

The documentation and process conversion measures necessary to comply with this revision shall be completed by 17 August 2020 (see 3.8).

INCH-POUND

MIL-PRF-55110J
16 May 2020
SUPERSEDING
MIL-PRF-55110H
W/AMENDMENT 3
26 March 2018
(See 6.6)

PERFORMANCE SPECIFICATION

PRINTED WIRING BOARD, RIGID, GENERAL SPECIFICATION FOR

Inactive for new design after 31 December 1997.
For new design use [MIL-PRF-31032](#).



Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime
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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 rigid single-sided, double-sided, and multilayered 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 and 1.2.2 and 1.2.3.

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

- Type 1 - Singled-sided printed wiring board (see 6.4.6.1).
- Type 2 - Double-sided printed wiring board (see 6.4.6.2) with or without plated-through holes.
- Type 3 - Multilayer printed wiring board with plated holes (see 6.4.6.3).
- Type 4 - Multilayer printed wiring board with plated holes and blind or buried via holes (see 6.4.6.4).

1.2.2 Base material. The printed wiring board base material type should be identified by the applicable base material specification sheet or by the legacy base material type designator as required by the master drawing (see 3.1.1).

1.2.3 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 grades are as follows:

- A - Printed boards of this grade have 80 percent or more of the specified plating thickness in the wrap area after surface processing.
- B - Printed boards of this grade have 50 percent or more of the specified plating thickness in the wrap area after surface processing.
- C - Printed boards of this grade have 20 percent or more of the specified plating thickness in the wrap area after surface 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 B details the quality management approach using a technical review board concept along with a Qualified Manufacturer List (QML) product assurance program addressed in MIL-PRF-31032, to supplement the generic verification criteria provided in this specification. Appendix D is optional and can be used when producing printed wiring boards designed to superseded design standards (see 6.6.2). 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. Appendix E contains the qualification requirements. Appendices A, 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 requirements of 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 have and use production facilities, 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 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 contained herein and the design, construction, and material requirement 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 sections 2 and B.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 B, 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 QPD before contract award (see 4.3 and 6.3). In addition, the manufacturer shall receive certification from the qualifying activity that the product assurance requirements of 3.3 have been met and are being maintained. 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 MIL-PRF-31032 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 satisfy the requirements of appendix B. 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 QML-31032 manufacturers to be retained on QPL-55110. 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.

3.4 Letters of interpretation and policy. Letters of interpretation and policy applicable to this specification shall be approved in writing by the preparing activity or qualifying activity. All letters of interpretation and policy applicable to MIL-PRF-55110 written prior to the current date of this specification 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 boards (see 6.5) shall be forwarded to the acquiring activity (see 6.4.1). When a certificate of conformance for compliant printed 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 board description, including classification (printed wiring board type and base materials), specification number with revision letter and amendment number when applicable, master drawing or other identification number, and the applicable design standard or standards.
- e. Lot date code.
- f. Quantity of printed boards in shipment from manufacturer.
- g. Statement certifying printed board conformance to this specification, the master drawing, and the contract or order.
- h. The date of transaction.
- i. A description or listing of any 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 boards compliant to this specification.

3.7 Qualifying activity on-site audit. Manufacturers listed on [QPL-55110](#) 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 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-PRF-55110 shall become effective within 120 days after the date of publication of this revision. If a qualified manufacturer is unable to implement the changes within the 120 day time period, additional time shall be requested from the qualifying activity. Manufacturers that are QPD 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 defects that exceed those allowed in this specification that could affect life or serviceability.

4. VERIFICATION

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

- a. Qualification inspection (see 4.2).
- b. Lot conformance inspection (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. The requirements for lot conformance inspection (inspection of product for delivery) shall be as specified in [appendix B](#).

4.4 Periodic conformance inspection. The requirements for periodic conformance inspection shall be as specified in [appendix B](#).

