INCH-POUND

MIL−PRF−50884G
W/AMENDMENT 1
21 September 2023
SUPERSEDING
MIL−PRF−50884G
28 July 2020
(See 6.6)

The documentation and process conversion measures necessary to comply with this revision shall be completed by 21 December 2023 (see 3.8).

PERFORMANCE SPECIFICATION

PRINTED WIRING BOARD, FLEXIBLE OR RIGID−FLEX, GENERAL SPECIFICATION FOR

Inactive for new design after 28 February 1999.
For new design use MIL−PRF−31032.

Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime ATTN: VAC, P.O. Box 3990, Columbus, OH 43218−3990, or by electronic mail to 5998.Documents@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

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APPENDICES

TABLES

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the performance and qualification requirements for flexible and rigid-flex printed wiring boards with or without plated through holes (see 6.1). Verification is accomplished through the use of MIL−PRF−31032 and its associated specification sheets. Detail requirements, specific characteristics, and other provisions which are sensitive to the particular intended use are specified in the applicable master drawing.

1.2 Classification. Printed wiring boards are classified by 1.2.1, 1.2.2, 1.2.3 and 1.2.6.

1.2.1 Printed wiring board type. The printed wiring boards covered by this specification are of the following types:

Type 1 − Singled−sided flexible printed wiring board (see 6.4.6.1) with or without shields or stiffeners.

Type 2 − Double−sided flexible printed wiring board (see 6.4.6.2) with or without shields or stiffeners with or without plated-through holes.

Type 3 − Multilayer flexible printed wiring board with plated holes (see 6.4.6.3) and with or without shields or stiffeners.

Type 4 − Multilayer rigid and flexible printed wiring board with plated-through holes (see 6.4.6.4).

Type 5 − Bonded rigid and/or flexible printed wiring board combinations without plated-through holes (see 6.4.6.5).

1.2.2 Installation use. The printed wiring boards covered by this specification are for the following installation uses:

Use A − Capable of withstanding flexing during installation (flex to install).

Use B − Capable of withstanding continuous flexing for the number of cycles specified (see 3.1.1).

1.2.3 Rework capability (see 6.6.1). The printed wiring boards covered by this specification are of the following rework capability grades:

Grade R − Flexible printed wiring that is capable of withstanding at least three solder and two unsolder operations without terminal area degradation.

Grade U − Flexible printed wiring that is capable of withstanding at least one solder operation without terminal area degradation. This grade can only be used in electrical or electronic assemblies that will not require an unsolder and re−solder capability.

If not specified on the applicable master drawing, the default rework capability is grade R.

1.2.4 Flexible base material. The printed wiring board flexible base material type should be identified by the base material designators of the applicable flexible base material specification as required by the master drawing (see 3.1.1).

1.2.5 Rigid base material (designs with stiffeners). The printed wiring board rigid base material type should be identified by the base material designators of the applicable base material specification as required by the master drawing (see 3.1.1).

1.2.6 Wrap plating (surface and knee continuous copper plating). The wrap plating grade designation is defined by the amount of plated-through hole surface and knee continuous copper plating thickness remaining after surface processing. The reduction is calculated from average hole wall thickness. The grades are as follows:

A − Printed boards of this grade have 80 percent or more of the specified average hole wall thickness on the surface and at the knee after processing.

B − Printed boards of this grade have 50 percent or more of the specified average hole wall thickness on the surface and at the knee after processing.

C − Printed boards of this grade have 20 percent or more of the specified average hole wall thickness on the surface and at the knee after processing.

Unless otherwise specified, the default grade of wrap copper plating is grade A for printed board designs that will not undergo planarization and grade B for designs that require planarization.

1.3 Description of this specification. The main body contains general provisions and is supplemented by detailed appendices. Appendix E contains the qualification requirements. Appendix D can be used when producing printed wiring boards designed to superseded design standards (see 6.4.4 and D.4.2). Appendix D may also be used as a guide in developing a test plan for legacy or existing designs based on the tests and inspections of legacy revisions. See 6.6.4 regarding the deletion and re-identification of appendices from the previous revision. Appendices A, B, C, F, G and H have been deleted.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirement documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL−PRF−31032 − Printed Circuit Board/Printed Wiring Board, General Specification for.

(Copies of these documents are online at https://quicksearch.dla.mil.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

IPC − ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES (IPC)

IPC−T−50 − Terms and Definitions for Interconnecting and Packaging Electronic Circuits.

(Copies of these documents are available online at https://www.ipc.org.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General requirements. The manufacturer of printed wiring boards, in compliance with this specification, shall use, or have access to production and verification facilities, and product assurance procedures adequate to assure successful compliance with the provisions of this specification and the associated master drawing. Adequacy of a printed wiring board manufacturer to meet the requirements of this specification shall be determined by the Government qualifying activity (DLA Land and Maritime, code VQE). Only printed wiring boards which are verified and meet all the applicable performance requirements herein and the design, construction, and material requirements of the associated master drawing shall be certified as compliant and delivered.

