Internal Specification Level I

Title: Workmanship Acceptability of Electronic Assemblies			Number: IS-003
Revision: 17	Revision Date:	02/17/2020	Requirements: AS9100 8.5.1
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PURPOSE & SCOPE

This Internal Specification (IS) authorizes the use of the following documents as the primary workmanship standards used for solder specific and electronic product assembly acceptance. Additionally it incorporates the class 3 requirements of these documents into the L3 Communication Systems-West (CSW) Workmanship Standards Manual (WSM) and training processes.

- J-STD-001 Current Revision, Class 3 Requirements for Soldered Electrical and Electronic Assemblies
- When required, J-STD-001Space Addendum Current Revision Space Applications Electronic Hardware Addendum to J-STD-001Current Revision Requirements for Soldered Electrical and Electronic Assemblies
- IPC-A-610 Current Revision, Class 3, Acceptability of Electronic Assemblies
- IPC/WHMA-A-620 Current Revision, Class 3, Requirements and Acceptance for Cable and Wire Harness Assemblies

Process and materials requirements established for manufacturing electronic assemblies and/or related product produced by CSW, its suppliers, and sub-tier suppliers, shall be in accordance with J-STD-001, Class 3, and/or IPC/WHMA-A-620, Class 3, whichever is associated with the process or product. These requirements are to be used for the development, implementation, and control of soldering and production processes.

Processes and process control shall assure effective implementation of visual workmanship acceptance criteria as prescribed by J-STD-001, Class 3, IPC-A-610, Class 3, and IPC/WHMA-A-620, Class 3.

Any contractual exceptions to this internal specification must be documented in the respective Quality Assurance Program Plan (QAPP) and flowed down to suppliers.

These documents are imposed with the following exceptions:

INTERNAL SPECIFICATION

Tuning Stubs

As an exception to Class 3 soldering requirements of J-STD-001 and IPC-A-610; tuning stubs required for proper product performance shall meet the following minimum requirements:

- be permanently soldered in place and exhibit wetting between the stub and its attached surface
- be free of flux residue

- Associated solder connections formed to component terminations or leads that have been bridged by a tuning stub shall as a minimum, exhibit wetting to 75% of the component termination or lead width (W) and the land.

Note: Upon completion of test validation, the tuning stub positioning or solder shall not be modified in any manner.

1. **J-STD-001**

   J-STD-001 describes materials, methods and acceptance for producing soldered electrical and electronic assemblies. Class 3 criteria shall be followed with the following exceptions:

   Exception 1: Allow exception to Class 3 solder joint requirements of Table 7-6, Castellated Terminations, Table 7-7 Flat Gull Wing Leads, and Table 7-18, Bottom Termination Components, provided the following conditions are met:

   a. The lead or termination is connected to the component ground plane and/or is placed in contact with circuitry that is connected to a circuit board ground plane that act as thermal heat sinks.

   b. The component complies with its positioning requirements.

   c. The solder as a minimum, exhibits wetting to 75% of the component termination or lead width (W) and the land.

   d. Surrounding solder joints meet requirements of Section 7 for the component type.

   Exception 2: Service loops are required for CSW products except where there is insufficient room in the assembly that prevents wire length (service loop) sufficient to allow at least one field repair.

   Requirement – When service loops are required, wires shall have sufficient length to allow at least one field repair. Reference Section 5.4.1.2 and Figure 5-6.

   Exception 3: As an exception to the vertical fill requirements in Table 6-6, the minimum permissible vertical fill of a Plated Through-Hole (PTH) is 50% or 1.9 mm [0.047 in], whichever is less, provided the following conditions are met:

   a. The PTH is connected to thermal or conductor layers that act as thermal heat sinks.

   b. The component lead is discernible on the solder source side.

   c. The solder fillet on the solder source side is wetted 360º of the PTH barrel and 360º of the lead.

   d. Surrounding PTH connections meet the requirements of Table 6-6.

   Requirement – Class 3 does not allow exception to the minimum 75% vertical fill of a PTH, Reference Section 6.2.2, Table 6-6 and Figure 6-4.

2. **J-STD-001Space Addendum – Space Applications**

   Note: When J-STD-001Space Addendum is required, J-STD-001 must be used.

