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by Global Electronics Association

IPC/WHMA-A-620F-S

Space and Military Applications Electronic Hardware Addendum to IPC/WHMA-A-620F

If a conflict occurs between the English language and translated versions of this document, the English version will take precedence.

Developed by the 7-31FS IPC/WHMA-A-620 Space and Military Electronic Assemblies Addendum Task Group of the 7-30 Product Assurance Committee of Global Electronics Association

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Table of Contents

The following topics are addressed in this Addendum.

0.1 Scope

0.1.1 Purpose

0.1.2 Precedence

0.1.3 Existing or Previously Approved Designs

0.1.4 Use of this Addendum

0.1.5 Lead (Pb)-Free Tin

0.1.6 Red Plague (Cuprous Oxide Corrosion)

0.1.7 White Plague (Fluorine Attack)

The following reference numbers are to IPC/WHMA-A-620 Clauses that are modified or added in this Addendum.

1.0	GENERAL
1.1	Scope
1.2	Purpose
1.3	Classification
1.5.1.2.1	Disposition
1.6	Process Control
1.10	Personnel Proficiency
1.12.2.1	Lighting
1.12.2.2	Magnification Aids
1.16	Materials and Processes
3.0	WIRES
3.1	Stripping
3.2	Strand Damage and End Cuts
4.0	SOLDERED TERMINATIONS
4.1.1.1	Materials – Solder
4.1.1.2	Materials – Flux
4.1.2	Gold Removal
4.2.1	Cleanliness – Presoldering
4.3.2.1	Partially Visible or Hidden Solder Connections
4.4	Wire/Lead Preparation, Tinning
4.8	Terminals
4.8.1.2	Turrets and Straight Pins – Solder
4.8.2.2	Bifurcated – Lead/Conductor(s) Placement – Bottom and Top Route
4.8.2.4	Bifurcated – Solder
4.8.4.2	Pierced/Perforated/Punched – Solder
4.8.5.2	Hook – Solder
4.8.6.2	Cup – Solder
5.0	CRIMP TERMINATIONS (CONTACTS AND LUGS)
5.1.2	Open Barrel – Insulation Clearance if No Support Crimp
5.2.1	Closed Barrel – Insulation Clearance
5.2.2	Closed Barrel – Insulation Support Crimp
5.2.3	Closed Barrel – Conductor Crimp and Bellmouth
5.3	Machined Contacts
5.3.1	Insulation Clearance
6.0	INSULATION DISPLACEMENT CONNECTION (IDC)
8.0	SPLICES
8.1	Soldered Splices
8.1.2	Wrap
8.1.4.1	Lap – Two or More Conductors
8.2.1	Barrel
8.2.2	Double Sided
8.4	Sleeving Over Splices
9.0	CONNECTORIZATION
9.1.1	Jackpost – Height
9.2.1	Clamp Fit
9.4.2	Hard Face – Mating Surface
9.4.3	Soft Face – Mating Surface or Rear Seal Area
9.4.4	Connector Damage – Contacts
9.4.5 [New]	Connector Damage – Seals/Gaskets
9.5	Installation of Contacts and Sealing Plugs into Connectors
10.0	OVER-MOLDING/POTTING
12.0	MARKING/LABELING
12.4	Location and Orientation
12.6.2	Marker Sleeve – Tubular
13.0	COAXIAL AND BIAXIAL CABLE ASSEMBLIES
13.1	Stripping
13.7.2	Press Fit
14.0	SECURING
14.1	Restraining Device Application
15.0	HARNESS/CABLE ELECTRICAL SHIELDING
15.1	Braided
15.1.1	Direct Applied
15.1.2	Prewoven
15.2	Shield Termination
15.2.1.1	Shield Jumper Wire – Attached Lead
15.2.1.1.1	Shield Jumper Wire – Attached Lead – Solder
15.3.1	Connector – Shrink
15.3.2	Connector – Crimp
15.3.3	Connector – Shield Jumper Wire Attachment
15.4.1	Splicing Prewoven – Soldered

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Table of Contents (cont.)