3.1.1 Master drawing. Printed wiring boards delivered under this specification shall be of the material, design, and construction specified on the applicable master drawing.

3.1.2 Conflicting requirements. In the event of conflict between the requirements of this specification and other requirements of the applicable master drawing, the precedence in which documents shall govern, in descending order, is as follows:

a. The applicable master drawing (see 3.1.1). Additional acquisition requirements (see 6.2) may be provided in the order or contract. Any deletion of any of the performance requirements or performance verifications of this specification not approved by the qualifying activity, will result in the printed wiring board being deemed noncompliant with this specification.

b. This specification.

c. The applicable design standard (see appendix D).

d. Specifications, standards, and other documents referenced in section 2, D.2 and E.2.

3.1.3 Terms and definitions. The definitions for all terms used herein shall be as specified in IPC−T−50 and those contained herein (see 6.4, and appendices D and E).

3.2 Qualification. Printed wiring boards furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable QPL at the time of award of contract (see 4.3 and 6.3). The qualification requirements shall be in accordance with appendix E. Products qualified in accordance with appendix E are monitored and maintained through the manufacturer's Capability Verification Inspection program and do not require requalification to this specification.

3.3 Product assurance requirements. A product assurance program for printed wiring boards furnished under this specification shall be satisfied by certification to MIL−PRF−31032. All printed wiring boards manufactured and delivered in compliance with this document shall be produced in accordance with the approved quality management plan. QML product assurance procedures shall be revised to address changes from the previous revision of this specification and made available to the qualifying activity no later than 6 months after the date of this specification in order for the QML−31032 manufacturer to be retained on QPD−50884. The manufacturer shall ensure the product assurance procedures reflect the actual product assurance practices of the manufacturing location qualified. The qualifying activity shall be notified concurrently of any changes to these procedures.

3.3.1 Performance requirements. The performance requirements of the applicable MIL−PRF−31032 specification sheet shall apply to all printed wiring boards procured to this document.

3.3.2 Accept/reject criteria. The accept/reject criteria of the applicable MIL−PRF−31032 specification sheet shall apply to all printed wiring boards procured to this document.

3.3.3 QML brand. At the option of the manufacturer, the QML brand specified in MIL−PRF−31032 may be placed on printed wiring boards procured to this document.

3.4 Letters of interpretation and policy. Letters of interpretation and policy applicable to this document shall be approved in writing by the preparing activity. All letters of interpretation and policy applicable to MIL−PRF−50884 or MIL−P−50884written prior to the current date of this document are not applicable to this revision. All subsequent letters of interpretation and policy letters are valid only until the next document change action (amendment or revision).

3.5 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.6 Certification of conformance and acquisition traceability. Unless otherwise specified by the contract or order (see 6.2), a certificate of conformance for compliant printed wiring boards shall be forwarded to the acquiring activity (see 6.4.1). When a certificate of conformance for compliant printed wiring boards is supplied, it shall include the following information, as a minimum:

a. Manufacturer’s name and address.

b. Customer’s name and address.

c. Manufacturer’s CAGE (Commercial and Government Entity) code (see 6.4.2).

d. Printed wiring board description, including classification (printed wiring board type, installation use, rework capability, and base materials), specification number with revision letter and amendment number when applicable, master drawing or other identification number, and the applicable design standard.

e. Lot date code.

f. Quantity of printed wiring boards in shipment from manufacturer.

g. Statement certifying printed wiring board conformance to this specification, the master drawing, and the contract or order.

h. The date of transaction.

i. A description or listing of the additional acquisition requirements not listed on the master drawing (see 3.1.1) that affects the design, test conditions, or acceptability requirements of the resulting printed boards.

j. The name of the company official approving the certificate of conformance. The manufacturer shall have a method for authenticating the approval of certificates of conformance for printed wiring boards compliant to this specification.

3.7 Qualifying activity on−site audit. Manufacturers listed on QPD−50884 will be required to undergo periodic on-site audits of their facilities by the qualifying activity. The manufacturer shall demonstrate to the qualifying activity that controls have been implemented to assure compliance to the requirements of this specification. The qualifying activity reserves the right to perform on−site audits of any other facilities, such as contracted services, that the manufacturer uses for producing printed wiring boards to this specification. The on-site audit shall verify that the manufacturer has an effective self-audit program for both itself and for all contract service operations used in the production of certified product. Evidence of conformance inspection (data and records) shall be available to the qualifying system audit team during any scheduled qualifying activity on-site audit.