   This addendum provides additional requirements to those published in J-STD-001 to ensure the reliability of soldered electrical and electronic assemblies in a space environment.

   When J-STD-001Space Addendum is specified by procurement documentation, drawing, or contract, the Addendum supplements or replaces specified requirements of J-STD-001. Where referenced criteria of the Addendum differ from the published J-STD-001, the Addendum shall take precedence.

3. **IPC-A-610**

   The criteria in IPC-A-610 reflect the minimum requirements to be imposed. IPC-A-610 has criteria outside the scope of J-STD-001 defining handling, mechanical and other workmanship requirements. IPC-A-610 is an integral part of the overall CS-West workmanship standards. Class 3 acceptance criteria are to be followed with the following exceptions:

   Exception 1: Allow exception to Class 3 solder joint requirements of Table 8-4, Castellated Terminations, Table 8-5, Flat Gull Wing Leads, and Table 8-16, Bottom Termination Components, provided the following conditions are met:

   a. The lead or termination is connected to the component ground plane and/or is placed in contact with circuitry that is connected to a circuit board ground plane that act as thermal heat sinks.

   b. The component complies with its positioning requirements.

   c. The solder as a minimum, exhibits wetting to 75% of the component termination or lead width (W) and the land.

   d. Surrounding solder joints meet requirements of Section 8 for the component type.

   Exception 2: Implement Class 3 requirement except where there is insufficient room in the assembly that prevents meeting the service loop requirement.

   Requirement – Sufficient service loop is provided to allow one field repair to be made. Reference Section 6.4, Figure 6-52.

   Exception 3: As an exception to the vertical fill requirements of Table 7-4, the minimum permissible vertical fill of a PTH is 50% or 1.9 mm [0.047 in] whichever is less, provided the following conditions are met:

   - The PTH is connected to thermal or conductor layers that act as thermal heat sinks.
   - The component lead is discernible on the solder source side of the connection. See Figure 7-86.
   - The solder fillet on the solder source side of Figure 7-86 has wetted 360° of the PTH barrel and 360º of the lead.
   - Surrounding PTHs meet the requirements of Table 7-4.

Requirement – Class 3 does not allow exception to the minimum 75% vertical fill of PTHs, reference Section 7.3.5, Figure 7-86, and Table 7-4.

4. **IPC/WHMA-A-620**

Note:

Suppliers and their sub-tier suppliers (where applicable) shall comply with the mechanical tests stipulated in IPC/WHMA-A-620, 19.7.2 for verifying crimp tensile strength (pull testing) of a crimped contact to connector joint.

IPC/WHMA-A-620, Section 19.6.1 states that a manufacturer's documented process control program may be used in lieu of 19.7 Mechanical Test Methods. CS-West uses a documented process control program as defined in Work Instruction W-083 Wire Crimp Pull Tests.

IPC/WHMA-A-620 describes requirements and visual acceptance criteria for producing Cable and Wire Harness Assemblies. Class 3 criteria shall be followed with the following exceptions:

Exception 1: Implement Class 3 requirement, except when there is not a full-cycle/ratcheting tool for the specified crimp termination upon which, the manufacturers specified or recommended tool shall be used.

Requirement – Full cycle tools shall be used for Class 3 crimping Reference Section 5, Crimp Terminations (Contact and Lugs).

Exception 2 (unused connector contact locations):

When contacts are provided with a connector, all locations shall be filled. Contacts for unused locations are not crimped unless required for insertion. When contacts are a separate item on the bill of materials, only documented locations are filled. Connectors that are designed with coax contacts are exempt from the fill requirements unless specified on the documentation.

Requirement - unused contact locations shall be filled with contacts and or plugs if specified on the documentation. The contacts are not crimped unless required for insertion. Reference 9.5 for further information.

Exception 3: Implement Class 3 requirement, except where there is insufficient room in the assembly that prevents meeting the service loop requirement.

Requirement – Sufficient service loop is provided to allow an additional wrap if repair is necessary. Reference Section 17.1, 17.3.3, and Figure 17-21.