16.0	CABLE/WIRE HARNESS PROTECTIVE COVERINGS
16.1.2	Braid – Prewoven
17.0	FINISHED ASSEMBLY INSTALLATION
17.1	General
17.2	Hardware Installation
19.0	TESTING
19.3	Electrical Test
19.3.1.2	Shorts
19.3.1.4	Insulation Resistance (IR)
19.4	Mechanical Test
19.4.1.1	Crimp Height
19.4.1.2	Pull Force (Tensile)
19.4.1.3	Contact Retention Verification
19.4.1.3.1 [New]	Push Testing
19.4.1.3.2 [New]	Pull Testing

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How To Use This Document

0.1 Scope This Addendum provides modified and additional requirements over those published in IPC/WHMA-A-620F to ensure the performance of cable and wire harness assemblies that must survive the vibration and thermal excursions encountered getting to and operating in the military and space environments.

Where content criteria are not supplemented or replaced, the Class 3 requirements of IPC/WHMA-A-620F apply.

0.1.1 Purpose When required by the contract or engineering documentation, this Addendum supplements or replaces specifically identified requirements of IPC/WHMA-A-620F.

0.1.2 Precedence The contract takes precedence over this Addendum, referenced standards and User-approved drawings. In the event of a conflict between this Addendum and the reference documents cited herein, this Addendum takes precedence. (See IPC/WHMA-A-620F 1.7 Order of Precedence.)

0.1.3 Existing or Previously Approved Designs This Addendum **shall not** constitute the sole cause for the redesign of previously approved designs. When drawings for existing or previously approved designs undergo revision, they should be reviewed and changes made that allow for compliance with the requirements of this Addendum.

0.1.4 Use of this Addendum This Addendum **shall not** be used as a stand-alone document. Where criteria are not supplemented by this Addendum, the Class 3 requirements of IPC/WHMA-A-620F **shall** apply. Clauses found only in this Addendum will have "[NEW]" after the clause number. If an IPC/WHMA-A-620F requirement is changed or added by this Addendum, the clause is identified and only the process requirements and defects for that clause are listed, i.e., Acceptable conditions, are not listed. If a feature is not listed as a defect, it **shall** be considered acceptable. Acceptable conditions (except where changed by this Addendum) and Figures are provided in IPC/WHMA-A-620F.

The clauses modified by this Addendum do not include subordinate clauses unless specifically stated, i.e., changes made to 1.4 do not affect 1.4.1 unless 1.4.1 is also addressed in this Addendum. Clauses, Tables, Figures, etc., in IPC/WHMA-A-620F that are not listed in this Addendum are to be used as-published.

When a paragraph refers to an entire chapter, for example the first paragraph in 15.1 Braided of this Addendum, it is the User of the standard's responsibility to determine which clauses from that chapter are used from IPC/WHMA-A-620F and which clauses are covered by this Addendum.

0.1.5 Lead (Pb)-Free Tin For this document, the definition of lead (Pb)-free tin is tin containing less than 3% Pb by weight as an alloying constituent. See 4.1.1.1 Materials and Components – Materials – Solder of this Addendum.

The use of components, assemblies, packaging technology, mechanical hardware and materials identified as having external surfaces (platings, metallization, etc.) of Pb-free tin or assembled with Pb-free tin solder alloys **shall** be prohibited unless documented and controlled through a User-approved Pb-Free Control Plan (LFCP). Solder alloy Sn96.3Ag3.7 is exempt from this requirement for a LFCP.

0.1.6 Red Plague (Cuprous Oxide Corrosion) Red Plague can develop in silver-coated soft or annealed copper wire when a galvanic cell forms between the copper base metal and the silver coating in the presence of moisture (H_2O) and oxygen (O_2). Once initiated, the sacrificial corrosion of the copper base conductor can continue indefinitely in the presence of oxygen. The color of the corrosion by-product (cuprous oxide crystals) may vary depending on the different levels of oxygen available, but is commonly noted as a red/reddish-brown discoloration on the silver coated surface.

The use of silver-coated copper wire and cable **shall** require the implementation of a User-approved Red Plague Control Plan (RPCP). See IPC-WP-113 for technical guidance and a generic RPCP template.