3.8 Change effectivity. Unless otherwise specified by the preparing activity or the qualifying activity, all changes from the previous revision of MIL−P−50884 shall become effective within 90 days after the date of publication of this revision. If a qualified manufacturer is unable to implement the changes within the 90 day time period, additional time shall be requested from the qualifying activity. Manufacturers that are QPL listed and have concerns regarding possible changes to retention reporting requirements should contact the qualifying activity for clarification.

3.9 Workmanship. Printed wiring boards shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Inspection of product for delivery (see 4.3).

c. Periodic conformance inspection (see 4.4).

4.2 Qualification inspection. The requirements for qualification shall be as specified in appendix E.

4.3 Lot conformance inspection. Printed wiring board performance verification inspection shall consist of lot conformance inspections on the production printed wiring boards and test coupons specified in the applicable MIL−PRF−31032 specification sheet.

4.4 Periodic conformance inspection. Periodic conformance inspection shall consist of inspections specified in the applicable MIL−PRF−31032 specification sheet.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in−house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the Military Service’s system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD−ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Flexible and rigid−flex printed wiring boards are intended primarily for use in ground support, airborne, and shipboard electronic equipment and electrical equipment to eliminate high density hand wiring, where space is limited and where compact packaging is desirable.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, revision letter (with any amendment number when applicable), and date of this specification.

b. Title, number, revision letter (with any engineering change proposal or notice of revision number when applicable), and date of the applicable master drawing (see 3.1.1).

c. The specific issue of individual documents referenced (see 2.2).

d. Appropriate printed wiring board type (see 1.2.1), installation use (see 1.2.2), rework capability grade (see 1.2.3), and grade of copper wrap (see 1.2.6).

e. Requirements for certificate of conformance, if other than 3.6.

f. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in QPD−50884 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, Ohio 43218−3990, or by e-mail to 5998.Qualifications@dla.mil, or at https://LandandMaritimeApps.dla.mil/Offices/Sourcing_and_Qualification. An online listing of products qualified to this specification may be found in the Qualified Products Database at https://qpldocs.dla.mil. Application procedures should conform to the guidelines of SD−6, "Provisions Governing Qualification" (see 6.3.3). Qualified capabilities details may be found in the Qualified Products Database Supplemental Information Sheet (QPDSIS) for QPL−50884 available at https://LandandMaritimeApps.dla.mil/programs/qmlqpl.

6.3.1 Transference of qualification. Manufacturers currently qualified to MIL−P−50884F with amendment 3 will have their qualification transferred to this document under the conditions described in 3.3. The expiration date of their current qualification will not be changed. Qualifications in process (before the date of this document) will be performed to the requirements of the specification revision and amendment as listed on the approved Authorization to Test Form, available from the qualifying activity. New applications for qualification (after the date of this document) should be performed to the requirements of this revision.

6.3.2 Retention of qualification. Printed wiring boards verified and certified to MIL−P−50884C (with any amendment) or MIL−P−50884D (with any amendment) to any product assurance level contained herein may be used to meet retention of qualification production to this document.

6.3.3 Legacy manufacturer certification program. The certification program of MIL−P−50884C (unamended) was not governed by the policies and procedures of the Defense Standardization Program as defined by DoD 4120.3−M and therefore does not exist within the QPL program of MIL−P−50884C with Amendment 1 and beyond. For additional information concerning this issue, see MIL−P−50884C, paragraph 60.1.

6.3.4 "Provisions Governing Qualification". Copies of SD−6, "Provisions Governing Qualification", may be downloaded at URL: https://quicksearch.dla.mil.

6.4 Terms and definitions.

6.4.1 Acquiring activity. The organizational element of the Government which contracts for articles, supplies, or services may authorize a contractor or sub-contractor to be its agent. When this organizational element of the Government has given specific written authorization to a contractor or sub-contractor to serve as agent, the agent will not have the authority to grant waivers, deviations, or exceptions to this specification unless specific written authorization to do so has also been given by the Government organization, which is the preparing activity or qualifying activity. In the absence of a specific acquiring activity, the acquiring activity will be an organization within the supplier's company that is independent of the group responsible for device design, process development, or screening, or may be an independent organization outside the supplier's company.

6.4.2 Commercial and Government Entity (CAGE) code. The Commercial and Government Entity Code, or CAGE Code, is a 5 digit identifier assigned to suppliers to the Federal Government of the United States of America in order to provide a standardized method of identifying a given facility or a specific location. CAGE was previously known as Federal Supply Code for Manufacturers (FSCM) and also the National Supply Code for Manufacturers (NSCM). Request for or an update to a CAGE code can be obtained at URL: https://cage.dla.mil.

6.4.3 Customer. A customer is the recipient of a good, service, product or an idea, obtained from the certified and qualified manufacturer. For the purposes of this document, the terms "buyer", "client", "contractor", "purchaser", "subcontractor", or "user" will be interpreted as the customer.