Exception 4: Implement Class 3 requirement except allow the use of adhesive (CSW material number 7917693-XX Adhesive – Two Part Epoxy, Harnessing) to bond the tubular marker in place when the tubular marker slides (freely moves) on the wire or wire group after shrinking, provided the following conditions are met:

- The marker sleeve is the smallest size available and the recovered (shrunk) inside diameter of the marker sleeve is larger than the wire or wire group diameter and there is no other option due to the wire gauge or wire group diameter.

- The marker sleeve size has been changed (reduced in diameter) as allowed per IS-001 Use of Non-Specified Hardware /Material, and the recovered (shrunk) inside diameter of the marker sleeve is larger than the wire or wire group diameter, and there is no other option due to the wire gauge or wire group diameter

Requirement – Tubular marking sleeves are required to be sufficiently shrunk to remain secure (no sliding). Reference 12.6.2 for more information.

Exception 5: Implement Class 3 Dielectric Withstanding Voltage (DWV) Test Parameters of section 19.5.3, Table 19-4, except allow the testing to be in accordance with CSW Specification number 60100697 for DWV and for test dwell time for cable assemblies. DWV exception shall appropriately reduce DWV based on detail specifications, connector manufacturers or CSW engineering. Dwell time exception shall allow for a minimum of 10 ms dwell time when tested with a CIRRIS CH2 test machine. This standard shall be used to establish the "Other Defined Value" referenced in Table 19-4 for connectors commonly used by CSW.

Requirement – DWV requires a minimum test voltage of 1500 VDC or equivalent peak AC voltage for Class 3, and a minimum of 1 second dwell time, unless "Other Defined Value" is established.

Exception 6: Implement crimp force (tensile) testing per Work Instruction W-083 Wire Crimp Tests. Crimp tooling that has not been used for 30 days will become dormant on day 31. All dormant tools that are returned to service shall be validated prior to use per W-083. The tool shall meet the parameters of IPC/WHMA-A-620, Section 19.7.2, Table 19-11 through Table 19-13 for each wire and contact combination. The tool shall then be placed on a regular 30 day recall cycle from the date of testing.

Requirement – Crimp tools shall not be used for longer than 30 days between verification testing. Reference 19.6.1for more information.

Exception 7: Implement Class 3 requirements for connector damage – limits – soft face, IPC/WHMA-A-620, clause 9.4.3 except for LEMO ratchet coupling connectors. Soft face damage is acceptable except when all contact locations have wires or sealing plugs indicating that an environmental seal is required.

Requirement – IPC/WHMA-A-620, clause 9.4.3 does not allow the following damage to the mating connector surface or rear seal area: cut, fracture, or tear in dielectric that extends beyond the cup diameter. It also does not allow cuts, fractures, or tears that extend from the cup through dielectric face or from one cup into another.

Exception 8: As an exception to clause 14.1, all lacing or lace tape ends **shall** be heat seared to eliminate fraying.

Requirement – IPC/WHMA-A-620, clause 14.1 states that processing cut ends to prevent fraying is optional.

Exception 9: Table 13-1, Note 3, will not be applicable to section 15 Harness/Cable Electrical Shielding. It will remain applicable to section 13 Coaxial and Biaxial Cable Assemblies.

Requirement – IPC/WHMA-A-620, table 13-1, Note 3 states no severed or missing shield braid strands allowed for Class 3. [Table 13-1 allows for up to 6% severed or missing strands without Note 3.]

Exception 10: Paragraph 9.2.1, Defect class 1,2,3 Shield termination, Shield ferrule or soldered drain wire, may be located under a back shell clamp as long as protection is provided under the clamp to prevent wire stress, (i.e. Tape, Sleeving, or Grommet).

Requirement – IPC/WHMA-A-620, paragraph 9.2.1, Defect class 1, 2, 3. Splice or ferrule located under the back shell clamp.

Exception 11: Stamped and Formed - Insulation Support - Crimp This exception describes criteria that are applicable only when the wire diameter is outside the insulation support range specified by the contact manufacturer and the insulation support crimp cannot meet the requirements of IPC/WHMA-A-620, sections 5.1, Open Barrel or 5.2, Closed barrel terminations due to design requirements.

Acceptable

Single Wire

• Insulation crimp (inside diameter) does not exceed 1.5 times the wire diameter including insulation.

