



Space product assurance

Manufacturing and control of electrical harness

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This Standard has been prepared by the ECSS-Q-ST-20-30C Working Group, reviewed by the ECSS Executive Secretariat and approved by the ECSS Technical Authority.

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Figure A-2 : Another figure**Error! Bookmark not defined.**

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Introduction

Electrical harnesses are used to interconnect electronic equipment and as such they have a critical function in any spacecraft.

A harness typically consists of one or more Harness Manufacturing Units (HMU). Each of which is made by arranging wires or cables and electrical termination components in such a way that can be manufactured, handled and integrated as one assembly. Wires and cables may be twisted and tied together to form bundles, and may be protected by common jackets, sleeves or braids.

Electrical harnesses are subjected to the constraints from the manufacturing, assembly, integration and testing/verification phases on ground in addition to those from the launch and space environment.

Electrical harness reliability depends on the robustness of the manufacturing processes, tests and inspections, for which this standard specifies requirements and acceptance criteria.

This standard to large extent applies the well-known IPC standard IPC/WHMA-A-620E 'Requirements and Acceptance for Cable and Wire Harness Assemblies' in conjunction with its addendum IPC/WHMA-A-620E-S 'Space and Military Applications Electronic Hardware Addendum to IPC/WHMA-A-620E'.

Within this standard, clauses and requirements from these IPC standards are made either applicable as is, applicable with modifications, applicable with amendments or not applicable.

In addition, new ECSS requirements are formulated to reflect the needs and best practices in the European Space Industry.

1 Scope

This standard specifies requirements for the manufacturing and control electrical harnesses.

This standard does not apply to Coaxial Cables Assemblies and Optical links. Requirements for Coaxial Cables Assemblies can be found in ECSS-Q-ST-70-18 'Preparation, assembly and mounting of RF coaxial cables'.

This standard does not cover requirements for soldering. Requirements for soldering can be found in ECSS-Q-ST-70-61 'Space product assurance – High reliability assembly for surface mount and through hole connections'.

This standard does not specify requirements for crimping. Requirements for crimping can be found in ECSS-Q-ST-70-26 'Space product assurance – Crimping of high-reliability electrical connections'.

This standard needs to be tailored to the specific characteristic and constrains of the space project on which it is applied in conformance with ECSS-S-ST-00-02.

For specialized harness technologies (such as RF, high data rate and optical data bus interfaces), for which dedicated ECSS standards and ESCC specifications exist, those documents supersede requirements specified in this ECSS standard in case of clashes.

NOTE 1 For radio frequency and microwave cable assemblies see generic specification ESCC 3408 and subordinate detailed specifications.

NOTE 2 For high data cable assemblies see generic specification ESCC 3409 and subordinate detailed specifications.

NOTE 3 For optical cable assemblies see generic specification ESCC 3420 and subordinate detailed specifications.

Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

ECSS-S-ST-00-01	ECSS system – Glossary of terms
ECSS-M-ST-10	Space project management - Project planning and implementation
ECSS-E-ST-20	Space engineering – Electric and electronic
ECSS-Q-ST-70	Space product assurance – Material, mechanical parts and processes
ECSS-Q-ST-70-26	Space product assurance – Crimping of high-reliability electrical connections
ECSS-Q-ST-70-61	Space product assurance – High reliability assembly for surface mount and through hole connections
ESCC 24800	Resistance to solvents of marking, materials and finishes
IPC/WHMA-A-620E	Requirements and acceptance for cable and wire assemblies
IPC/WHMA-A-620E-S	Space and military applications electronic hardware addendum to IPC/WHMA-A-620E

Terms, definitions and abbreviated terms

3.1 Terms from other standards

- a. For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply, in particular for the following terms:
 1. repair
 2. rework
- b. For the purpose of this Standard, the terms and definitions from IPC/WHMA-A-620E and IPC/WHMA-A-620E-S (Addendum for Space and Military Applications) apply, in particular for the following terms:
 1. defect
 2. engineering documentation
 3. manufacturer

3.2 Terms specific to the present standard

3.2.1 harness manufacturing unit

smallest, single harness item that can be manufactured, assembled, tested and integrated as a separate entity

NOTE A harness manufacturing unit can be a complex wiring network, a simple 1:1 cable assembly (e.g. two connectors interconnected by one or multiple wires/cables) or a single termination connector assembly (e.g. safe-and-arm plugs). Harness manufacturing units are typically specified by the harness design authority.

3.3 Abbreviated terms

For the purpose of this Standard, the abbreviated terms and symbols from ECSS-S-ST-00-01 and the following apply:

Abbreviation	Meaning
HMU	harness manufacturing unit

3.4 Conventions

Convention	Meaning
IPC/WHMA-A-620E-(S)	Refers to the sum of the IPC/WHMA-A-620E plus the complementary IPC/WHMA-A-620E-S (Addendum for Space and Military Applications requirements)
Applicable as is	Indicates that the respective section of the IPC standard is fully applicable without any modifications or amendments by this ECSS standard.
Applicable with modification	Indicates that the respective section of the IPC standard is partially modified within this ECSS standard. These modifications supersede the respective statements and requirements in the IPC standard.
Applicable with amendment	Indicates that the respective section of the IPC standard remains fully applicable and is complemented by this ECSS standard.
Not applicable	Indicates that the respective section of the IPC standard is fully not applicable

3.5 Nomenclature

The following nomenclature applies throughout this document:

- a. The word “shall” is used in this Standard to express requirements. All the requirements are expressed with the word “shall”.
- b. The word “should” is used in this Standard to express recommendations. All the recommendations are expressed with the word “should”.

NOTE It is expected that, during tailoring, recommendations in this document are either converted into requirements or tailored out.

- c. The words “may” and “need not” are used in this Standard to express positive and negative permissions, respectively. All the positive permissions are expressed with the word “may”. All the negative permissions are expressed with the words “need not”.
- d. The word “can” is used in this Standard to express capabilities or possibilities, and therefore, if not accompanied by one of the previous words, it implies descriptive text.

NOTE In ECSS “may” and “can” have completely different meanings: “may” is normative (permission), and “can” is descriptive.

- e. The present and past tenses are used in this Standard to express statements of fact, and therefore they imply descriptive text.

4 Principles

4.1 General

The design and definition of a harness is always specific to the user needs. The detailed requirements applicable to a given harness is expected to be included in the engineering documentation agreed upon between the customer and the harness manufacturer.

The existence of the requirements specified in this standard as well as compliance to these requirements does not automatically render the related techniques suitable and qualified for the respective, specific mission application.

Compliance to the requirements in this standard does not automatically establish qualification of the final harness product.

For especially demanding applications, such as cryogenic or highly contamination sensitive, careful tailoring of this standard should be performed to ensure the required performance related to the specific application profile.

4.2 Use of this standard

This standard cannot be used as a standalone document, but needs to be used in conjunction with IPC/WHMA-A-620E and IPC/WHMA-A-620E-S (Addendum for Space and Military Applications).

Clause 6 of this standard is structured in accordance with the sections of the applicable IPC standard. This is done to ease future modifications in line with the given structure of the IPC standard.

4.3 Order of precedence for requirements

Requirements in the engineering document always supersede requirements in this standard. Clashes between engineering documentation provided by the customer and this standard should be brought to the attention of the customer for clarification via statement of compliance or verification control process.

When no requirements are specified in the engineering document for a manufacturing operation, requirements from this standard should be considered with the following order of precedence:

- Requirements specified in clause 7 of this standard.
- Requirements specified in IPC/WHMA-A-620E-S considering applicability in clause 6 of this standard.
- Requirements specified in IPC/WHMA-A-620E for product Class 3 with modifications and amendments given in clause 6 of this standard.

NOTE Product Class 1 and 2 as defined in IPC/WHMA-A-620E are considered insufficient for this standard.

For any cross-reference given within the IPC/WHMA-A-620E-(S), the tailoring specified in clause 6 of this standard applies.

NOTE For instance, IPC/WHMA-A-620E-S section 17.1 is declared [applicable as is], with some requirements making reference to IPC sections 4 and 5. However, sections 4 and 5 are declared [not applicable] as per clause 6 of this ECSS Standard. As a result, these requirements from section 17.1 are not applicable.

5

General requirements

- a. The use of any technique or technology involved in harness manufacturing shall be agreed upon between customer and manufacturer.

NOTE Examples for techniques (non-exhaustive) are crimping, soldering, splicing, welding and potting.

- b. The manufacturer shall establish a qualified process in accordance with ECSS-Q-ST-70 for each technique used for the harness manufacturing.

NOTE All processes are expected to be listed and approved via the DPL issued by the manufacturer in accordance with ECSS-Q-ST-70, Annex C.

