CHANGE NOTICE

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Space Station Electrical Bonding Requirements	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
012	Revision and History page	X		4/18/2001
	Pagea 3–3 and 3–4.	X		
	Page C–18.	X		
012	Page C–19.		X	
	Order of Incorporation DCN 009, 010, 011, 013, 012			

16. Technical Concurrence (Contracting Agency)	Date

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

REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE
	Draft Revision B – SDR Version "Reference SSCBD 000008"	03–22–94
B	Revision B (Reference SSCBD 000008 R1, Eff. 6–3–94) Revised to Transition from Freedom to ISS. Changes include extensive simplification of requirements and scope.	09–30–94
C	Revision C (SSCD 000263, Eff. 09–04–96) Administration Update	01–29–97
	DCN 001 incorporates ECP 263 (Supplemental Release)	06–06–97
	DCN 002 incorporates SSCN 000588	05–13–98
	DCN 003 incorporates SSCN 000777	07–21–98
D	Revision D incorporates SSCN 001102	07–21–98
	DCN 004 incorporates SSCN 001405	01–12–99
	DCN 005 incorporates SSCN 001462	06–09–99
	DCN 006 incorporates SSCN 001662	06–09–99
	DCN 007 incorporates SSCN 001920	08–25–99
	DCN 008 incorporates SSCN 002107	08–27–99
E	Revision E incorporates SSCD 002345 Eff. 08–06–99	11–22–99
	DCN 009 incorporates SSCD 003213 Eff. 06–28–00	04–13–01
	DCN 010 incorporates SSCD 003690 Eff. 11–08–00	04–13–01
	DCN 011 incorporates SSCD 003746 Eff. 11–15–00	04–13–01
	DCN 013 incorporates SSCN 004676 Eff. 12–06–00	04–16–01
	DCN 012 incorporates SSCD 004140	08–31–01

ERU: /s/Beth Mason 08–31–01

3.2.1.2.2 NEARBY CONDUCTORS

All conducting items having any linear dimension of 30 centimeters (cm) or more installed within one–fourth of the wavelength of the highest operating frequency of wiring carrying signals with frequencies that exceed 10 MHz, such as transmitting or receiving antenna lead–ins, shall have a bond to structure at least every interval that is one–fourth the wavelength of the highest operating frequency. Direct metal–to–metal contact is preferred. If a jumper/strap is used, the jumper/strap shall comply with the requirements of Class R bonds.

3.2.1.2.3 SPACE STATION STRUCTURE

Space Station structure shall be so designed that the conducting members provide a uniform low impedance path through inherent bonding during construction. Structure bond design shall include accommodation of the effects of operational vibration and resultant breakdown of insulating finishes or intermittent electrical contact.

3.2.1.3 CLASS S BONDING (STATIC CHARGE)

3.2.1.3.1 CONDUCTING STRUCTURAL ITEMS

All isolated structural conducting items having an area greater than 100 square centimeters which carry fluids in motion, or otherwise are subject to frictional charging or plasma–induced current flow or charging, shall have a mechanically secure conducting connection to conductive structure. The resistance of the connection shall be less than 1 ohm. See appendix C for exception (EMECB TIA–0012, EMECB TIA–0015, EMECB TIA–0017, EMECB TIA–0018, EMECB TIA–0032, EMECB TIA–0076, EMECB TIA–0078, and EMECB TIA–0099) to this paragraph.

3.2.1.3.2 COMPOSITE MATERIALS

All composite structural materials which are subject to frictional charging or plasma–induced current flow or charging shall have a mechanically secure conductive connection to adjacent conductive structural items. The dc resistance between the composite material connection and the structure shall not exceed 1000 ohms.

3.2.1.3.3 CONDUCTIVE MECHANICAL SUBASSEMBLIES/PARTS

All moving parts having a surface area greater than 100 square centimeters and which are subject to frictional charging (charging mechanism required), e.g., gears, cams, rotary joints, etc., shall be equipped with a charge bleed off mechanism. This mechanism may take the form of bleed wire, wiper strap, conductive lubricant, etc. The bleed off path shall not exceed 1000 ohms to conductive structure. See appendix C for exception (EMECB TIA–0006, EMECB TIA–0029, EMECB TIA–0047, EMECB TIA–0099, and EMEP TIA–0296) to this paragraph. **DCN 012**

3.2.1.3.4 PIPE AND HOSE BONDING

All conductive pipes, tubes, and hoses that carry fluids shall have a mechanically secure conductive connection to conductive structure that shall measure 1 ohm or less. The pipe, tube, or hose installation shall not be the primary path for electrical power under normal or fault conditions. Nonconductive plumbing installations shall be designed so that the static voltage generated by fluid flow will not exceed 350 volts at any point outside the pipes, tubes, or hoses.

