GROUND FAULT CIRCUIT INTERRUPTERS

A Ground Fault Circuit Interrupter (GFCI) is not required. All portable equipment with internal voltages greater than 30 volts rms is required to demonstrate two fault tolerance in its operating configuration without using GFCI. **DCN 010**

**DCN 010**

**DCN 010**

**DCN 010**

**DCN 010**

**DCN 010**

### 6.4.3.17.1 GFCI – PORTABLE EQUIPMENT SOURCING VOLTAGE

A GFCI is not required. All portable equipment with internal voltages greater than 30 volts rms is required to demonstrate two fault tolerance in its operating configuration without using GFCI.

**DCN 010**

**DCN 010**

**DCN 010**

**DCN 010**

### 6.4.3.18 LEAKAGE CURRENT DESIGN REQUIREMENTS

A. Deleted.

B. For nonpatient portable equipment with internal voltages exceeding 30 volts rms, and the safety analysis shows the design can defeat verification of the 1 meg–ohm isolation (reference SSP 30240, paragraph 3.2.1.2), the equipment developer shall perform the following measurements as indicated, using a test setup as specified in Figure 6.4.3.18–1.

**DCN 010**

(1) Measurement #1, using an rms voltmeter, measure the voltage across R–1, where R–1 is a 100,000 ohm +/– 2 percent, noninductive resistor. If the voltage measured across R–1 is less than or equal to 30 volts rms then no shock hazard is present and no additional measurements are required. If the voltage measured across R–1 is greater than 30 volts rms, then a possible shock hazard exists, perform Measurement #2. **DCN 010**

(2) Measurement #2, using an oscilloscope, measure the voltage across R–1, where R–1 is a 1000 ohm +/– 2 percent, noninductive resistor. If the calculated current through R–1, determined from the voltage measured across R–1 is less than or equal to 8.5 ma peak, then no catastrophic shock hazard is present and no additional measurements are required. If the calculated current through R–1, determined from the voltage measured across R–1, is greater than 8.5 ma peak, then a possible catastrophic shock hazard exists, perform Measurement #3. **DCN 010**

(3) Measurement #3, using an oscilloscope, measure the voltage across R–1, where R–1 is a 1,000 ohm +/– 2 percent, noninductive resistor. If the calculated current through R–1, determined from the voltage measured across R–1 is more than 8.5 ma peak and less than or equal to 24.3 ma peak, then a possible catastrophic shock hazard exists, perform Measurement #4. If the calculated current through R–1, determined from the voltage measured across R–1, is greater than 24.3 ma peak, then a catastrophic shock hazard is present and the equipment fails the shock hazard testing.

**DCN 010**

(4) Measurement #4, using a Spectrum Analyzer or Fast Fourier Transform Oscilloscope, measure the rms voltage across R–1, where R–1 is a 1,000 ohm +/– 2 percent, noninductive resistor. Compare the calculated peak current through R–1 at each frequency to the peak current at each frequency in Figure 6.4.3–1. If the calculated peak current is equal to or greater than the peak current value at the indicated frequency in Figure 6.4.3–1, then a catastrophic shock hazard is present and the equipment fails the shock hazard testing. **DCN 010**

C. Deleted. **DCN 010**

D. For isolated patient connection lead leakage current, the equipment developer shall perform the following measurement using the test setup as specified in Figure 6.4.3.18–1. **DCN 010**

Using an rms voltmeter, measure the voltage across R–1, where R–1 is a 1000 ohm +/– 2 percent, noninductive resistor. If the equivalent leakage current, calculated from the voltage measurement, through R–1 is greater than the patient connection leakage current specified in Figure 6.4.3.18.1.2–1, the equipment fails the shock hazard testing. **DCN 010**