- c. IPC/WHMA-A-620E-S (Addendum for Space and Military Applications Requirements) and IPC/WHMA-A-620E shall apply with the conventions for 'Applicable as is', 'Applicable with modification', 'Applicable with amendment' and 'Not applicable' defined in clause 3.4.

6

Applicability of IPC/WHMA-A-620E(-S)

This clause specifies the applicability of the IPC/WHMA-A-620E-S (Addendum for Space and Military Applications Requirements) and IPC/WHMA-A-620E.

The applicability statements, as defined in clause 3.4, for a given section of IPC/WHMA-A-620E(-S) is applicable for all its sub-sections unless for a given sub-section another applicability statement is made.

6.0 IPC/WHMA-A-620E-S, § 0: Addendum for Space and Military Applications Requirements

6.0.1 IPC/WHMA-A-620E-S, § 0.1: Scope

[Applicable as is]

6.0.1.1 IPC/WHMA-A-620E-S, § 0.1.1: Purpose

[Applicable as is]

6.0.1.2 IPC/WHMA-A-620E-S, § 0.1.2: Precedence

[Applicable as is]

6.0.1.3 IPC/WHMA-A-620E-S, § 0.1.3: Existing or Previously Approved Design

[Applicable as is]

6.0.1.4 IPC/WHMA-A-620E-S, § 0.1.4: Use of this Addendum

[Applicable as is]

6.0.1.5 IPC/WHMA-A-620E-S, § 0.1.5: Lead (Pb)-Free Tin

[Applicable as is]

6.0.1.6 IPC/WHMA-A-620E-S, § 0.1.6: Red Plague (Cuprous Oxide Corrosion)

[Applicable with modification]

- a. For wires and cables, which are manufactured, qualified, procured and handled in accordance with ESCC specifications, a Red Plague control plan may be omitted.

6.0.1.7 IPC/WHMA-A-620E-S, § 0.1.7: White Plague (Fluorine Attack)

[Applicable with modification]

- a. For wires and cables, which are manufactured, qualified, procured and handled in accordance with ESCC specifications, a White Plague control plan may be omitted.

6.1 IPC/WHMA-A-620E, § 1.0: General

6.1.1 IPC/WHMA-A-620E-S, § 1.1: Scope

[Applicable as is]

6.1.2 IPC/WHMA-A-620E-S, § 1.2: Purpose

[Applicable as is]

6.1.3 IPC/WHMA-A-620E-S, § 1.3: Classification

[Applicable as is]

6.1.4 IPC/WHMA-A-620E, § 1.4: Measurement Units and Applications

[Applicable as is]

6.1.5 IPC/WHMA-A-620E, § 1.5: Definition of requirements

[Applicable as is]

6.1.5.1 IPC/WHMA-A-620E, § 1.5.1: Inspection Conditions

[Applicable as is]

6.1.5.1.1 IPC/WHMA-A-620E, § 1.5.1.1: Acceptable

[Applicable as is]

6.1.5.1.2 IPC/WHMA-A-620E, § 1.5.1.2: Defect

[Applicable as is]

6.1.5.1.2.1 IPC/WHMA-A-620E-S, § 1.5.1.2.1: Disposition

[Applicable as is]

6.1.5.1.3 IPC/WHMA-A-620E, § 1.5.1.3: Process indicator

[Applicable as is]

6.1.5.1.4 IPC/WHMA-A-620E, § 1.5.1.4: Condition Not Specified

[Applicable as is]

6.1.5.1.5 IPC/WHMA-A-620E, § 1.5.1.5: Uncommon or Specialized Designs

[Applicable as is]

6.1.5.2 IPC/WHMA-A-620E, § 1.5.2: Material and Process Nonconformance

[Applicable as is]

6.1.6 IPC/WHMA-A-620E-S, § 1.6: Process Control

[Applicable as is]

6.1.6.1 IPC/WHMA-A-620E, § 1.6.1: Statistical Process Control

[Applicable as is]

6.1.7 IPC/WHMA-A-620E, § 1.7: Order of Precedence

[Applicable as is]

6.1.8 IPC/WHMA-A-620E, § 1.8: Terms and Definitions

[Applicable as is]

6.1.9 IPC/WHMA-A-620E, § 1.9: Requirements Flowdown

[Not applicable]

- a. Requirement flow down shall be performed in accordance with ECSS-M-ST-10.

6.1.10 IPC/WHMA-A-620E-S, § 1.10: Personnel Proficiency

[Applicable with modification]

Modifications to the IPC/WHMA-A-620E(-S) specified in the frame of this ECSS standard cannot be covered by the *IPC/WHMA-A-620-Space Addendum Training and Certification Program*.

For a manufacturer developed program it is still recommended, but not mandatory, that the training of personnel related to the *IPC/WHMA-A-620-Space Addendum Training and Certification Program* is traceable to a Master IPC trainer.

6.1.11 IPC/WHMA-A-620E, § 1.11: Acceptance Requirements

[Applicable as is]

6.1.12 IPC/WHMA-A-620E, § 1.12: Inspection Methodology

6.1.12.1 IPC/WHMA-A-620E, § 1.12.1: Process Verification Inspection

[Applicable as is]

6.1.12.2 IPC/WHMA-A-620E, § 1.12.2: Visual Inspection

[Applicable as is]

6.1.12.2.1 IPC/WHMA-A-620E-S, § 1.12.2.1: Lighting

[Applicable as is]

6.1.12.2.2 IPC/WHMA-A-620E-S, § 1.12.2.2: Magnification Aids

[Applicable as is]

6.1.13 IPC/WHMA-A-620E, § 1.13: Facilities

[Applicable as is]

6.1.14 IPC/WHMA-A-620E, § 1.14: Electrostatic Discharge (ESD) Protection

[Applicable as is]

6.1.15 IPC/WHMA-A-620E, § 1.15: Tools and Equipment

[Applicable as is]

6.1.16 IPC/WHMA-A-620E(-S), § 1.16: Materials and Processes

[Not applicable]

- a. Materials and Processes shall be handled in accordance with ECSS-Q-ST-70.

6.1.17 IPC/WHMA-A-620E, § 1.17: Electrical Clearance

[Applicable as is]

6.1.18 IPC/WHMA-A-620E, § 1.18: Contamination

[Applicable as is]

6.1.19 IPC/WHMA-A-620E, § 1.19: Rework/Repair

[Applicable as is]

6.1.19.1 IPC/WHMA-A-620E, § 1.19.1: Rework

[Not applicable]

The definition of ‘rework’ as per ECSS-S-ST-00-01 applies.

- a. Rework shall be documented.
- b. Rework shall be performed in accordance with the applicable requirements in this standard.

6.1.19.2 IPC/WHMA-A-620E, § 1.19.2: Repair

[Not applicable]

The definition of ‘repair’ as per ECSS-S-ST-00-01 applies.

- a. Repair shall be documented.
- b. Repair shall be performed in accordance with documented procedures agreed between the manufacturer and the customer.
- c. Any deviation of the repair procedure to the requirements in this standard and any deviation of the final product as consequence of the repair procedure to the requirements in this standard shall be highlighted by the manufacturer and agreed with the customer prior to performing.

NOTE For deviations a “Request for Deviation” or “Waiver” can be used.

6.1.19.3 IPC/WHMA-A-620E, § 1.19.3: Post Rework/Repair Cleaning

[Applicable as is]

6.2 IPC/WHMA-A-620E, § 2.0: Applicable documents

[Not applicable]

Applicable documents listed in the IPC/WHMA-A-620E are considered for reference only **unless specifically referenced by a requirement made applicable by this standard.**

6.3 IPC/WHMA-A-620E, § 3.0: Wires

[Applicable as is]

6.3.1 IPC/WHMA-A-620E-(S), § 3.1: Stripping

[Not applicable]

6.3.2 IPC/WHMA-A-620E-(S), § 3.2: Strand Damage and End Cuts

[Not applicable]

6.3.3 IPC/WHMA-A-620E, § 3.3: Conductor Deformation/Birdcaging

[Not applicable]

6.3.4 IPC/WHMA-A-620E, § 3.4: Twisting of Wires

[Applicable as is]

6.3.5 IPC/WHMA-A-620E, § 3.5: Insulation Damage - Striping

[Not applicable]

6.4 IPC/WHMA-A-620E-(S), § 4.0: Soldered Terminations

[Not applicable]

6.5 IPC/WHMA-A-620E-(S), § 5.0: Crimp termination (Contact and Lugs)

[Not applicable]

6.6 IPC/WHMA-A-620E(-S), § 6.0: Insulation displacement connection (IDC)

[Not applicable]

6.7 IPC/WHMA-A-620E(-S), § 7.0: Ultrasonic Welding

[Not applicable]

6.8 IPC/WHMA-A-620E, § 8.0: Splice

[Applicable as is]

6.8.1 IPC/WHMA-A-620E(-S), § 8.1: Soldered Splices

[Not applicable]

6.8.2 IPC/WHMA-A-620E(-S), § 8.2: Crimped Splices

[Not applicable]

6.8.3 IPC/WHMA-A-620E(-S), § 8.3: Ultrasonic Weld Splices

[Not applicable]

6.8.4 IPC/WHMA-A-620E-S, § 8.4: Sleeving over Splices

[Applicable with amendment]

- a. The minimum sleeving overlap shall be 3mm.