3.2.1.3.5 TRADITIONALLY HOMOGENEOUS STRUCTURAL MATERIALS

The traditionally homogeneous class of structural materials includes glass, quartz, surface coatings, polymers, plastics, etc. These materials cover a wide range of conductivities. In each case where Class S applies (in all cases where none of the other classifications applies), the bond methodology shall assure that no conductive surface area greater than 200 square centimeters is without a bond path from conductive layer to conductive structure. The bond resistance from the connection point to conductive structure shall be less than 1 ohm. For example, a metalized thermal blanket may have the dielectric surface exposed to the plasma as long as the metalized layers are grounded to conductive structure. See appendix C for exceptions (EMECB TIA–0136 and EMEP TIA–0279) to this paragraph. **DCN 011**

3.2.1.3.6 MULTILAYER INSULATION

Conductive layers shall be bonded together in at least two locations. The bonding resistance from those locations to structure shall be less than 1 ohm. See appendix C for exceptions (EMECB TIA–0120, EMEP TIA–0236, EMEP TIA–0292, and EMEP TIA–0294) to this paragraph. **DCN 010, 013, 012**

3.3 PROCESSES, METHODS, AND PROCEDURES

3.3.1 SELECTION OF MATERIALS

Materials and parts for electrical bonding shall be as specified herein. Materials specified in this document shall also be selected in accordance with SSP 30233.

3.3.2 STANDARD PARTS

Standard parts (Military Standard (MS), Army Navy (AN), or Joint Army Navy (JAN)) that comply with the requirements of this document shall be used for electrical bonding wherever suitable for the purpose intended and shall be identified on drawings by part numbers. Commercial standard parts such as screws, bolts, washers, nuts, and cotter pins that comply with the requirements of this document shall be permitted for electrical bonding in place of standard parts (MS, AN, or JAN).

EMEP TIA–0292 **DCN 012**

C.3.2.1.3.6 MULTILAYER INSULATION **DCN 012**

Exceedance: The multi layer insulation requirement specified in 3.2.1.3.6 shall be relaxed to allow the MLI blanket to have its EVA ground wire disconnected in between flights on orbit. **DCN 012**

Rationale: The objective of grounding the MLI blanket is to protect the SGTRC equipment against the plasmas and ESD environment and to provide a safety ground for the crews. An exception can be made for a temporarily disconnected ground wire based on the following: **DCN 012**

A. The SGTRC is not operable when the ground wire is disconnected. The build up charges (about 5 to 10 volts) due to plasmas and ESD environment should not be of any concern. **DCN 012**

B. The ORUs and the crew suits and gloves are designed to withstand the ESD requirement of 4000 volts. **DCN 012**

C. The heaters on the TRC are activated on Flight 3A so that their sensors are not susceptible to the 5 to 10 volts of ESD and plasmas. The blanket is removed prior to TRC activation on either Flights 5A or 6A. **DCN 012**

When the MLI blanket is disconnected, the Plasmas Contactor Unit will be operational and will prevent any charges that might be built up by the plasma or ESD environment. **DCN 012**

EMEP TIA–0294 **DCN 013**

C.3.2.1.3.6 MULTILAYER INSULATION **DCN 013**

Exceedance: Four MLI patch blankets used under the meteroid debris shield midspan brackets on the USL (PN 683–52335–031, no CI number) are allowed not to be bonded to conducting structure in accordance with 3.2.1.3.6. **DCN 013**

Rationale: The additional MLI patch blanket sections are being added in response to recent thermal calculations showing a higher than acceptable heat loss. These patches are standard MLI blanket construction, but lack grounding wires. These patches are approximately 137 square centimeters in area. Items less than 100 square centimeters in area are exempt from Class S bonding per 3.2.1.3.1. Homogeneous materials less than 200 square centimeters are exempt from Class S bonding per 3.2.1.3.5. These patches will be installed in contact with other MLI blanket sections which are grounded to the USL structure via Class S electrical bonds and will be underneath the outer meteroid debris shield. This shield is also grounded to the USL structure via Class S electrical bonds. These MLI patch blanket sections will not be exposed to charging mechanisms. **DCN 013**

EMEP TIA–0296 **DCN 012**

C.3.2.1.3.3 CONDUCTIVE MECHANICAL SUBASSEMBLIES/PARTS **DCN 012**

Exceedance: The conductive mechanical subassemblies and part requirement specified in 3.2.1.3.3 shall be relaxed to allow an exception of no bond between the keel and the ITS Z1. **DCN 012**

Rationale: An exception to the 3.2.1.3.3 requirement is to not have an electrical bond between the keel and the ITS Z1 for the following reasons: **DCN 012**

A. The surface area (excluding the holes) of the keel structure is calculated to be about 333 square inches. The surface area of the ITS Z1 is calculated to be about 13,385 square inches. The charge that may build up on the keel due to the plasma and ESD environment is approximately 3 to 7 volts. Comparing it to the potential build up on the ITS Z1 (about 30 volts), the keel build up potential is negligible. There should not be any concern of an ESD during EVA operation. The crew suits and gloves are designed to the ESD requirement of 4000 volts. **DCN 012**

B. There is no ORU installed on the keel. **DCN 012**

C. No safety ground wire is connected to the keel. **DCN 012**

D. The keel is isolated from the ITS Z1, which means that there is no common mode current existing on the keel to cause any conducted or radiated emission. **DCN 012**

E. The keel will be relocated on the ITS Z1 structure only one time. **DCN 012**

During launch, there should not be any ESD voltage or current spike transfer between the shuttle and the ITS Z1 because there is a special longeron latch bond wiper installed on the ITS Z1 trunnion. This provides a class S bonding between the ITS Z1 payload and the shuttle. **DCN 012**