6.4.4 Design standard. A document that establishes the baseline parameters (default values), standard practices and guidelines for the design of printed wiring boards. Within this document, the term "design standard" is used to describe those documents that contains the design, construction, material, and test coupon requirements and guidelines used to produce panels of flexible printed wiring boards.

6.4.5 Manufacturer. The actual producer of a good, service, product or idea. For the purposes of this document, the terms "seller", "supplier", or "vendor" will be interpreted as the certified and qualified manufacturer.

6.4.6 Printed wiring board type. The printed wiring board type should be as specified in IPC−2223. The legacy printed wiring board types of MIL−STD−2118 correspond to the types described in IPC−2223 and are listed herein.

6.4.6.1 Type 1. Type 1 flexible printed wiring boards have only one conductive layer (single sided conductor pattern) with coverlayer and no plating in the component holes. In addition, the design may contain shields or stiffeners. Type 1 flexible printed wiring boards are usually designed for installation use B (continuous flex) applications.

6.4.6.2 Type 2. Type 2 flexible printed wiring boards are printed wiring boards with conductor patterns on both sides of the printed wiring board (double sided). In addition, the design of the printed wiring board may require the following: (1) that the holes through the base material be plated through to connect the conductor patterns on both sides together, (2) with or without shields, and (3) with or without stiffeners. Type 2 flexible printed wiring boards are usually designed for installation use B (continuous flex) applications.

6.4.6.3 Type 3. Type 3 flexible printed wiring boards are multilayered (with three or more conductor layers) with plated-through holes. Type 3 printed wiring boards are usually designed for installation use A (flex to install) applications.

6.4.6.4 Type 4. Type 4 flex−rigid printed wiring boards are multilayered boards containing plated-through holes with rigid sections connected by flexible sections. Type 4 printed wiring boards are usually designed to be used in installation use A (flex to install) applications.

6.4.6.5 Type 5. Type 5 printed wiring boards are multilayer bonded rigid and flexible printed wiring board combinations without plated-through holes. Type 5 printed wiring boards are usually designed to be used in installation use A (flex to install) applications.

6.4.7 Product assurance. The method of complying with the two different levels of this document using either the QPL method or the QML method.

6.4.7.1 QPL. A transitional program that allows a manufacturer that is certified and qualified to the QML program of MIL−PRF−31032 to fabricate, test, and supply products to this document.

6.4.7.2 QML. A list of manufacturers, by name and plant address, who have met the certification and qualification requirements stated in MIL−PRF−31032. A QML focuses on qualifying an envelope of materials and processes rather than individual products or designs. That envelope is qualified by carefully selecting representative worst case test vehicles or representative samples from production that contain all potential combinations of materials and processes that may be subsequently used during production. A QML is normally appropriate for items of supply that have very rapid technological advancement or a myriad of variations or custom designs that make individual product qualifications impractical or excessively expensive.

6.4.8 Qualified Products Database (QPD). A QPD is an electronic version of a Qualified Products List (QPL) and Qualified Manufacturers List (QML) document. The QPD has replaced all of the information that used to contained on QPL−50884. As the data in a specific QPL or QML is converted to database format, the QPL or QML will be phased out and replaced by an equivalent Qualification Dataset (QDS) associated with the specification requiring qualification. For MIL−PRF−50884, a Qualified Products Database Supplemental Information Sheet containing the information once listed on QPD−50884 is available from the qualifying activity.

6.4.9 Qualified Products Database Supplemental Information Sheet (QPDSIS). The qualified capabilities for manufacturers may be found in the QPDSIS for any particular MIL−PRF−50884 listing. The QPDSIS is available at https://LandandMaritimeApps.dla.mil/programs/qmlqpl.

6.4.10 System for Award Management (SAM). The Central Contractor Registration (CCR) system was transitioned to the System for Award Management (SAM) in 2012. The SAM is the primary registrant database for the U.S. Federal Government. SAM collects, validates, stores and disseminates data in support of agency acquisition missions. Qualified manufacturers should be registered in the SAM prior to the award of a contract; basic agreement, basic ordering agreement or blanket purchase agreement. SAM information can be obtained at https://www.sam.gov.

6.4.11 Quality−conformance test circuitry, test coupons, and microsection mounts.

6.4.11.1 Quality−conformance test circuitry. A portion of a printed board panel that contains a complete set of test coupons that are used to determine the acceptability of the board(s) on the panel.

6.4.11.2 Microsection mount. A term used to describe the cured thermosetting resin holder/carrier of encapsulated portions of printed wiring products (test coupon, printed board, or multiples thereof) used for preparing a metallographic specimen.