6.9 IPC/WHMA-A-620E, § 9.0: Connectorization

[Applicable as is]

6.9.1 IPC/WHMA-A-620E, § 9.1: Hardware Mounting

6.9.1.1 IPC/WHMA-A-620E-S, § 9.1.1: Hardware Mounting – Jackpost - Height

[Applicable as is]

6.9.1.2 IPC/WHMA-A-620E, § 9.1.2: Hardware Mounting – Jackscrews - Protrusion

[Applicable as is]

6.9.1.3 IPC/WHMA-A-620E, § 9.1.2: Hardware Mounting – Retaining Clips

[Applicable as is]

6.9.1.4 IPC/WHMA-A-620E, § 9.1.2: Hardware Mounting – Connector Alignment

[Applicable as is]

6.9.2 IPC/WHMA-A-620E, § 9.2: Strain relief

6.9.2.1 IPC/WHMA-A-620E-S, § 9.2.1: Strain relief - Clamp fit

[Applicable with amendment]

- a. The use of build-up material shall be agreed between manufacturer and customer prior to use.
- b. Wires and cables under a cable clamp shall be protected against mechanical damages induced by the cable clamp by means of a dedicated layer of protective material.

NOTE Typical protective, build-up materials utilised for that purpose are sleeves or tapes (e.g. Polyimide/Kapton or Aluminium)

6.9.2.2 IPC/WHMA-A-620E, § 9.2.2: Strain relief - Wire dress

[Applicable as is]

6.9.2.2.1 IPC/WHMA-A-620E, § 9.2.2.1: Strain relief - Wire dress - Straight approach

[Applicable with amendment]

The following complement is added to clarify the definition of a sharp angle in the frame of the defect definition. A sharp angle is an angle of more than 45° between the longitudinal axis of the contact and the wires (see Figure 6-1).

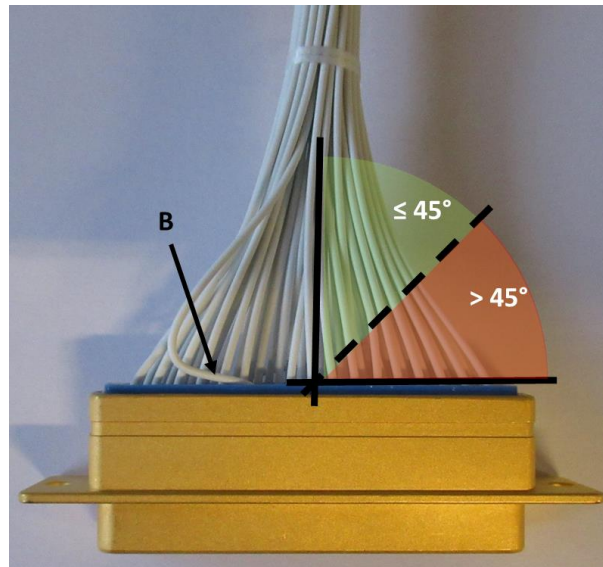


Figure 6-1: Sharp angle definition

6.9.2.2.2 IPC/WHMA-A-620E, § 9.2.2.1: Strain relief - Wire dress - Side approach

[Applicable as is]

6.9.3 IPC/WHMA-A-620E, § 9.3: Sleeving and Boots

[Applicable as is]

6.9.4 IPC/WHMA-A-620E, § 9.4: Connector damage

6.9.4.1 IPC/WHMA-A-620E, § 9.4.1: Connector Damage - Criteria

[Applicable as is]

6.9.4.2 IPC/WHMA-A-620E-S, § 9.4.2: Connector Damage - Limits - Hard Face - Mating Surface

[Applicable as is]

6.9.4.3 IPC/WHMA-A-620E-S, § 9.4.3: Connector Damage - Limits - Soft Face - Mating Surface or Rear Seal Area

[Applicable as is]

6.9.4.4 IPC/WHMA-A-620E-S, § 9.4.4: Connector Damage - Contacts

[Applicable as is]

6.9.4.4.1 IPC/WHMA-A-620E-S, § 9.4.4.4.1: Connector Damage -
Contacts - Exposed Sockets, Protected Pins, e.g., MIL-DTL-
83513 Micro D

[Applicable as is]

**6.9.4.5 IPC/WHMA-A-620E-S, § 9.4.5: Connector Damage –
Seals/Gaskets**

[Applicable as is]

**6.9.5 IPC/WHMA-A-620E-S, § 9.5: Installation of
Contacts and Sealing Plugs into Connectors**

[Applicable as is]

**6.9.5.1 IPC/WHMA-A-620E, § 9.5.1: Installation of Contacts
and Sealing Plugs into Connectors – Installation of
Contacts**

[Applicable as is]

**6.9.5.2 IPC/WHMA-A-620E, § 9.5.2: Installation of Contacts
and Sealing Plugs into Connectors – Installation of
Sealing Plugs**

[Applicable as is]

6.10 IPC/WHMA-A-620E-S, § 10: Over-Molding/ Potting

[Applicable as is]

6.10.1 IPC/WHMA-A-620E, § 10.1: Over-Molding

[Applicable as is]

**6.10.2 IPC/WHMA-A-620E, § 10.2: Potting
(Thermoset Molding)**

[Applicable as is]

**6.10.3 IPC/WHMA-A-620E, § 10.3: Over-Molding of
Flexible Flat Ribbon**

[Applicable as is]

6.11 IPC/WHMA-A-620E, § 11.0: Measuring Cable Assemblies and Wires

[Applicable as is]

6.12 IPC/WHMA-A-620E-S, § 12.0: Marking/Labelling

[Applicable as is]

6.12.1 IPC/WHMA-A-620E, § 12.1: Content

[Applicable as is]

6.12.2 IPC/WHMA-A-620E, § 12.2: Legibility

[Applicable as is]

6.12.3 IPC/WHMA-A-620E, § 12.3: Permanency

[Applicable with amendment]

- a. Marking and colour-coding shall be resistant to solvents as specified in ESCC 24800.

6.12.4 IPC/WHMA-A-620E-S, § 12.4: Location and Orientation

[Applicable as is]

6.12.5 IPC/WHMA-A-620E, § 12.5: Functionality

[Applicable as is]

6.12.6 IPC/WHMA-A-620E, § 12.6: Marker Sleeve

6.12.6.1 IPC/WHMA-A-620E, § 12.6.1: Marker Sleeve – Wrap Around

[Applicable as is]

6.12.6.2 IPC/WHMA-A-620E-S, § 12.6.2: Marker Sleeve – Tubular

[Applicable with amendment]

- a. Marking sleeves shall be free from burn marks or charring due to excessive overheating (see Figure 6-2Figure 6-1).

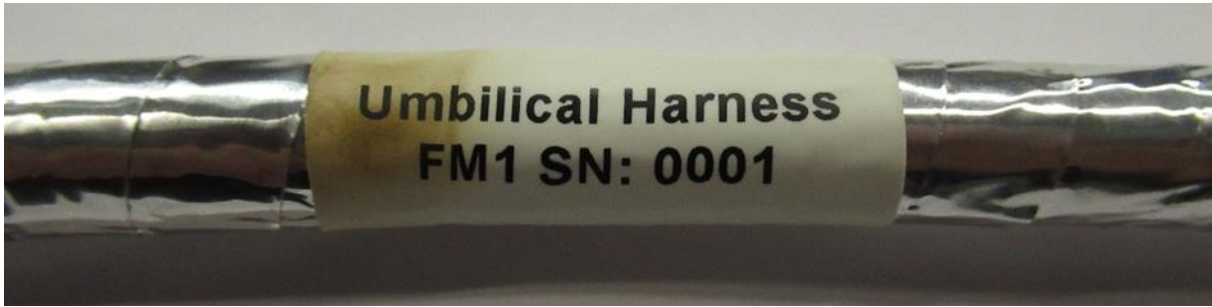


Figure 6-2: Excessive (defect) overheating of marking sleeves

- b. Slight discoloration due to minor overheating shall not be a cause of rejection but be treated as process indicator in accordance with the IPC/WHMA-A-620 (see Figure 6-3).