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 requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities 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. Rigid printed wiring boards covered by this specification are intended for use in ground support, airborne, and shipboard electronic equipment to eliminate high density hand wiring and where compact electronic 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. The specific issue of individual documents referenced (see 2.2).
- c. 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).
- d. Appropriate printed wiring board type (see 1.2.1), base material type or classification (see 1.2.2), and grade of wrap plating (see 1.2.3).
- 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 QPL-55110 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 email 5998.Qualifications@dla.mil, or at Universal Resource Locator (URL) 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 (QPD) at <http://qpldocs.dla.mil>. Application procedures should conform to the guidelines of SD-6, "Provisions Governing Qualification" (see 6.3.4). In order to be listed in the QPD for QPL-55110, manufacturers will also have to maintain an active registration in the System for Award Management (SAM) database (see 6.4.3). Qualified capabilities details may be found in the Qualified Products Database Supplemental Information Sheet (QPDSIS) for QPL-55110 available at <https://LandandMaritimeApps.dla.mil/programs/qmlqpl>.

6.3.1 Transference of qualification. Manufacturers currently qualified to MIL-PRF-55110H will have their qualification transferred to this document under the conditions described in 3.3. Qualifications in process (before the date of this document) will be performed to the requirements MIL-PRF-55110H. New applications for qualification (after the date of this document) will be performed to the requirements of this revision.

6.3.2 Retention of qualification. Printed wiring boards verified and certified to MIL-P-55110D, MIL-P-55110E, MIL-PRF-55110E, MIL-PRF-55110F, MIL-PRF-55110G, or MIL-PRF-55110H, including any amendments, will retain qualification to this document.

6.3.3 Legacy manufacturer certification program. MIL-P-55110C certification program 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-55110D and beyond. For additional information concerning this issue, see MIL-P-55110C, 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 Definitions.

6.4.1 Acquiring activity. The organizational element of the Government which contracts for articles, supplies, or services may authorize a contractor or subcontractor to be its agent. When this organizational element of the Government has given specific written authorization to a contractor or subcontractor 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. Request for or an update to a CAGE code can be obtained at URL: <https://cage.dla.mil>. CAGE was previously known as Federal Supply Code for Manufacturers (FSCM) and also the National Supply Code for Manufacturers (NSCM).

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 specification, the term "design standard" is used to describe those documents that contain the design, construction, material, test coupon requirements, and guidelines used to produce panels of rigid 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 types. The printed wiring board types should be as specified herein.

6.4.6.1 Type 1. Type 1 rigid printed wiring boards have only one conductive layer (single-sided conductor pattern) with cover lay and no plating in the component holes.

6.4.6.2 Type 2. Type 2 rigid printed wiring boards are printed wiring boards with conductor patterns on both sides of the printed board (double-sided). In addition, the design of the printed wiring board may require plated-through holes in order to connect the conductor patterns on both sides together.

6.4.6.3 Type 3. Type 3 rigid printed wiring boards are multi-layered (with 3 or more conductor layers) with plated holes. Type 3 designs include those with metal core.

6.4.6.4 Type 4. Type 4 rigid printed wiring boards are multi-layered (with 3 or more conductor layers) with plated holes and blind or buried via holes.

6.4.7 Product assurance. The method of complying with the two different levels of this specification using either the QPL method, that has been integral to this specification since revision MIL-P-55110D, or the newer method, QML which was introduced in revision MIL-PRF-55110F.

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 specification.

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 currently contained on QPL-55110. 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-55110, a Qualified Products Database Supplemental Information Sheet containing the information once listed on QPL-55110 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-55110 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 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.

6.4.11.2 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.

6.4.11.3 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 specification, it must be produced by a manufacturer qualified for listing on [QPL-55110](#) or reciprocal listing as described in [appendix B](#), and must be obtained from a lot which was subjected to and passed all inspection of product for delivery verifications using the applicable product assurance program.

6.5.1 Reference to MIL-P-55110 and MIL-PRF-55110. When this document is referenced or used in conjunction with QML printed boards in conformance with MIL-PRF-31032 using the requirements of [appendix B](#), such processing and testing is required to be in full conformance with all applicable requirements and those of the specifically referenced test methods and procedures. The following conditions apply:

- a. For contracts negotiated prior to 26 April 1978: Designs for printed board that have been classified as requiring compliance to MIL-P-55110 prior to 26 April 1978 are not required to meet [6.5.2](#) or [6.5.3](#).
- b. Existing contracts as of 26 April 1978: Previously negotiated add-ons to these contracts, and future spares for these contracts may continue to use master drawings for printed boards which were classified as requiring compliance prior to 26 April 1978.
- c. New contracts and any printed board designs classified to be compliant to MIL-P-55110 after 26 April 1978: These printed boards are required to comply with [6.5.2](#). Any printed boards meeting only the provisions of [6.5.3](#) are noncompliant to MIL-PRF-55110.