6.4.11.3 Test coupon. A portion of quality conformance test circuitry that is used for a specific test, or group of related tests, in order to determine the acceptability of a printed board or panel (multiple printed boards).

6.4.11.3.1 Tested test coupon. A test coupon that has undergone a test that involves a chemical, electrical, environmental, or physical stress. Test coupons that have not been stress tested but have been cross-sectioned (microsectioned) are classified as a tested test coupon.

6.4.11.3.2 Untested test coupon. A test coupon that has not undergone a test that involves a chemical, electrical, environmental or physical stress. Test coupons that have been separated from the production panel or QCTC strip but have not been subjected to any stress test are classified as an untested test coupon.

6.5 Compliant printed wiring boards. For a printed wiring board to be compliant with this document, it has to be produced by a manufacturer qualified for listing on QPD−50884 or reciprocal listing as described in appendix E, and come from a lot which was subjected to and passed all inspection of product for delivery verifications using the applicable product assurance program.

6.6 Supersession.

6.6.1 Superseded types and classes. Superseded types and classes are listed below:

a. Type A of MIL−P−50884B (the ability to withstand only one solder operation without degradation) was not addressed in previous revisions, but is addressed by rework capability grade U in this revision.

b. Type B of MIL−P−50884B (the ability to withstand five solder and unsoldering operation without degradation) was superseded by all printed wiring board types of MIL−P−50884C and MIL−P−50884D. It is addressed by rework capability grade R in this revision.

c. Class 1 of MIL−P−50884B was superseded by types 1, 2, and 5 of MIL−P−50884C and beyond.

d. Class 2 of MIL−P−50884B was superseded by types 3 and 4 of MIL−P−50884C and beyond.

6.6.2 Design, construction, and verification. Design, construction, and verification supersession information is included in appendix D of this document.

6.6.3 Reference to superseded specifications. All the requirements of this document can be interchangeable with those documents identified as MIL−P−50884. Therefore, existing documents (master drawings or OEM documents) referencing MIL−P−50884 need not be revised, updated, or changed to make reference to MIL−PRF−50884 in order for this document to be used.

6.6.4 Reference to superseded appendices. The previous revision of this specification had 8 appendices (A through H). Previous revisions deleted 5 of the 9 and this revision deletes 1 of the remaining 3 appendices. Also, one of the 2 that remain has been re-identified. The status of the appendices that have been removed and the identification of those appendices that remain in this revision are listed below:

a. MIL−PRF−50884F, appendix A, dated 15 March 2014, was canceled without replacement.

b. MIL−PRF−50884G, appendix B, dated 28 July 2020, is hereby canceled. The information that was contained in appendix B was moved to appendix E of this document.

c. MIL−PRF−50884F, appendix C, dated 15 March 2014, was canceled. The information that was contained in appendix C of MIL−PRF−50884F is covered by appendix E of MIL−PRF−31032.

d. MIL−PRF−50884G, appendix D, remains active in this revision.

e. MIL−PRF−50884G, appendix E, remains active in this revision.

f. MIL−PRF−50884F, appendix F, dated 15 March 2014, was canceled without replacement.

g. MIL−PRF−50884F, appendix G, dated 15 March 2014, was canceled without replacement.

h. MIL−PRF−50884F, appendix H, dated 15 March 2014, was canceled without replacement.

6.7 Design standard. This document contains requirements and guidelines for the testing of printed wiring boards that were designed to and or make use of test coupons conforming to IPC−2221 and the flex and rigid-flex design details unique to IPC−2223. See appendix D for additional guidance regarding the verification of panels using different design standards.

6.8 Automatic update notification. An electronic mail notification option is available to registered ASSIST users. If you do not receive an electronic mail message that an amendment or revision of this document has been completed, information pertaining to how to make use of this option within ASSIST may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, Ohio 43218−3990, or by email to 5998.Qualifications@dla.mil.

6.9 Subject term (key word) listing.

Design standard
Master drawing
Qualified Manufacturer List (QML)
Qualified Product List (QPL)
Test coupon
Product assurance program

6.10 Amendment notations. The margins of this specification are marked with asterisks to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

APPENDIX A

MIL−PRF−50884G, appendix A, dated 28 July 2020, is hereby canceled without replacement.

APPENDIX A

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APPENDIX B

MIL−PRF−50884G, appendix B, dated 28 July 2020, is hereby canceled. The information that was contained herein was moved to appendix E of this issue.

APPENDIX B

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APPENDIX C

MIL−PRF−50884F, appendix C, dated 15 March 2014, is hereby canceled. The information that was contained herein is covered by appendix E of MIL−PRF−31032.

APPENDIX C

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APPENDIX D

SUPERSESSION AND USAGE OF LEGACY DESIGN STANDARDS

D.1 SCOPE

D.1.1 Scope. This appendix contains information and guidance concerning the supersession of legacy Department of Defense documents such as MIL−P−50884 revision C and MIL−STD−2118. This appendix is not a mandatory part of this specification. The information contained herein is intended for guidance only.