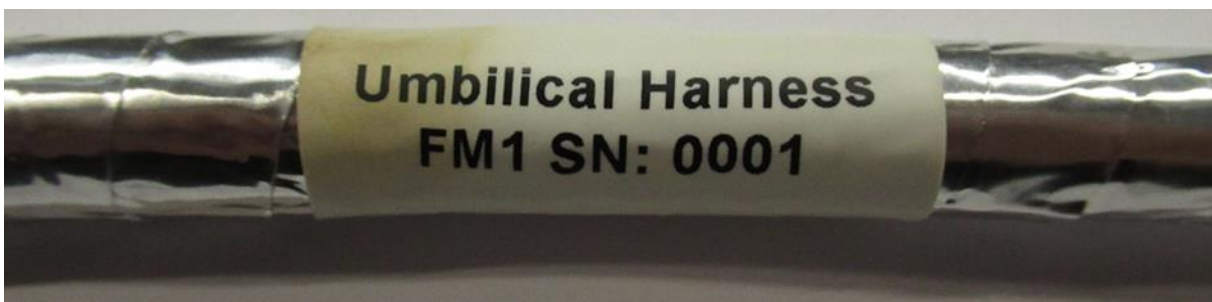


Figure 6-3: Minor (acceptable) overheating of marking sleeves

6.12.7 IPC/WHMA-A-620E, § 12.7: Flag Markers

6.12.7.1 IPC/WHMA-A-620E, § 12.7.1: Flag Markers - Adhesive

[Applicable as is]

6.12.8 IPC/WHMA-A-620E, § 12.8: Tie Wrap Markers

[Applicable as is]

6.13 IPC/WHMA-A-620E(-S), § 13.0: Coaxial and Biaxial Cable Assemblies

[Not applicable]

Requirements for preparation, assembly and mounting of RF coaxial cables are specified in ECSS-Q-ST-70-18.

6.14 IPC/WHMA-A-620E-S, § 14.0: Securing

[Applicable as is]

6.14.1 IPC/WHMA-A-620E-S, § 14.1: Tie Wrap/ Lacing application

[Applicable with amendment]

- a. Cut end protrusion shall be 0 mm to 0,5 mm and square to the face of the tie wrap.

NOTE A receded tie-wrap tail with regards to the collar head (see Figure 6-4) is considered as a negative protrusion as thus not acceptable.

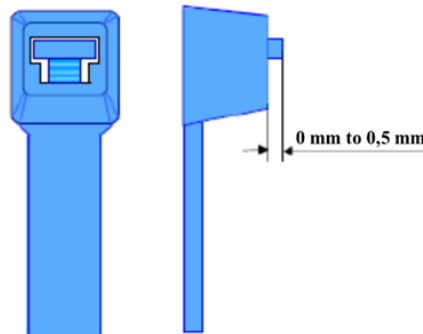


Figure 6-3: Tie-wrap – acceptable cut end protrusion



Figure 6-4: Tie-wrap – receded tail

- b. Where a tie wrap is used to fix a harness bundle to a structural element, a dedicated layer of protection shall be applied onto the bundle under the tie wrap.

NOTE The term structural element here means any element that prevents the tie-wrap from moving with the harness under mechanical loads.

6.14.1.1 IPC/WHMA-A-620E, § 14.1.1: Tie Wrap/ Lacing Application - Tightness

[Applicable with modification]

- a. The insulation shall not be damaged by the restraining device
- b. Compression of the insulation shall not degrade the performance of the cables and is controlled by a qualified process in accordance with requirement 5b.

NOTE Compression of insulation can lead to reduction in insulation thickness and thus affect performance parameters such as insulation resistance and insulation breakdown voltage.

- c. For insulation materials sensitive to creeping (cold-flow), measures shall be taken to protect the respective material from compressive stress induced by the restraining device.

NOTE Example for materials sensitive to creeping (cold-flow) are PTFE and FEP.

NOTE Measures can include the addition of local cable protection under the restraining device

6.14.1.2 IPC/WHMA-A-620E, § 14.1.2: Tie Wrap/ Lacing Application - Damage

[Applicable as is]

6.14.1.3 IPC/WHMA-A-620E, § 14.1.3: Tie Wrap/ Lacing Application - Spacing

[Applicable as is]

6.14.2 IPC/WHMA-A-620E, § 14.2: Breakouts

6.14.2.1 IPC/WHMA-A-620E-S, § 14.2.1: Breakouts – Individual Wires

[Applicable as is]

6.14.2.2 IPC/WHMA-A-620E, § 14.2.2: Breakouts - Spacing

[Applicable as is]

6.14.3 IPC/WHMA-A-620E, § 14.3: Routing

6.14.3.1 IPC/WHMA-A-620E, § 14.3.1: Routing – Wire Crossover

[Applicable as is]

6.14.3.2 IPC/WHMA-A-620E, § 14.3.2: Routing – Bend Radius

[Applicable as is]

6.14.3.3 IPC/WHMA-A-620E, § 14.3.3: Routing – Coaxial Cable

[Applicable as is]

6.14.3.4 IPC/WHMA-A-620E, § 14.3.4: Routing – Unused Wire Termination

[Applicable as is]

6.14.3.5 IPC/WHMA-A-620E, § 14.3.5: Routing – Ties over Splices and Ferrules

[Applicable as is]

6.14.4 IPC/WHMA-A-620E, § 14.2: Broom Stitching

[Applicable as is]

6.15 IPC/WHMA-A-620E, § 15.0: Harness/Cable Electrical Shielding**6.15.1 IPC/WHMA-A-620E-S, § 15.1: Braided**

[Applicable with modification]

- a. Table 15-1 of IPC/WHMA-A-620E-S is not applicable. Any broken strand shall be considered as a defect.

6.15.2 IPC/WHMA-A-620E-S, § 15.2: Shield Termination

[Applicable as is]

6.15.2.1 IPC/WHMA-A-620E, § 15.2.1: Shield Termination - Shield Jumper Wire

- 6.15.2.1.1 IPC/WHMA-A-620E(-S), § 15.2.1.1: Shield Termination - Shield Jumper Wire - Attached Lead

[Not applicable]

- 6.15.2.1.1.1 IPC/WHMA-A-620E(-S), § 15.2.1.2.1: Shield Termination - Shield Jumper Wire - Attached Lead - Solder

[Not applicable]

- 6.15.2.1.1.2 IPC/WHMA-A-620E, § 15.2.1.2.1: Shield Termination - Shield Jumper Wire - Attached Lead - Crimp

[Not applicable]

- 6.15.2.1.2 IPC/WHMA-A-620E(-S), § 15.2.1.2: Shield Termination - Shield Jumper Wire - Shield braid

[Not applicable]

**6.15.2.1.2.1 IPC/WHMA-A-620E, § 15.2.1.2.1: Shield Termination -
Shield Jumper Wire - Shield braid - Woven**

[Applicable with modification]

- a. Any broken strand shall be considered as a defect

**6.15.2.1.2.2 IPC/WHMA-A-620E, § 15.2.1.2.2: Shield Termination -
Shield Jumper Wire - Shield braid – Combed and twisted**

[Applicable as is]

**6.15.2.1.3 IPC/WHMA-A-620E(-S), § 15.2.1.1: Shield Termination -
Shield Jumper Wire – Daisy Chain**

[Not applicable]

**6.15.2.1.4 IPC/WHMA-A-620E, § 15.2.1.1: Shield Termination - Shield
Jumper Wire – Common Ground point**

[Not applicable]

**6.15.2.2 IPC/WHMA-A-620E, § 15.2.2: Shield Termination –
Unterminated Shield**

[Applicable as is]

**6.15.2.2.1 IPC/WHMA-A-620E, § 15.2.2.1: Shield Termination -
Unterminated Shield - Shield Not Folded Back:**

[Applicable with modification]

Any criteria (acceptable, process indicator or defect) limiting the stripped shield length specified in this IPC section is considered not applicable.

- a. An additional insulation layer shall be added between the exposed shielding and the wire insulation and shall extend beyond the end of the exposed shield by at least 2 mm to prevent the sharp braid ends from damaging the wire insulation.

**6.15.2.2.2 IPC/WHMA-A-620E, § 15.2.2.1: Shield Termination -
Unterminated Shield - Shield Folded Back:**

[Applicable as is]

**6.15.3 IPC/WHMA-A-620E, § 15.3: Shield
Termination - Connector**

**6.15.3.1 IPC/WHMA-A-620E-S, § 15.3.1: Shield Termination -
Connector - Shrink**

[Applicable as is]

6.15.3.2 IPC/WHMA-A-620E-S, § 15.3.2: Shield Termination - Connector - Crimp

[Applicable with modification]

- a. The crimp ring shall not extend beyond the crimp area.
- b. The number of shield strands not contained under the crimp ring shall be less than 6% of the total number of strands within the shield.
- c. Trimmed strand ends shall be covered by a protective insulation layer.

