

1.0 INTRODUCTION

1.1 Scope

This specification establishes workmanship standards for electronic equipment fabricated for Sponsored Research Projects by the MIT, Center for Space Research.

1.2 Purpose

These standards will govern workmanship in electronic assemblies. These same standards will be applied by the CSR R&QA group to determine the acceptance or rejection of electronic equipment during inspection. The standards of workmanship contained herein are designated as the minimum acceptable

2.0 APPLICABLE DOCUMENTS

2.1 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

The following documents, of the issue in effect at contract start, form a part of this specification:

- NHB 5300.4 (3A-1) Requirements for Soldered Electrical Connections dated Dec 1976
- NHB 5300.4 (3G) Requirements for Interconnecting Cables, Harnesses, and Wiring dated Apr 1985
- NHB 5300.4 (3H) Requirements for Crimping and Wire Wrap, dated May 1984
- NHB 5300.4 (3I) Requirements for Printed Wiring Boards, dated May 1984
- NHB 5300.4 (3J) Requirements for Conformal Coating and Staking of Printed Wiring Boards and Electronic Assemblies, dated Apr 1985
- NHB 5300.4 (3K) Design Requirements for Rigid Printed Wiring Boards and Assemblies, dated Jan 1986

2.2 MIT/CSR

The applicable project Performance Assurance Plan.

2.3 **Others**

The following documents are not specifically imposed by this specification but are listed here for guidance.

Martin Marietta Aerospace Workmanship Standards

General Electric Ten (10) Volume Electronic Craftsmanship
Training Re-Entry Systems Dept. Manual

United Aircraft -HSD Workmanship Manual

3.0 **REQUIREMENTS**

3.1 **Conflicting Requirements**

In the event of discrepancies between this specification and a detail specification or drawing, the detail specification or drawing shall prevail.

Note: Departures from contractual requirements shall be documented in the form of a deviation request. Such departures in CSR drawings and specifications must be approved prior to the final approval and release of the drawing or specification.

4.0 **LIMITATIONS**

4.1 **Acceptance or Rejection**

Acceptance or rejection of parts, modules, subassemblies, assemblies, or materials will be based on the data contained in this specification. These requirements are to be construed as minimum limits. Since all possible situations can not be covered in this document, any processes, materials, or workmanship suspected of being substandard will be reported to the CSR Project Engineer and to the Quality Assurance Group at once.

5.0 **MISAPPLICATION OF MATERIALS**

Materials which are not used as specified in the applicable drawings, specifications, or related documents, will be cause for rejection.

6.0 INSPECTION CRITERIA

The following sections of this document state requirements which are to be used in the acceptance and rejection of equipment.

6.1 Soldering

The soldering of connections shall be inspected for compliance with requirements of NASA, NHB 5300.4 (3A-1).

6.1.1 Microscopic Inspection.

All soldered connections shall be 100 percent visually inspected aided by a magnification between 4x and 10x. Higher powers of magnification may be used as required. Binocular microscopes are recommended.

6.1.2 Acceptable Soldering

Acceptable soldering shall be in accordance with 3A704 and 3A804 of NHB 5300.4 (3A-1).

6.1.3 Unacceptable Soldering

Paragraphs 3A705 and 3A805 of NHB 5400.5 (3A-1) details some characteristics of unsatisfactory solder conditions, any of which is cause for rejection.

6.2 Part Installation and Inspection

Part mounting and installation shall be in accordance with Chapter 5 of NHB 5300.4 (3K). Inspection shall be in accordance with drawing requirements.

6.3 Fabrication of Printed Wiring Boards

Printed wiring boards will be inspected for compliance with requirements of NHB 5300.4 (3I), paragraph 3I612.

6.4 Assembly and Subassembly Wiring

Assembly and subassembly wiring shall be inspected for compliance with the NASA HDBK 5300.4 (3A-1), paragraph 3A803.

6.4.1 Materials. Materials used in printed wiring boards shall comply with the requirements of Chapter 4 of NHB 5300.4 (3K).

6.4.2 Acceptance Criteria for Assembly and Subassembly Wiring. Acceptance criteria shall be per NHB 5300.4 (3A-1), paragraph 3A804.

6.4.3 Unacceptable Assembly and Subassembly Wiring

Reject criteria shall be per NHB 5300.4 (3A-1), paragraph 3A805.

6.5 Temperature Control Surfaces

6.5.1 Inspection

Temperature control surfaces shall be inspected for compliance with the requirements of this document and such other documents as may be specified.

NOTE: Special precautions are required during handling of temperature control surfaces to prevent degradation of the surface due to fingerprints, solvents, tool marks, corrosive gases, etc.

6.5.2 Materials

Materials will comply with the applicable detail and process specification.

6.5.3 Acceptance Criteria for Temperature Control Surfaces

- a. Surface will be free from nicks, scratches, bubbles, and blisters.
- b. Coatings will be uniform in color and texture.
- c. Surface is free from stamps, stickers, or other identification marks.
- d. Evidence of special tests if required.

6.5.4 Unacceptable Temperature Control Surfaces

- a. Nicks, scratches, bubbles, blisters, or fingerprints on surfaces.
- b. Coating applied to incorrect area.
- c. Incomplete removal of polishing compound, primer, abrasive, etc.
- d. Streaks or uneven texture and color.
- e. Incomplete or missing test documentation.
- f. Missing sample if required to determine proper bonding of surface to base material.

6.6 Conformal Coating and Staking

6.6.1 Inspection

Conformal Coating and staking shall be inspected for compliance with the requirements of NHB 5300.4 (3J).