D.2 APPLICABLE DOCUMENTS

D.2.1 General. The documents listed in this section are specified in sections D.3 and D.4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirement documents cited in sections D.3 and D.4 of this specification, whether or not they are listed.

D.2.2 Non−Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

IPC − ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES (IPC)

IPC−T−50	−	Terms and Definitions for Interconnecting and Packaging Electronic Circuits.
IPC−2221	−	Generic Standard on Printed Board Design.
IPC−2223	−	Sectional Design Standard for Flexible Printed Boards.

(Copies of these documents are available online at https://www.ipc.org.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

D.2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

D.3 DEFINITIONS

D.3.1 Design standard. A document that establishes the standard practices, guidelines, and default values for the design of printed wiring boards. Within this document, the term "design standard" is used to describe those documents that contain the design, construction, material, and test coupon requirements and guidelines.

D.3.2 Legacy designs or documents. See D.4.1.

D.3.3 Supersession. The act of replacing a legacy document that no longer exists or is no longer supported with a currently supported document.

D.3.4 Quality conformance test circuitry. See IPC−T−50.

D.3.5 Printed wiring board type. The printed board types are defined in IPC−2223.

APPENDIX D

D.4 SUPERSESSION

D.4.1 Superseded specifications. The MIL-PRF-31032 specifiations sheets for flexible and rigid-flex printed boards includes the essential requirements of the previous revision and can be used to supersede the following specifications:

a. MIL−P−50884C, dated 4 May 1984 with amendment 1, dated 19 August 1988.

b. MIL−P−50884C, dated 4 May 1984 with amendment 2, dated 22 June 1990.

c. MIL−P−50884C, dated 4 May 1984 with amendment 3, dated 13 December 1991.

d. MIL−P−50884C, dated 4 May 1984 with amendment 4, dated 9 April 1993.

e. MIL−P−50884C, dated 4 May 1984 with amendment 5, dated 27 November 1998.

f. MIL−P−50884D, dated 28 December 2000.

g. MIL−P−50884D, dated 28 December 2000 with amendment 1, dated 13 September 2002.

h. MIL−P−50884D, dated 28 December 2000 with amendment 2, dated 29 May 2006.

i. MIL−P−50884E, dated 24 November 2008.

j. MIL−P−50884E, dated 24 November 2008 with amendment 1, dated 4 July 2009.

k. MIL−P−50884E, dated 24 November 2008 with amendment 2, dated 14 February 2010.

l. MIL−P−50884E, dated 24 November 2008 with amendment 3, dated 1 September 2010.

m. MIL−P−50884F, dated 15 March 2014.

n. MIL−P−50884F, dated 15 March 2015 with amendment 1, dated 27 November 2015.

o. MIL−P−50884F, dated 15 March 2015 with amendment 2, dated 28 November 2016.

p. MIL−P−50884F, dated 15 March 2015 with amendment 3, dated 28 March 2018.

q. MIL−P−50884G, dated 28 July 2020.

D.4.1.1 Reference to superseded specifications. All the requirements of this document (MIL−PRF−50884F) can be interchangeable with those of MIL−P−50884. Therefore, existing procurement documents (master drawings or OEM documents) referencing MIL−P−50884 need not be revised, updated, or changed to make reference to MIL−PRF−50884F in order for this document to be used.

D.4.1.2 Revisions. Printed wiring boards tested to this document generally would meet or exceed the performance requirements of past revisions. However, due to various changes in acceptability and evaluation criteria, testing procedures and test coupon sampling, an exact duplication of a previous revision cannot be claimed or made in all areas of concern. Manufacturers should not pick-and-choose or mix acceptability requirements and test procedures from one revision of MIL−P−50884 to another. Compliance should be either to MIL−P−50884B, MIL−P−50884C (with a specific amendment, if applicable), or this document entirely, unless the manufacturer documents a direct correlation between the revisions (with any amendments, if applicable) under consideration.

APPENDIX D

D.4.2 Superseded guidelines and standards. The following design standards have been superseded by IPC−2221 and IPC−2223 for all types and classes of printed wiring boards:

a. MIL−STD−2118, dated 4 May 1984.

b. MIL−P−50884B (appendix), dated 19 January 1976.

c. MIL−P−50884A, dated 5 June 1972.

D.4.2.1 Retooling. Printed wiring boards that were designed using superseded Department of Defense design standards shall be converted to IPC−2221 and IPC−2223.