6.15.3.3 IPC/WHMA-A-620E-S, § 15.3.1: Shield Termination - Connector - Shield Jumper Wire attachment

[Applicable as is]

6.15.3.4 IPC/WHMA-A-620E, § 15.3.1: Shield Termination - Connector - Soldered

[Not applicable]

6.15.4 IPC/WHMA-A-620E, § 15.4.1: Shield Termination - Splicing Prewoven

[Applicable as is]

6.15.4.1 IPC/WHMA-A-620E(-S), § 15.4.1: Shield Termination - Splicing Prewoven - Soldered

[Not applicable]

6.15.4.2 IPC/WHMA-A-620E §15.4.2: Shield termination - Splicing Prewoven - Tie/Tape On:

[Applicable as is]

6.15.5 IPC/WHMA-A-620E, § 15.5: Tapes - Barrier and Conductive, Adhesive or Non-Adhesive

[Applicable with amendment]

IPC/WHMA-A-620E section 15.5 is not applicable for EMI shielding or shielding against ionizing radiation.

NOTE The application of shielding for EMI and ionizing radiation is described in clause 7.8 of this standard.

6.15.6 IPC/WHMA-A-620E, § 15.6: Conduit (Shielding)

[Applicable as is]

**6.15.7 IPC/WHMA-A-620E(-S), § 15.6: Shrink Tubing
– Conductive Lined**

[Not applicable]

**6.16 IPC/WHMA-A-620E, § 16.0: Harness/Cable
Protective Coverings**

[Applicable as is]

6.16.1 IPC/WHMA-A-620E, § 16.1: Braid

6.16.1.1 IPC/WHMA-A-620E, § 16.1.1: Braid – Direct Applied

[Applicable as is]

6.16.1.2 IPC/WHMA-A-620E-S, § 16.1.2: Braid - Prewoven

[Applicable as is]

**6.16.2 IPC/WHMA-A-620E, § 16.2: Sleeving/Shrink
Tubing**

[Applicable as is]

**6.16.3 IPC/WHMA-A-620E(-S), § 16.3: Spiral Plastic
Wrap (Spiral Wrap Sleeving)**

[Not applicable]

**6.16.4 IPC/WHMA-A-620E, § 16.4: Wire Loom
Tubing – Split and Unsplit**

[Applicable as is]

**6.16.5 IPC/WHMA-A-620E, § 16.5: Tapes, Adhesive
and Non-Adhesive**

[Applicable as is]

**6.17 IPC/WHMA-A-620E-S, § 17.0: Finished assembly
Installation**

[Applicable as is]

6.17.1 IPC/WHMA-A-620E-S, § 17.1: General

[Applicable as is]

6.17.2 IPC/WHMA-A-620E-S, § 17.2: Hardware installation

[Applicable as is]

6.17.2.1 IPC/WHMA-A-620E, § 17.2.1: Hardware installation – Threaded Fasteners

[Not applicable]

6.17.2.2 IPC/WHMA-A-620E(-S), § 17.2.2: Hardware installation - Wires

[Not applicable]

6.17.2.3 IPC/WHMA-A-620E, § 17.2.3: Hardware installation – Safety Wiring

[Not applicable]

6.17.3 IPC/WHMA-A-620E, § 17.3: Wire/Harness installation

[Not applicable]

6.18 IPC/WHMA-A-620E(-S), § 18.0: Solderless Wrap

[Not applicable]

Solderless Wrap connection requirements are specified in ECSS-Q-ST-70-30.

6.19 IPC/WHMA-A-620E, § 19.0: Testing

[Applicable as is]

6.19.1 IPC/WHMA-A-620E, § 19.1: Nondestructive Tests

[Applicable as is]

6.19.2 IPC/WHMA-A-620E, § 19.2: Testing After Rework or Repair

[Applicable as is]

6.19.3 IPC/WHMA-A-620E, § 19.3: Intended Table Usage

[Applicable as is]

6.19.4 IPC/WHMA-A-620E-S, § 19.4: Electrical Test

[Applicable with Amendment]

a. The manufacturer shall maintain a mating and de-mating logbook for each connector, including at a minimum

1. Project designation
2. Harness / HMU identifier
3. CI number of the Harness / HMU
4. Serial number (SN) of the Harness / HMU
5. Connector identifier

NOTE Connectors are typically identified using the scheme *UNIT_A000*, where:

- 'UNIT' denotes the name of the unit (e.g. PCDU)
- 'A' denotes the connector gender with P for Plug and J for Jack
- '000' denotes a sequential number unique to the unit, starting with 001

6. Dedicated record of each mating and de-mating operation
7. Date and signature for each mating and de-mating operation by the respective operator or inspector
8. Maximum number of allowed mating cycles

NOTE 1 A mating cycle is defined as one (1) mating and one (1) de-mating operation

NOTE 2 The maximum number of allowed cycles is typically specified in the engineering documentation, manufacturer datasheet or applicable standards

9. (De-)Mating justification

NOTE 1 Typically includes the reason for the mating operation (e.g. electrical testing, electrical AIT) and indicates the use of savers or mating to flight equipment

NOTE 2 Annex B can be used as template for the mating logbook.

b. The test procedure shall ensure that the harness is fully discharged at the end of each test and prior to disconnecting the harness from the test equipment.

6.19.4.1 IPC/WHMA-A-620E-S, § 19.4.1: Electrical Test - Selection

[Applicable with modification]

- a. The 'Shorts' test is not required by default and shall only be performed when specified by the customer.

6.19.5 IPC/WHMA-A-620E, § 19.5: Electrical Test Methods**6.19.5.1 IPC/WHMA-A-620E, § 19.5.1: Electrical Test Methods - Continuity**

[Applicable with amendment]

- a. Continuity testing shall be performed on any intentionally conductive paths, including shielding.

6.19.5.2 IPC/WHMA-A-620E-S, § 19.5.1: Electrical Test Methods - Shorts

[Applicable as is]

6.19.5.3 IPC/WHMA-A-620E-S, § 19.5.1: Electrical Test Methods - Dielectric Withstanding Voltage (DWV)

[Applicable as is]

6.19.5.4 IPC/WHMA-A-620E-S, § 19.5.1: Electrical Test Methods - Insulation Resistance (IR)

[Applicable as is]

6.19.5.5 IPC/WHMA-A-620E, § 19.5.1: Electrical Test Methods - Voltage Standing Wave Ratio (VSWR)

[Not applicable]

6.19.5.6 IPC/WHMA-A-620E, § 19.5.1: Electrical Test Methods - Insertion Loss

[Not applicable]

6.19.5.7 IPC/WHMA-A-620E, § 19.5.1: Electrical Test Methods - Reflection Coefficient

[Not applicable]

6.19.5.8 IPC/WHMA-A-620E, § 19.5.1: Electrical Test Methods - User Defined

[Applicable as is]

6.19.6 IPC/WHMA-A-620E, § 19.6: Mechanical Test**6.19.6.1 IPC/WHMA-A-620E(-S), § 19.6.1: Mechanical Test - Selection**

[Not applicable]

- a. Contact Retention Verification shall be performed in accordance with IPC/WHMA-A-620E-S, section 19.7.5.

6.19.7 IPC/WHMA-A-620E, § 19.7: Mechanical Test Methods**6.19.7.1 IPC/WHMA-A-620E(-S), § 19.7.1: Mechanical Test Methods – Crimp Height (Dimensional Analysis)**

[Not applicable]

6.19.7.2 IPC/WHMA-A-620E(-S), § 19.7.2: Mechanical Test Methods – Pull Force (Tensile)

[Not applicable]

6.19.7.3 IPC/WHMA-A-620E, § 19.7.3: Mechanical Test Methods – Crimp Force Monitoring

[Not applicable]

6.19.7.4 IPC/WHMA-A-620E, § 19.7.4: Mechanical Test Methods – Crimp Tool Qualification

[Not applicable]

6.19.7.5 IPC/WHMA-A-620E-S, § 19.7.5: Mechanical Test Methods – Contact Retention Verification

[Applicable as is]

6.19.7.5.1 IPC/WHMA-A-620E-S, § 19.7.5.1: Mechanical Test Methods – Contact Retention Verification – Push Testing

[Applicable as is]

6.19.7.5.2 IPC/WHMA-A-620E-S, § 19.7.5.2: Mechanical Test Methods – Contact Retention Verification – Pull Testing

[Applicable as is]

6.19.7.6 IPC/WHMA-A-620E(-S), § 19.7.6: Mechanical Test Methods – RF Connector Shield Pull Force (Tensile)

[Not applicable]

**6.19.7.7 IPC/WHMA-A-620E, § 19.7.7: Mechanical Test
Methods – RF Connector Shield Ferule Torsion**

[Not applicable]

**6.19.7.8 IPC/WHMA-A-620E, § 19.7.7: Mechanical Test
Methods – User Defined**

[Applicable as is]

**6.20 IPC/WHMA-A-620E, § 20.0: High voltage
application**

[Not Applicable]

Soldering requirements for high voltage applications are specified in ECSS-Q-ST-70-61.