Multiple Wires

• Insulation crimp (inside diameter) does not exceed 1.5 times the wire group diameter including insulation.

Requirement - Paragraph 5.1.1.2 Open Barrel. Defect class 1, 2, 3. The insulation crimp tabs do not provide support at least 180° around the insulation. At least one tab does not contact the top of the wire insulation. The second tab does not contact either the top of the wire insulation or is greater than one material thickness of contacting the top of the wire insulation.

Paragraph 5.2.2 Closed Barrel. Acceptable class 1, 2, 3. Irregular shaped insulation crimp contacts the wire insulation providing support

Exception 12: Defect Class 1, 2, 3. Splits or holes in Tubular markers. (No holes of any size allowed).

Requirement – 12.6.2 Marker Sleeve – Tubular. Defect – Class 2, 3. Any hole greater than 3 mm [0.12 in].

Exception 13: Paragraph 14.3.2 and Table 14-1. Minimum Bend Radius Requirements shall not be less than the cable manufacturer's stated minimum bend radius, unless the minimum bend radius has otherwise been determined by CSW design authority.

Requirement – Paragraph 14.3.2 Bend radius is measured along the inside curve of the wire or wire bundles. The minimum bend radius of a harness assembly shall not be less than whichever wire/cable in the assembly has the largest bend radius defined in Table 14-1.

END OF DOCUMENT

DOCUMENT INFORMATION

Responsible Organization: Operations (OPS)

Sub-Level Function: Manufacturing (MFG)

Governing Document: Contract

Subordinate Documents: N/A

Related Documents: IPC-A-610: Acceptability of Electronic Assemblies
IPC/WHMA-A-620: Requirements and Acceptance for Cable and Wire Harness Assemblies
J-STD-001: Requirements for Soldered Electrical and Electronic Assemblies
J –STD-001S: Space Applications Electronic Hardware Addendum to IPC J-STD-001Requirements For Soldered Electrical and Electronic Assemblies
IS-001: Use of Non-Specified Hardware/Material
60100697: Specification for Dielectric Withstanding Voltage (DWV) for Cable Assemblies
W-083: Wire Crimp Pull Tests

Approval Requirements: Chairman of the PCCB

Review Requirements: DCMA Representative (Review Only)

Revision History Summary:

Revision #	Reason for Update/Revision	Date
Initial to 07	Release for revision. I.e.: Initial release.	Various
08	Re-write to include "J" std	06-02-2009
09	Added reference to Amendment 1.	09-14-2009
10	Modified the Purpose & Scope and added exceptions for IPC/WHMA-A-620. Bolded all the "shalls".	02-02-2010
11	Modified the Purpose and Scope. Modified to reflect E revisions of J-STD-001, J-STD-001ES, IPC-A-610, added/modified and deleted exceptions. Added DWV testing to be performed in accordance with 60100697. All changes are indicated with blue text.	07/18/2011
12	Updated to reflect crimp pull (tensile) testing per W-83 Wire Crimp Tests to meet WHMA/IPC-A-620 requirements. Added an exception for LEMO connector soft face damage. Changes are indicated with blue text.	1/3/2012
NA	Changed "parts number" to "material list" and "Parts List" to "Bill of Materials" due to new SAP terminology. Added W-083 to Related documents. Changes made indicated in blue text. No revision upgrade necessary.	11/01/2013
13	Removed specific IPC document revision and replaced with "current revision". Modified approval requirements. Changes indicated with blue text.	9/18/2014

14	Updated tables, clause numbers, and terminology to reflect current IPC documents. Fixed grammar and punctuation errors.	2/13/2017
15	Added exception 8 to the IPC/WHMA-A-620 section	9/27/2017
16	Change L-3 to L3. Added exceptions and requirements #9-12 in section 4 (IPC/WHMA-A-620)	01/30/2019
17	Revise IPC-620 Exception 5 to include hi-pot dwell time exception. Add IPC-620 Exception 13 for bend radii. Changes in blue text. Changed L3 Communications, Communication Systems – West (CSW) to L3 Communication Systems – West (CSW) in Purpose & Scope. Changed header and footer to current logo standards.	02/17/2020