D.4.2.2 Superseded types. Before MIL−P−50884C, only single and double sided printed wiring boards were covered in MIL−P−50884. The obsolete type A requirements in MIL−P−50884B (flexible printed wiring that is capable of withstanding at least one solder operation without terminal degradation) did not carry over to MIL−P−50884C. However, the type B requirements in MIL−P−50884B (flexible printed wiring that is capable of withstanding at least five solder and unsolder operations without terminal area degradation, i.e., rework simulation) was carried over to and extended to all printed wiring board designs in MIL−P−50884C.

D.4.3 Testing.

D.4.3.1 Group A inspection. Group A inspection should be performed to the specific revision, and amendment if applicable, called out by the acquisition documents. For example, if printed wiring boards are produced to MIL−P−50884C with amendment 1, MIL−P−50884C with amendment 3 and MIL−P−50884D, a manufacturer would be expected to perform group A testing, for the applicable lot, to the requirements of the revision specified. In those three different revisions (C w/amendment 1, C w/amendment 3, and D) a requirement for an acceptability criteria or test procedure may be the same or it might be significantly different. Retention of qualification summaries for group A should list the lots produced, grouped by revision and amendment.

D.4.3.2 Group B samples and testing. Samples to be selected for group B testing should be based on the most complex compliant printed wiring boards produced that month. For example, if printed wiring boards are produced to MIL−P−50884C, MIL−P−50884C with amendment 4 and MIL−P−50884D during a given month, and the most complex printed wiring boards produced that month were in the lot ordered to MIL−P−50884C with amendment 4, then that should be the lot from which the group B sample should be selected. The samples should be tested in accordance with MIL−P−50884C with amendment 4. If during that same month, printed wiring boards were produced to MIL−P−50884B and MIL−P−50884C (unamended), group B tests to those specific revisions would also be required in order to be compliant to those revisions, unless specifically specified in the contract.

D.4.3.3 Group C samples and testing. Group C testing is for manufacturers of installation use A and use B printed wiring boards to verify that it is still capable of meeting the flexibility class performance requirements. Samples to be selected for group C testing, unlike group B inspection, are not based on the most complex compliant printed wiring boards produced that month or reporting period. The group C samples can be either production printed wiring boards or the appropriate test coupon.

D.4.4 Superseded test coupons. Before MIL−P−50884C, test coupons were only used for first article inspection and not required for production. The production panel test coupons were introduced within MIL−P−50884C and MIL−STD−2118 were for the supplier certification program concept. The production test coupons of MIL−P−50884C, described within MIL−STD−2118, should be used when already incorporated onto production tooling. New designs or jobs should use the test coupons specified in IPC−2221. Table D−I contains a cross listing of the various test coupon designations that have been used in superseded design standards.

APPENDIX D

D.4.5 Test coupons, placement, quantity and usage. IPC−2221 contains a table that specifies for each production panel the test coupon placement, quantity (see note below) and usage. However, MIL−STD−2118 did not provide a table that specifies for each production panel the test coupon placement, quantity, and usage.

NOTE: A sufficient number of test coupons should be incorporated onto the production panel in order to be able to perform the required inspections regardless of the number of test coupons specified by the design standard.

D.4.5.1 Intended use and intent of this appendix. This appendix can be used to understand the test coupons that were referenced in previous revisions of this document. These guidelines are intended for the re-identification and proper usage of test coupons within this document that are or were originally identified in various legacy Department of Defense printed wiring board design standards. This appendix is intended for use in conjunction with a manufacturer's verification conformance compliancy program.

D.4.5.2 Guidance concerning legacy test coupons. IPC−2221 contains a table that specifies for each production panel the test coupon placement, quantity, and usage. However, MIL−STD−2118 did not contain a table that specifies for each production panel the test coupon placement, quantity, and usage. In the past, when attempting to be compliant with the group A table of MIL−P−50884C, it was confusing and difficult to determine how many test coupons were needed on the production panel, how many test coupons needed to be microsectioned, and what evaluations could be combined during group A inspection.

TABLE D−I. Test coupon translation.

Usage in this document	MIL−STD−2118	IPC−D−249	IPC−2221 1/	
			Legacy	New design
Hole solderability Non-stressed specimens (microsection)	A	A	A	A
Resistance to soldering heat (solder float thermal stress) Rework simulation	B	B	B	B
Plating adhesion	C	C	C	C
Interconnect resistance (continuity)	D	D	D	D
Insulation resistance	E		E	E
Flexibility	F	H	H	H
Solder mask	I or G 2/	G	G/T	G
Peel strength			P	
Solderability			S	
Registration			F	

1/ H coupon was added to IPC−2221 with the issuance of amendment 1.
2/ MIL−P−50884C, group A table reference test coupon "G" while MIL−STD−2118 displayed a test coupon "I" next to the solder mask test coupon figure.