Complementary requirements

7.1 Information

This clause specifies topics and respective requirements to complement and/or substitute parts of the IPC standards.

7.2 General Requirements

- a. Any bare conductor at the back of a connector shall be insulated.

NOTE The back of a connector is where the contact, crimped to a wire, enters the connector insulator as opposed to the front of the connector which mated the respective interface counterpart.

NOTE Common means to implement insulation are:

- Application of insulation sleeves
- Potting
- Use of grommets

7.3 Soldering

- a. All processes related to soldering operations shall be performed in accordance with ECSS-Q-ST-70-61.

7.4 Crimping

- a. All processes related to crimping operations shall be performed in accordance with ECSS-Q-ST-70-26.

7.5 Insulation sleeving on contact termination

- a. Insulation sleeving shall overlap the contact barrel and the wire insulation by a minimum of two times the wire diameter or 3 mm, whichever is greater.
- b. Insulation sleeving shall not prevent the movement of the contact inside connector insulator.
- c. Insulation sleeve shall not slide or vibrate off.

NOTE Additional shrinking sleeves can be added to build up the diameter of the wire so the outer

shrinking sleeve is tight on the assembly from one end to the other as illustrated in Figure 7-1.



Figure 7-1: Double sleeving on D-Sub contacts

- d. Insulation sleeve shall not cover the inspection hole as illustrated in Figure 7-2.

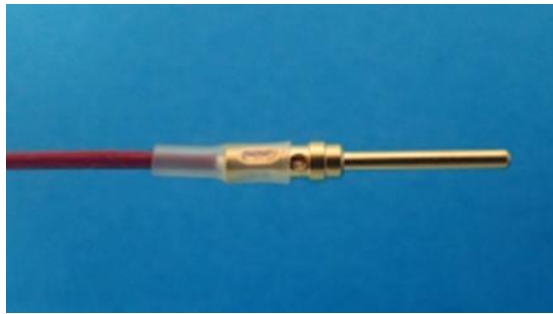


Figure 7-2: Insulation sleeving over pin contact

- e. In case the geometry of the connector allows, the insulation sleeve shall enter into the insulator cavity of the connector, not leaving any exposed conductor detectable by visual inspection at a 45° angle to the cavity axis as illustrated in Figure 7-3.

NOTE Verification can be done by visual inspection only.

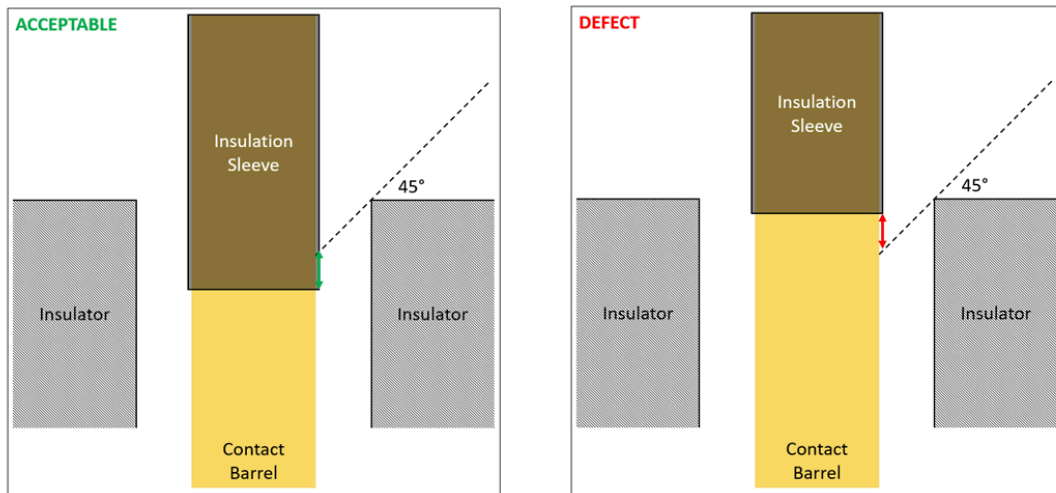


Figure 7-3: Inspection of exposed conductor into connector insulator

- f. In case the geometry of the connector does not allow the insulation sleeve to enter into the insulator cavity of the connector, the gap between the insulator and the sleeve shall be 0,5 mm or less from the point where the connector terminal enters the connector insert.

NOTE Examples of acceptable and unacceptable gaps are depicted in Figure 7-4.

- g. In case the connector is subject to reliable insulation, clause 4.2.1.2 of ECSS-E-ST-20 shall be applied instead of requirement 7.5e and 7.5f.

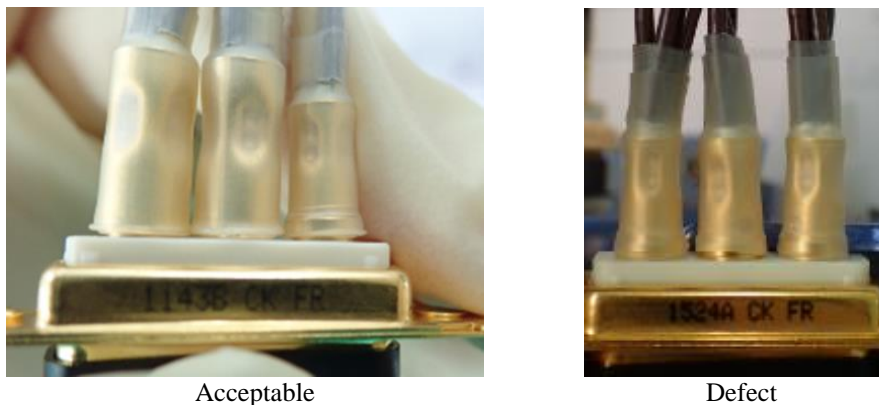


Figure 7-4: Gap between sleeve and insulating insert

- h. There shall be no foreign particles entrapped underneath the shrinking sleeve.

NOTE Examples of a foreign particle trapped underneath a shrinking sleeve is shown in Figure 7-5.

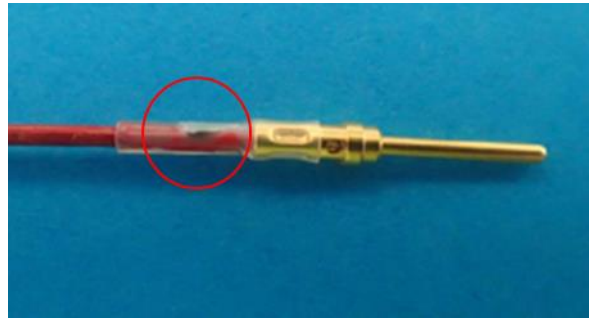


Figure 7-5: Example of foreign particles entrapped under shrinking sleeve

- i. Shrinking sleeve shall not show any signs of excessive deformation or stress.

NOTE For example whitening as shown in Figure 7-6

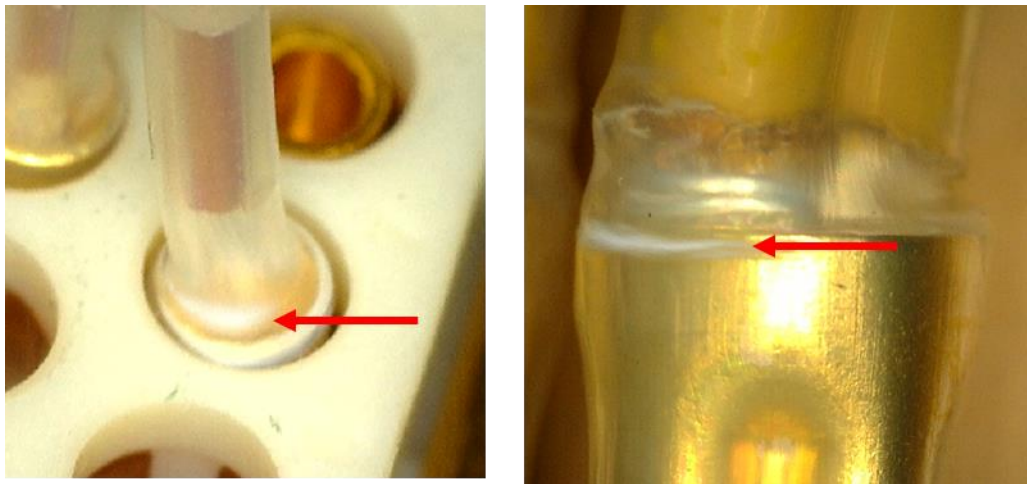


Figure 7-6: Example of sleeve showing signs of excessive deformation

7.6 Labelling and marking:

- a. For connector identification labels applied longitudinally to the harness bundle the read direction of the marking on the label shall be towards connector (see Figure 7-7).