6.6.2 Criteria

Acceptance/Rejection criteria for coating and staking shall be per NHB 5300.4 (3J), paragraphs 3J701 and 3J704.

6.7 Cabling Flight Equipment

Cabling shall be tested and inspected for compliance with requirements of NHB 5300.4 (3G), Chapter 14.

6.8 Splices

6.8.1 Materials

Materials used will conform to the requirements of the appropriate detail specification.

6.8.2 Acceptance Criteria for Lead Splicing of Flight Equipment

Broken or damaged conductors, part leads, or printed wiring conductors shall not be spliced.

6.9 Shield Terminations

6.9.1 Inspection

Shield terminations for flight equipment will be inspected for compliance with the requirements of NHB 5300.4 (3G), Chapter 8.

6.9.2 Materials

Materials used in the construction of shield terminations will comply with the requirements of the detail specification.

6.9.3 Acceptance Criteria for Shield Termination

Shield terminations shall be per NHB 5300.4 (3G), Paragraph 3G811.

6.9.4 Unacceptable Termination Conditions

The characteristics detailed in NHB 5300.4 (3G), paragraph 3G812 shall be cause for rejection.

6.10 Potting of Connectors - Flight Equipment

The potting of connector back shells will be inspected for compliance with the requirements of the detail specification.

6.10.1 Materials

Materials utilized will conform with the requirements of the detail specification.

6.10.2 Acceptance Criteria

Acceptance criteria for potted connector back shells will be as follows:

- a. Potting material is that which is required in the detail drawing or specification
- b. Evidence that in-process inspection had been completed.
- c. Potting compound free from voids, cracks, and foreign material.
- d. Potting compound fully cured.

6.10.3 Unacceptable Potting of Connector Back Shells

- a. No evidence that in-process inspection had been completed.
- b. Potting compound material not to specification.
- c. Potting compound material soft, tacky, or otherwise has not completed the curing cycle.
- d. Cracks, voids, cavities, or any other evidence of unsuccessful blending or uneven curing.
- e. Uneven discoloration or streaks in the potting compound material.
- f. Floating connector pins unintentionally locked in place by potting compound.
- g. Unsuccessful bonding of the potting material to any part of the connector or cable.
- h. Dust or other contaminants trapped in the cured compound.
- i. Potting material torn, burned, or crumbling.
- j. Potting compound in any area of the connector or cable outside of the potting boot.

6.11 Identification

Identification of parts, subassemblies, assemblies, components, cable harnesses, etc., will be inspected for compliance with the marking requirements of the appropriate drawings.

6.11.1 Acceptance of Markings

Acceptance of identification will be based on the following requirements:

- a. Identification complete as specified in the CSR design documentation.
- b. Identification is positioned so that it is visible after installation, unless otherwise specified.
- c. All markings are clean, legible, well-defined, and uniform.
- d. Letters are between 1/8 and 3/16 of an inch high (or as specified by the detail drawing).

6.11.2 Impression Stamping

6.11.2.1 Acceptable Impressions

- a. Impressions are uniform and deep enough to be entirely legible.
- b. Stampings leave no sharp edges.
- c. Impression markings will be utilized only where specifically authorized by the appropriate drawing or specification.

6.11.2.2 Unacceptable Impressions

- a. Markings are indistinct.
- b. Stamping has created sharp burrs.
- c. Markings are double stamped.
- d. Markings not uniform.

6.11.3 Identification of Cabling

Cable identification shall conform with NHB 5300.4 (3G) paragraph 3G1000.

6.11.4 Acceptable Criteria for Cable Identification

- a. All markings will be permanent, well defined, and legible.
- b. Identification will be located so that it is visible after cable installation.
- c. Identification will be complete as specified in the applicable CSR specification.
- d. All cables will be identified.
- e. All connectors and pigtails will be identified.

6.11.5 Unacceptable Cable Identification

- a. Appropriate criteria listed in paragraph 6.11.2.2 will apply.
- b. Stamping process has damaged cable.
- c. Label has been altered or re-identified.
- d. Stamping or marking process had damaged insulation.

6.12 Crimp Connections

Crimping shall be performed in accordance with the requirements of chapter 4 of NHB 5300.4(3H).

6.12.1 Process Controls

Tools shall be calibrated in accordance with MIL-C-22520. The calibration period shall not exceed six (6) months. The crimping process shall be per paragraph 3H406 of NHB 5300.4(3H).

6.12.2 Acceptance Criteria

Crimp acceptance shall be per paragraph 3H406 of NHB 5300.4(3H), subparagraph 7.

6.12.3 Rejection Criteria

Crimp rejection shall be per paragraph 3H406 of NHB 5300.4(3H), subparagraph 8.

6.13 General Notes on Completed Assemblies.

In addition to the requirements detailed in the proceeding sections of this document, completed assemblies will be inspected to the following requirements.

6.13.1 Cleanliness.

Completed assemblies shall be free of all drill chips, greases, oils, thread tapping residue, solder flux, loose bits of solder, wire fragments, fingerprints on sensitive surfaces, metal fragments, hairs, or other foreign matter.

6.13.2 Finish

Treated surfaces such as paint, coatings, platings or etchings will be complete, uniform, and free from scratches or voids.

6.13.3 Handling

Completed assemblies shall show no evidence of deformed castings, bent walls, buckled or concave webs, fractures, twisted supports or brackets, or any other abnormal conditions acquired through mishandling or abuse.