0.1.7 White Plague (Fluorine Attack) During the manufacturing of fluoropolymer-insulated electrical wires and cables made with tin-coated, silver-coated, or nickel-coated copper or copper alloy conductors, the extrusion of fluorocarbon resin to form the insulation jacket occurs at a temperature high enough that oxidative degradation of the polymer may occur, possibly resulting in the evolution or outgassing of a number of materials, including carbonyl fluoride (COF_2), an extremely reactive compound. This outgassing from the insulation is both internal, e.g., to the wire strand/cable bundle, and external, e.g., to the surrounding environment. In the presence of trace atmospheric moisture, e.g., humidity, the carbonyl difluoride hydrolyzes to generate carbon dioxide (CO_2) and hydrogen fluoride (HF). The hydrogen fluoride (HF) will then hydrate to form concentrated hydrofluoric acid (HF aq), an extremely corrosive agent that attacks metal and metal oxides, including, but not limited to, conductors, contacts, connector shells, etc.

The use of fluoropolymer-insulated copper wire and cable may require the implementation of a User-approved White Plague Control Plan (WPCP). See IPC-WP-114 for technical guidance and a generic WPCP template.

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1.0 GENERAL

1.1 Scope This standard prescribes practices and requirements for the manufacture of cable, wire and harness assemblies. This standard does not provide criteria for cross-section or x-ray evaluation. Exception: Non-Destructive Evaluation (NDE) **shall** be required when an item is subject to the requirements of 4.3.2.1 Solder Connection – Soldering Anomalies – Partially Visible or Hidden Solder Connections.

If a conflict occurs between the English and translated versions of this document, the English version will take precedence.

The illustrations in this document portray specific points noted in the title of each section. A brief description follows each illustration. The development committee recognizes that different parts of the industry have different definitions for some terms used herein. For the purposes of this document, the terms cable and wire harness are used interchangeably.

IPC/WHMA-A-620 can be used as a stand-alone document for purchasing products, however it does not specify frequency of in-process inspection or frequency of end product inspection. No limit is placed on the number of process indicators or the number of allowable repair/rework of defects. Such information should be developed with a statistical process control plan (see IPC-9191).

The processes, materials and criteria in this document are based on designs established in accordance with IPC-D-620.

1.2 Purpose This standard describes materials, methods, tests and acceptability criteria for producing crimped, mechanically secured, or soldered interconnections and the related assembly activities associated with cable and harness assemblies.

The intent of this document is to rely on process control methodology to ensure consistent quality levels during the manufacture of products. Any method that produces an assembly conforming to the acceptability requirements described in this standard may be used.

Standards may be updated at any time using revisions or amendments. The use of an amendment or newer revision is not automatically required. The revision in effect **shall** be as specified by the User.

Note: This clause is unchanged from IPC/WHMA-A-620F. It is included here to clarify that the Purpose of the Space Addendum does not replace nor alter Purpose of IPC/WHMA-A-620F.

1.3 Classification If an IPC/WHMA-A-620F clause is not addressed by this Addendum, the Class 3 requirement in IPC/WHMA-A-620F **shall** apply. See 0.1.4 Use of this Addendum.

1.5.1.2.1 Disposition Disposition is the determination of how defects should be treated. Dispositions include, but are not limited to, rework, use as is, scrap or repair. Each disposition of "use as is" or "repair" **shall** be approved by the User. Repairs **shall** be conducted in accordance with documented procedures approved by the User. Each repair **shall** be approved by the User prior to implementation.

Note: Disposition requirements should be identified in the contract.

1.6 Process Control A documented process control system **shall** be developed and implemented. Process control tools such as IPC-9191, EIA-557-1 or other User-approved system may be used as guidelines for implementing process control.

The documented process control system **shall** define process control and corrective action limits. This may or may not be a "statistical process control" system, see IPC/WHMA-A-620F 1.6.1 Statistical Process Control. The use of "statistical process control" (SPC) is optional and should be based on factors such as design stability, lot size, production quantities, and the needs of the company.

Verification of acceptability to this standard **shall** be based on 100% inspection of the assemblies, including crimps, solder connections and each successive level of assembly, e.g., securing, shielding, connectorization. Visual inspection may be supplemented by the measurement of characteristics appropriate to the product being assembled, e.g., go/no-go gauges, pull force measurements, torque measurement.

Process control methodologies **shall** be used in the planning, implementation and evaluation of the manufacturing processes used to produce cables and wire harness assemblies.

The philosophy, implementation strategies, tools and techniques may be applied in different sequences depending on the specific company, operation, or variable under consideration to relate process control and capability to end product requirements.

When a decision or requirement is to use a documented process control system, failure to implement process corrective action and/or the use of continually ineffective corrective actions **shall** be grounds for disapproval of the process and associated documentation.

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