Figure 7-7: Connector label applied onto harness bundle

- b. For connector identification labels applied perpendicular to the harness bundle the marking on the label shall be readable upright looking from harness side towards connector (see Figure 7-8).



Figure 7-8: Marking on connector backshell or with a flag

7.7 Branching of metallic braid-shielded bundles:

- a. An additional insulation layer shall be positioned under shielding and shall extend beyond shielding termination to prevent sharp edges from cut braid ends to damage the underlying wire and cable insulation (see Figure 7-9).
- b. Overlapping braids shall be secured on all branches over the full length of the overlap (see Figure 7-10).
- c. The required optical coverage of the braided shield shall be maintained across the entire branching area (see Figure 7-11).
- d. The ends of the braid shall be secured.
- e. The braids of the different branches shall overlap for at least 30 mm or two times the diameter of the largest bundle, whichever is longer, at the breakout.
- f. The open ends of the braid shall be cut in a uniform manner.
- g. The open ends of the braid shall be free of fraying, unraveling and pulled loops (see Figure 7-11).
- h. The braid shall be free of bulges and dents.
- i. The braid shall be free of tears and cuts (see Figure 7-11).

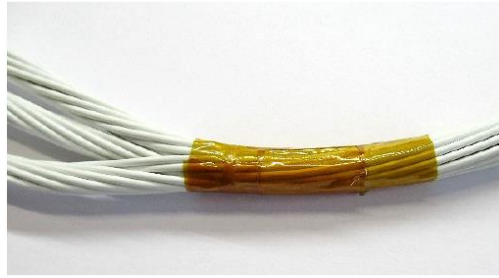


Figure 7-9: Insulation protection under the shield at the breakout



Figure 7-10: Secured braid along the breakout

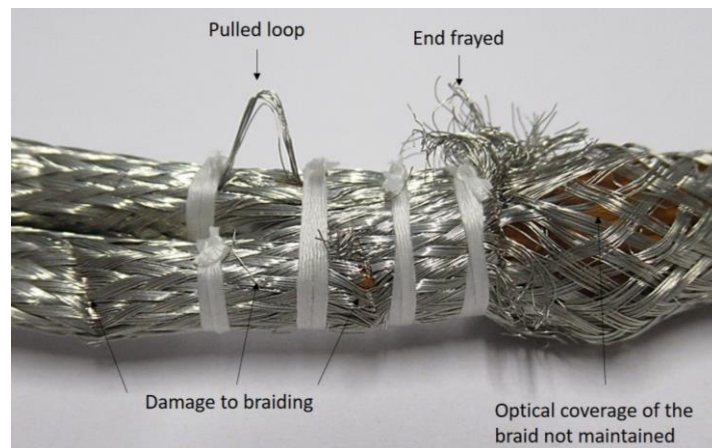


Figure 7-11: Example of defective braided shield

7.8 EMC shielding with conductive metal foil

- a. Shielding of harness bundles with conductive, metal foil to achieve Electromagnetic Compatibility shall be performed by helicoidal wrapping around the bundle as depicted in Figure 7-12.

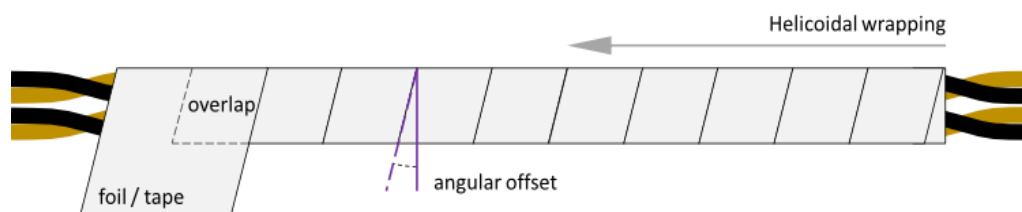


Figure 7-12: Helicoidal wrapping of conductive shield

- b. The wrapping shall be performed with an overlap of at least 50 %.

NOTE Handling and in particular bending of harness bundles can alter the overlap of the wrapping locally when using non-adhesive foils.

- c. The harness manufacturer shall ensure the electrical continuity of the shield along the entire harness.

NOTE For example by wrapping using a single, continuous piece of foil or utilizing a drain wire.

- d. Wrapping shall be tight to the bundle as shown in Figure 7-13 and not slide along the bundle as indicated in Figure 7-14.



Figure 7-13: Example of acceptable foil shielding



Figure 7-14: Example of not acceptable, loose foil shielding

- e. The ends of the foil pieces shall be secured.
- f. The foil shall be free of tears, cracks and holes as shown in Figure 7-15.



Figure 7-15: Example of not acceptable foil shielding

- g. The foil shall be free of wrinkles that jeopardize shield continuity and proper shield function or are prone to tearing.

NOTE Minor wrinkles are considered unavoidable and acceptable.

- h. Foil wrappings of the different branches shall overlap at the breakout for at least 30 mm or two times the diameter of the largest bundle, whichever is longer.

Annex A (informative)

Applicability tables

A.1 IPC/WHMA-A-620E(-S) applicability table

Table A-1 provides the applicability of all sections for both IPC/WHMA-A-620E and the Addendum for Space and Military Applications IPC/WHMA-A-620E-S in line with clause 6 of this standard for quick and easy reference.

Table A-1: Applicability of IPC/WHMA-A-620E(-S)

Section	Section Title	Applicability	Standard
0	Addendum for Space and Military Applications Requirements	-	620E-S
0.1	Scope	as is	620E-S
0.1.1	Purpose	as is	620E-S
0.1.2	Precedence	as is	620E-S
0.1.3	Existing or Previously Approved Design	as is	620E-S
0.1.4	Use of this Addendum	as is	620E-S
0.1.5	Lead (Pb)-Free Tin	as is	620E-S
0.1.6	Red Plague (Cuprous Oxide Corrosion)	with modification	620E-S
0.1.7	White Plague (Fluorine Attack)	with modification	620E-S
1.0	General	-	620E
1.1	Scope	as is	620E-S
1.2	Purpose	as is	620E-S
1.3	Classification	as is	620E-S
1.4	Measurement Units and Applications	as is	620E
1.5	Definition of Requirements	as is	620E
1.5.1	Inspection Conditions	as is	620E
1.5.1.1	Acceptable	as is	620E
1.5.1.2	Defect	as is	620E
1.5.1.2.1	Disposition	as is	620E-S
1.5.1.3	Process indicator	as is	620E
1.5.1.4	Condition Not Specified	as is	620E
1.5.1.5	Uncommon or Specialized Designs	as is	620E
15.2	Material and Process Nonconformance	as is	620E
1.6	Process Control	as is	620E-S
1.6.1	Statistical Process Control	as is	620E
1.7	Order of Precedence	as is	620E

Section	Section Title	Applicability	Standard
1.8	Terms and Definitions	as is	620E
1.9	Requirements Flowdown	not applicable	620E
1.10	Personnel Proficiency	with modification	620E-S
1.11	Acceptance Requirements	as is	620E
1.12	Inspection Methodology	-	620E
1.12.1	Process Verification Inspection	as is	620E
1.12.2	Visual Inspection	as is	620E
1.12.2.1	Lighting	as is	620E-S
1.12.2.2	Magnification Aids	as is	620E-S
1.13	Facilities	as is	620E
1.14	Electrostatic Discharge (ESD) Protection	as is	620E
1.15	Tools and Equipment	as is	620E
1.16	Materials and Processes	not applicable	Both
1.17	Electrical Clearance	as is	620E
1.18	Contamination	as is	620E
1.19	Rework/Repair	as is	620E
1.19.1	Rework	not applicable	620E
1.19.2	Repair	not applicable	620E
1.19.3	Post Rework/Repair Cleaning	as is	620E
2.0	Applicable Documents	not applicable	620E
3.0	Wires	as is	620E
3.1	Stripping	not applicable	Both
3.2	Strand Damage and End Cuts	not applicable	Both
3.3	Conductor Deformation/Birdcaging	not applicable	620E
3.4	Twisting of Wires	as is	620E
3.5	Insulation Damage – Stripping	not applicable	620E
4.0	Soldered Terminations	not applicable	Both
5.0	Crimp Terminations (Contacts and Lugs)	not applicable	Both
6.0	Insulation Displacement Connection (IDC)	not applicable	Both
7.0	Ultrasonic Welding	not applicable	Both
8.0	Splices	as is	620E
8.1	Soldered Splices	not applicable	Both
8.2	Crimped Splices	not applicable	Both
8.3	Ultrasonic Weld Splices	not applicable	Both
8.4	Sleeving over Splices	with amendment	620E-S
9.0	Connectorization	as is	620E
9.1	Hardware Mounting	-	620E