APPENDIX E

QUALIFICATION REQUIREMENTS

E.1 SCOPE

E.1.1 Scope. This appendix contains the qualification requirements for printed wiring boards covered by this specification. The process for extending qualification is also outlined herein. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

E.2 APPLICABLE DOCUMENTS

E.2.1 General. The documents listed in this section are specified in sections E.3 and E.4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections E.3 and E.4 of this specification, whether or not they are listed.

E.2.2 Government documents.

E.2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL−PRF−31032	−	Printed Circuit Board/Printed Wiring Board, General Specification for.
MIL−PRF−31032/3	−	Printed Wiring Board, Flexible, Single and Double Layer, With or Without Plated Holes, With or Without Stiffeners, for Soldered Part Mounting.
MIL−PRF−31032/4	−	Printed Wiring Board, Rigid-Flex or Flexible, Multilayer, with Plated Holes, with or Without Stiffeners, for Soldered Part Mounting.

(Copies of these documents are available online at https://quicksearch.dla.mil.)

E.2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

E.3 REQUIREMENTS

E.3.1 Qualification inspection. Qualification testing shall be performed on suitable test vehicles in accordance with the qualifying activity approved MIL−PRF−31032 qualification test plan.

E.3.2 Reciprocal qualification from MIL−PRF−31032. A reciprocal qualification listing (i.e., from a technology qualified to a MIL−PRF−31032 specification sheet) to this appendix will depend on the level of QML technology qualified. Unless otherwise detailed in MIL−PRF−31032 qualification test plan, following guidelines will apply:

a. Printed wiring board type (see 6.4.6 and D.3.5). The extent of qualification for base materials types defined in E.4 will apply. EXAMPLE: A type 2 qualification under a MIL−PRF−31032 specification sheet will not justify a type 4 qualification listing to this appendix.

b. Printed board material. The extent of qualification for base materials types defined in MIL−PRF−31032 will apply. EXAMPLE: An adhesiveless flexible metal clad base material qualification under a MIL−PRF−31032 specification sheet will justify an adhesiveless flexible metal clad base material qualification listing to this appendix (of the corresponding type).

c. Complexity. Printed wiring board designs verified using the QML product assurance option shall flow through the conversion of customer requirements element of the approved Quality Management (QM) plan as described in MIL−PRF−31032, appendix A. The Technical Review Board (TRB) shall evaluate designs exceeding their current QPD−31032 qualification listing to determine if the add−on qualification provisions of MIL−PRF−31032 shall be used. Reasons for not using the add−on qualification provisions shall be documented in the periodic status reports.

E.3.3 Retention. The QML status report described in MIL−PRF−31032 will cover the retention requirements to this appendix.

E.4 EXTENT OF QUALIFICATION

E.4.1 General. The extent of qualification shall be in accordance with the following ranges specified in E.4.1.1 through E.4.1.7.

E.4.1.1 Printed wiring board type. Qualification of a particular printed wiring board type shall be extended to cover all conductor patterns of that same printed wiring board type produced.

a. Qualification of type 4 printed wiring boards shall be extended to cover all other types (5, 3, 2, and 1).

b. Qualification of type 3 printed wiring boards shall be extended to cover types 1 and 2 printed wiring boards.

c. Qualification of type 2 printed wiring boards shall be extended to cover type 1 printed wiring boards.

d. Qualification of type 5 printed wiring boards shall be extended to cover type 1 printed wiring boards.

e. Qualification of any type shall be extended to cover the approved type or types with a stiffener.

E.4.1.2 Installation use. Qualification to installation use B shall be extended to cover installation use A. If not qualifying installation use B, installation use A shall be qualified.

E.4.1.3 Rework capability. Qualification to rework capability grade R shall be extended to cover rework capability grade U.

E.4.1.4 Base materials. All flexible and rigid base materials to be used in subsequent production shall be qualified.

E.4.1.5 Conductor surface finish. All conductor surface finishes to be used in subsequent production shall be qualified.

E.4.1.6 Foil lamination. If foil lamination techniques are to be used in subsequent production, the process shall be qualified.

E.4.1.7 Solder mask. All solder masks to be used in subsequent production shall be qualified.

APPENDIX E

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APPENDIX F

MIL−PRF−50884F, appendix F, dated 15 March 2014, is hereby canceled without replacement.

APPENDIX F

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APPENDIX G

MIL−PRF−50884F, appendix G, dated 15 March 2014, is hereby canceled without replacement.

APPENDIX G

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APPENDIX H

MIL−PRF−50884F, appendix H, dated 15 March 2014, is hereby canceled without replacement.

APPENDIX H

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Custodians:
Army − CR
Navy − EC
Air Force − 85
DLA − CC

Review activities:
Army − AR, MI
Navy − AS, MC, OS, SH
Air Force − 16

Preparing activity:
DLA − CC

(Project 5998−2023−030)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.