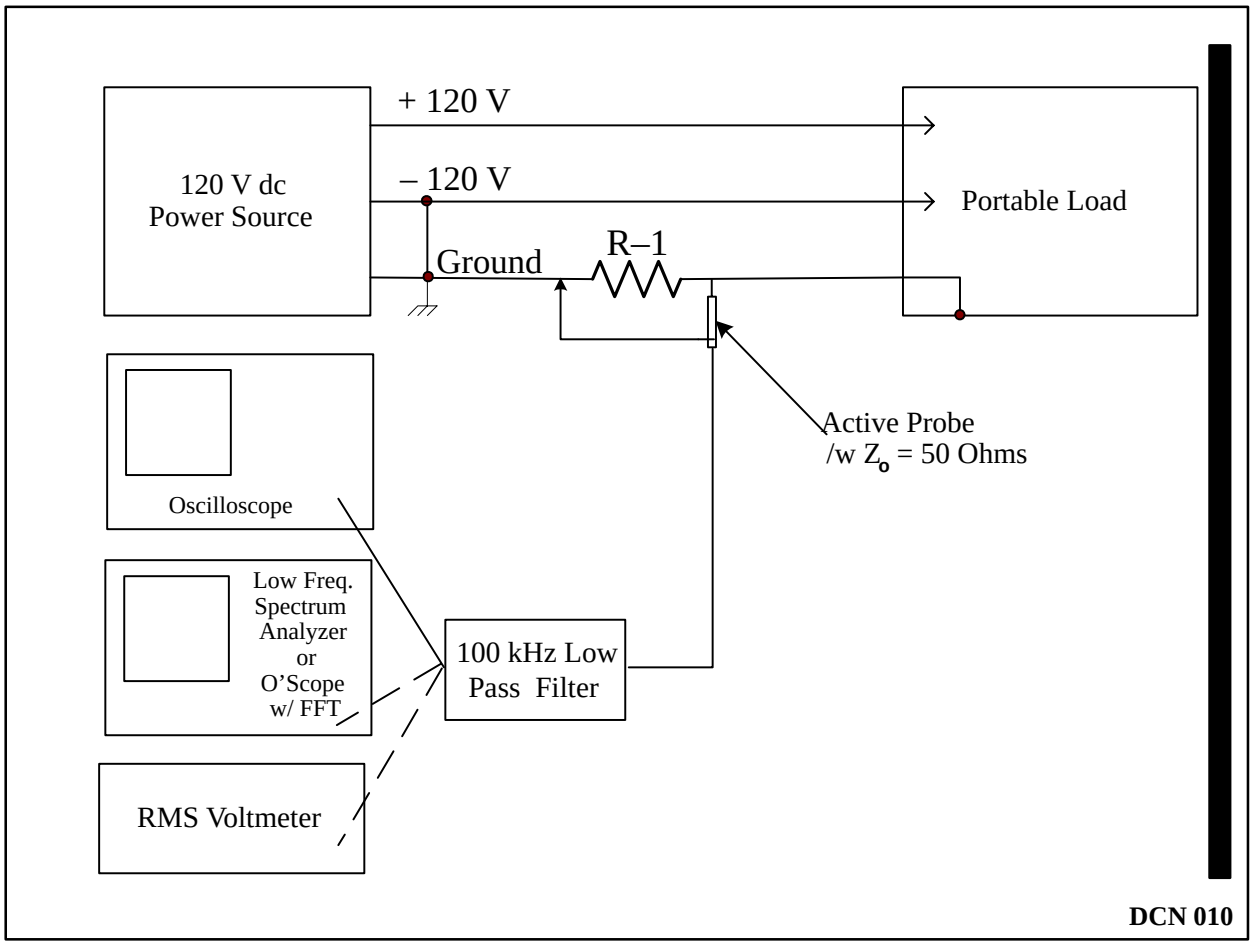



**FIGURE 6.4.3.18–1 LEAKAGE CURRENT VERIFICATION NETWORK**

### 6.4.3.18.1 CHASSIS LEAKAGE CURRENT

A. Deleted. **DCN 010**

B. Deleted. **DCN 010**

C. Leakage current test procedures for dc powered equipment shall not include reversed polarity input power tests.

#### 6.4.3.18.1.1 CHASSIS LEAKAGE CURRENT – NONPATIENT EQUIPMENT

A. The chassis leakage currents for nonpatient equipment shall not exceed the values shown in Figure 6.4.3.18.1.1–1.

B. Deleted. **DCN 010**

| Enclosure or Chassis Leakage Current | | | |
|---|---|---|---|
| Grounded | | Double Insulated | |
| dc | ac ma | dc | ac ma |
| ma | rms | ma | rms |
| 0.700 | 0.500 | 0.350 | 0.250 |