Section	Section Title	Applicability	Standard
9.1.1	Hardware Mounting – Jackpost - Height	as is	620E-S
9.1.2	Hardware Mounting – Jackscrews - Protrusion	as is	620E
9.1.3	Hardware Mounting – Retaining Clips	as is	620E
9.1.4	Hardware Mounting – Connector Alignment	as is	620E
9.2	Strain Relief	-	620E
9.2.1	Clamp Fit	with amendment	620E-S
9.2.2	Wire Dress	as is	620E
9.2.2.1	Straight Approach	with amendment	620E
9.2.2.2	Side Approach	as is	620E
9.3	Sleeving and Boots	as is	620E
9.4	Connector Damage	-	620E
9.4.1	Criteria	as is	620E
9.4.2	Mating Surface	as is	620E-S
9.4.3	Mating Surface or Rear Seal Area	as is	620E-S
9.4.4	Contacts	as is	620E-S
9.4.4.1 (a)	MIL-DTL-83513 Micro D	as is	620E-S
9.4.5 (a)	Seals/Gaskets	as is	620E-S
9.5	Installation of Contacts and Sealing Plugs into Connectors	as is	620E-S
9.5.1	Installation of Contacts	as is	620E
9.5.2	Installation of Sealing Plugs	as is	620E
10.0	Over-Molding/Potting	as is	620E-S
10.1	Over-Molding	as is	620E
10.2	Potting	as is	620E
10.3	Over-Molding of Flexible Flat Ribbon	as is	620E
11.0	Measuring Cable Assemblies and Wires	as is	620E
12.0	Marking/Labeling	as is	620E-S
12.1	Content	as is	620E
12.2	Legibility	as is	620E
12.3	Permanency	with amendment	620E
12.4	Location and Orientation	as is	620E-S
12.5	Functionality	as is	620E
12.6	Marker Sleeve	-	620E
12.6.1	Wrap Around	as is	620E
12.6.2	Tubular	with amendment	620E-S
12.7	Flag Markers	-	620E
12.7.1	Adhesive	as is	620E

Section	Section Title	Applicability	Standard
12.8	Tie Wrap Markers	as is	620E
13.0	Coaxial and Biaxial Cable Assemblies	not applicable	Both
14.0	Securing	as is	620E
14.1	Tie Wrap/Lacing Application	with amendment	620E-S
14.1.1	Tightness	with modification	620E
14.1.2	Damage	as is	620E
14.1.3	Spacing	as is	620E
14.2	Breakouts	-	620E
14.2.1	Individual Wires	as is	620E-S
14.2.2	Spacing	as is	620E
14.3	Routing	-	620E
14.3.1	Wire Crossover	as is	620E
14.3.2	Bend Radius	as is	620E
14.3.3	Coaxial Cable	as is	620E
14.3.4	Unused Wire Termination	as is	620E
14.3.5	Ties over Splices and Ferrules	as is	620E
14.4	Broom Stitching	as is	620E
15.0	Harness/Cable Electrical Shielding	-	620E
15.1	Braided	with modification	620E-S
15.2	Shield Termination	as is	620E-S
15.2.1	Shield Jumper Wire	-	620E
15.2.1.1	Attached Lead	not applicable	Both
15.2.1.1.1	Solder	not applicable	Both
15.2.1.1.2	Crimp	not applicable	Both
15.2.1.2	Shield braid	not applicable	Both
15.2.1.2.1	Woven	with modification	620E
15.2.1.2.2	Combed and twisted	as is	620E
15.2.1.3	Daisy Chain	not applicable	Both
15.2.1.4	Common Ground Point	not applicable	620E
15.2.2	Unterminated Shield	as is	620E
15.2.2.1	Shield Not Folded Back	with modification	620E
15.2.2.2	Shield Folded Back	as is	620E
15.3	Connector	-	620E
15.3.1	Shrink	as is	620E-S
15.3.2	Crimp	with modification	620E-S
15.3.3	Shield Jumper Wire Attachment	as is	620E-S
15.3.4	Soldered	not applicable	620E

Section	Section Title	Applicability	Standard
15.4	Splicing Prewoven	as is	620E
15.4.1	Soldered	not applicable	Both
15.4.2	Tie/Tape On	as is	620E
15.5	Tapes – Barrier and Conductive, Adhesive or Non-Adhesive	with amendment	620E
15.6	Conduit (Shielding)	as is	620E
15.7	Shrink Tubing – Conductive Lined	not applicable	Both
16.0	Cable/Wire Harness Protective Coverings	as is	620E
16.1	Braid	-	
16.1.1	Braid – Direct Applied	as is	620E
16.1.2	Braid - Prewoven	as is	620E-S
16.2	Sleeving/Shrink Tubing	as is	620E
16.3	Spiral Plastic Wrap (Spiral Wrap Sleeving)	not applicable	Both
16.4	Wire Loom Tubing – Split and Unsplit	as is	620E
16.5	Tapes, Adhesive and Nonadhesive	as is	620E
17.0	Finished assembly Installation	as is	620E-S
17.1	General	as is	620E-S
17.2	Hardware Installation	as is	620E-S
17.2.1	Threaded Fasteners	not applicable	620E
17.2.2	Wires	not applicable	Both
17.3	Wire/Harness Installation	not applicable	620E
18.0	Solderless Wrap	not applicable	Both
19.0	Testing	-	620E
19.1	Nondestructive Tests	as is	620E
19.2	Testing After Rework or Repair	as is	620E
19.3	Intended Table Usage	as is	620E
19.4	Electrical Test	with amendment	620E-S
19.4.1	Selection	with modification	620E-S
19.5	Electrical Test Methods	-	620E
19.5.1	Continuity	with amendment	620E
19.5.2	Shorts	as is	620E-S
19.5.3	Dielectric Withstanding Voltage (DWV)	as is	620E-S
19.5.4	Insulation Resistance (IR)	as is	620E-S
19.5.5	Voltage Standing Wave Ratio (VSWR)	not applicable	620E
19.5.6	Insertion Loss	not applicable	620E
19.5.7	Reflection Coefficient	not applicable	620E
19.5.8	User Defined	as is	620E

Section	Section Title	Applicability	Standard
19.6	Mechanical Test	-	620E
19.6.1	Selection	not applicable	Both
19.7	Mechanical Test Methods	-	620E
19.7.1	Crimp Height (Dimensional Analysis)	not applicable	Both
19.7.2	Pull Force (Tensile)	not applicable	Both
19.7.3	Crimp Force Monitoring	not applicable	620E
19.7.4	Crimp Tool Qualification	not applicable	620E
19.7.5	Contact Retention Verification	as is	620E-S
19.7.5.1 ^(a)	Mechanical Test Methods – Contact Retention Verification – Push Testing	as is	620E-S
19.7.5.2 ^(a)	Mechanical Test Methods – Contact Retention Verification – Pull Testing	as is	620E-S
19.7.6	RF Connector Shield Pull Force (Tensile)	not applicable	Both
19.7.7	RF Connector Shield Ferrule Torsion	not applicable	620E
19.7.8	User Defined	as is	620E
20.0	High Voltage Applications	not applicable	620E
(a) Section not included in IPC/WHMA-A-620E, but only added through the Addendum for Space and Military Applications, IPC/WHMA-A-620E-S			

Annex B (informative)

Example of a “(De-)mating Logbook”

Company Logo		(De-)mating Logbook				Program / Project:		
						Harness / HMU CI-No.:		
						Harness / HMU SN:		
Max. no of allowed cycles:		* a cycle is defined as one (1) mating and one (1) demating operation						
Connector Identifier	Cycle No.	Date of Mating	Operator / Inspector <small>(Sign. / Stamp / Date)</small>	Date of De-Mating	Operator/ Inspector <small>(Sign. / Stamp / Date)</small>	Justification / Remarks <small>(indicate reason for mating, use of saver, etc.)</small>		

Bibliography

ECSS-S-ST-00	ECSS system – Description, implementation and general requirements
ECSS-Q-ST-70-18	Space product assurance – Preparation, assembly and mounting of RF coaxial cables
ECSS-Q-ST-70-30	Space product assurance – Wire wrapping of high-reliability electrical connections
ESCC 3408	RF Cable Assemblies
ESCC 3409	High Data Rate Cable Assemblies
ESCC 3420	Optical Fibre Cable Assemblies with Single Fibre Ferrules, Generic