**FIGURE 6.4.3.18.1.1–1 NONPATIENT EQUIPMENT MAXIMUM CHASSIS LEAKAGE CURRENT**

**DCN 010**

#### 6.4.3.18.1.2 CHASSIS LEAKAGE CURRENT – PATIENT CARE EQUIPMENT

A. The chassis leakage currents for patient care equipment shall not exceed the values shown in Figure 6.4.3.18.1.2–1.

B. Deleted. **DCN 010**

| Patient Connection Leakage Current | | | | |
|---|---|---|---|---|
| | Isolated (1) | | Ordinary | |
| Patient | dc | ac ma | dc | ac ma |
| Interface | ma | rms | ma | rms |
| Invasive | 0.014 | 0.010 | Not Permitted | |
| Noninvasive | 0.070 (1) | 0.050 (1) | 0.070 | 0.050 |
| Enclosure or Chassis Leakage Current | | | | |
| | Grounded | | Double Insulated | |
| Patient | dc | ac ma | dc | ac ma |
| Interface | ma | rms | ma | rms |
| Noninvasive | 0.140 | 0.100 | 0.070 | 0.050 |

Note:
(1) If equipment labeling indicates ”isolated,” the maximum current is 0.014 ma dc/0.010 ma rms.

**FIGURE 6.4.3.18.1.2–1 PATIENT CARE EQUIPMENT MAXIMUM LEAKAGE CURRENT**

**DCN 010**

### 6.4.3.18.2 CREWMEMBER APPLIED CURRENT

A. Crewmembers shall not be exposed to excessive levels of leakage current from direct or indirect contact with electrically powered equipment.

B. Deleted. **DCN 010**

C. Leakage current test procedures for dc powered equipment shall not include reversed polarity input power tests.

D. The leakage currents for patient care equipment as seen from the patient end of cables or terminals shall not exceed the values shown in Figure 6.4.3.18.1.2–1. **DCN 010**

E. Leakage currents shall be tested:

(1) lead to ground

a. between each patient lead and ground, and

b. between combined patient leads and ground; and

(2) between leads

a. between any pair of patient leads, and

b. between any single patient lead and all other patient leads.

### 6.4.3.18.2.1 LEAKAGE CURRENT – PATIENT CARE EQUIPMENT – PATIENT CONNECTION – ISOLATED

A. Isolated, patient connected, patient care equipment leakage current shall not exceed 0.014 ma dc for isolated, patient connected, patient care equipment, such as intra–aortic pressure monitors (i.e., invasive interface).

B. Isolated, patient connected, patient care equipment leakage current shall not exceed 0.070 ma dc for isolated, patient connected, patient care, equipment, such as muscle stimulators utilizing attached body surface electrodes (i.e., noninvasive interface) provided that equipment labeling does not indicate the equipment is isolated.

### 6.4.3.18.2.2 LEAKAGE CURRENT – PATIENT CARE EQUIPMENT – PATIENT CONNECTION – ORDINARY

Ordinary, patient connected, patient care equipment leakage current shall not exceed 0.070 ma dc for ordinary, patient connected, patient care equipment, such as blood pressure cuffs, thermometers, and limb muscle stimulators.

### 6.4.3.18.2.3 HEALTH MAINTENANCE SYSTEM INSTRUMENTATION GROUNDING

A. Any two exposed conductive surfaces in the instrumented crewmember's vicinity shall not exceed a 40.0 millivolt potential difference at frequencies up to 1000 Hertz or less measured across a 1000 ohm noninductive resistor. **DCN 010**

B. Conductive surfaces which can be contacted by an attending crewmember while the attending crewmember is in contact with the instrumented crewmember shall be considered as within the crewmember's vicinity.

### 6.4.3.18.2.4 COUNTERMEASURE SYSTEM

A. Any two exposed conductive surfaces in the instrumented crewmember's vicinity shall not exceed a 40.0 millivolt potential difference at frequencies up to 1000 Hertz or less measured across a 1000 ohm noninductor resistor. **DCN 010**

B. Conductive surfaces which can be contacted by an attending crewmember while the attending crewmember is in contact with the instrumented crewmember shall be considered as within the crewmember's vicinity.

### 6.4.3.18.2.5 AMBULATORY CREWMEMBER INSTRUMENTATION

While attached to an ambulatory crewmember, electrically powered medical instrumentation shall be:

A. Battery powered,

B. Double insulated,

C. Electrically isolated from ground, and

D. Not connected to vehicle power (e.g., charging).