6.5.2 Provisions for the use of MIL-PRF-55110 in conjunction with compliant printed boards. When any manufacturer, contractor, subcontractor, or original equipment manufacturer requires or claims a printed board to be compliant with MIL-PRF-55110, all provisions of [appendix B](#) of this document are required to be met. In addition, manufacturers that have produced, or are producing, printed boards in accordance with [6.5.1.a](#) are subject to a qualifying activity compliance audit as specified in [3.7](#). Such processing and testing of printed boards are required to be in compliance with all of the applicable general controls and requirements defined herein, and those of the specifically referenced test methods and procedures with no reinterpretations, deviations, or omissions except as specifically allowed in the master drawing. Such references of compliance include the following:

- a. Manufacturers who reference MIL-PRF-55110 in certificates of conformance, or make statements that printed boards are compliant with MIL-PRF-55110 (or MIL-P-55110), or make statements in advertisements, or in published brochures, or other marketing documents, that printed boards provided are compliant with MIL-PRF-55110.
- b. Contractors, sub-contractors, or original equipment manufacturers who prepare master drawings, or printed board procurement documentation, which require compliance with MIL-PRF-55110 (or MIL-PRF-55110), or invoke it in its entirety as the applicable specification (see [6.5.3](#) for non-compliant printed boards) are be subject to the following:
 - i. Printed boards described as compliant to appendix B of MIL-PRF-55110 are required to meet all the requirements of the applicable MIL-PRF-31032 specification sheet.
 - ii. Custom technologies described on master drawings but not covered by MIL-P-55110 or MIL-PRF-55110 should be supplied by manufacturers qualified to MIL-PRF-31032.

6.5.3 Provisions for the use of MIL-PRF-55110 in conjunction with non-compliant printed boards. Any printed board that is processed with negative deviations (see [6.5.4](#)) and which is not processed in compliance with the provisions of [6.5.2](#) herein cannot be claimed to be compliant and cannot be certified "to the intent of MIL-PRF-55110", "tested to, but not qualified to MIL-PRF-55110", or any variant thereof. All applicable documentation (including master drawings and printed board procurement documentation and responses to RFQ's invoking MIL-PRF-55110) are required to clearly and specifically define any and all areas of nonconformance and identify them as deviations in language that is not subject to misinterpretation by the acquiring activity.

6.5.4 Deviations to requirements. Deviations that increase sample sizes, tighten requirements, or add inspections and tests are considered additive deviations. These additive deviations do not negate the compliance of printed boards and hence, the certification of the affected printed boards as being compliant. Deviations that reduce sample sizes, loosen requirements, or eliminate inspections and tests, are viewed as negative deviations. These negative deviations negate the compliance of printed boards and hence, the certification of the affected printed boards is not possible.

6.6 Supersession.

6.6.1 Design, construction, and verification. Design, construction, and verification supersession information is included in [appendix D](#) of this specification.

6.6.2 Reference to superseded design standards. See [appendix D](#) for additional guidance regarding the verification of printed boards using different design standards.

6.6.3 References on master drawings. All the requirements of this specification are interchangeable with those specifications identified as MIL-P-55110. Therefore, existing master drawings or OEM documents referencing MIL-P-55110 need not be revised, updated, or changed to make reference to MIL-PRF-55110 in order for this specification to be used.

6.6.4 Reference to superseded specifications. Superseded specifications are listed below.

a. MIL-P-55110 including:

- (1) MIL-P-55110C, dated 26 April 1978.
 - (a) MIL-P-55110C with Amendment 1, dated 18 July 1978.
 - (b) MIL-P-55110C with Amendment 2, dated 27 August 1979.
 - (c) MIL-P-55110C with Amendment 3, dated 16 October 1980.
 - (d) MIL-P-55110C with Amendment 4, dated 28 June 1982.
 - (e) MIL-P-55110C with Amendment 5, dated 28 March 1984.
- (2) MIL-P-55110D, dated 31 December 1984.
 - (a) MIL-P-55110D with Amendment 1, dated 6 March 1987.
 - (b) MIL-P-55110D with Interim Amendment 2 (USAF), dated 22 April 1988.
 - (c) MIL-P-55110D with Amendment 3, dated 18 May 1989.
 - (d) MIL-P-55110D with Amendment 4, dated 2 December 1990.
- (3) MIL-P-55110E, dated 22 December 1993.
- (4) MIL-PRF-55110E, dated 29 September 1995.
- (5) MIL-PRF-55110F, dated 31 May 1997.
 - (a) MIL-PRF-55110F with Amendment 1, dated 27 November 1998.
- (6) MIL-PRF-55110G, dated 11 December 2005.
 - (a) MIL-PRF-55110G with Amendment 1, dated 2 July 2006.
 - (b) MIL-PRF-55110G with Amendment 2, dated 2 August 2007.
 - (c) MIL-PRF-55110G with Amendment 3, dated 29 February 2008.

- (7) MIL-PRF-55110H, dated 15 September 2014.
 - (a) MIL-PRF-55110H with Amendment 1, dated 20 May 2016.
 - (b) MIL-PRF-55110H with Amendment 2, dated 19 May 2017.
 - (c) MIL-PRF-55110H with Amendment 3, dated 26 March 2018.
- b. MIL-P-55640 including:
 - (1) MIL-P-55640(EL), dated 6 February 1969.
 - (2) MIL-P-55640A, dated 29 October 1970.
 - (a) MIL-P-55640A with Amendment 1, dated 14 October 1971.
 - (b) MIL-P-55640A with Amendment 2, dated 4 April 1975.
- c. MIL-P-82585(OS), dated 24 February 1970.
- d. MIL-P-55424(ER), dated 1 June 1965.
- e. MIL-P-22629(OS), dated 10 March 1964.
- f. MIL-P-21193(NOrd), dated 13 January 1958.

6.7 Subject term (key word) listing.

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

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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APPENDIX A

MIL-PRF-55110H, appendix A, dated 15 September 2014, is hereby canceled without replacement.

MIL-PRF-55110J

APPENDIX A

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APPENDIX B

PRODUCT ASSURANCE REQUIREMENTS (PERFORMANCE AND VERIFICATION)
FOR QUALIFIED MANUFACTURER LIST LEVEL

B.1 SCOPE

B.1.1 Scope. This appendix contains the requirements concerning the QML product assurance level for printed wiring boards covered by this specification. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

B.2 APPLICABLE DOCUMENTS

B.2.1 General. The documents listed in this section are specified in sections B.3 and B.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 of documents cited in sections B.3 and B.4 of this specification, whether or not they are listed.

B.2.2 Government documents.

B.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-31032/1 - Printed Wiring Board, Rigid, Multilayered, Thermosetting Resin Base Material, with or Without Blind and Buried Plated through Holes, for Soldered Part Mounting.
- MIL-PRF-31032/2 - Printed Wiring Board, Rigid, Single And Double Layer, Woven E-Glass Reinforced Thermosetting Resin Base Material, with or without Plated Holes, for Soldered Part Mounting.
- MIL-PRF-31032/5 - Printed Wiring Board, Rigid, Multilayered, Thermoplastic, Thermosetting, or Thermoplastic and Thermosetting Resin Base Material, with Plated Through Holes, for High Frequency Applications.
- MIL-PRF-31032/6 - Printed Wiring Board, Rigid, Single and Double Sided, Thermoplastic or Thermosetting Resin Base Material, with or without Plated-Through Holes, for High Frequency Applications.

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

B.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.

B.3 REQUIREMENTS

B.3.1 Performance requirements. The performance requirements of the applicable MIL-PRF-31032 specification sheet shall apply to all printed wiring boards procured to the QML product assurance level.

B.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 the QML product assurance level.

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APPENDIX B

B.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 that comply with the product assurance requirements of this appendix.

B.4 VERIFICATION

B.4.1 Qualification inspection. Manufacturers shall be qualified for listing on [QML-31032](#) for the technology and capabilities required to produce printed boards under this appendix.

B.4.2 QML product assurance. The product assurance requirements for the QML level of printed wiring board furnished under this specification shall be satisfied by certification to [MIL-PRF-31032](#). All printed wiring boards manufactured and delivered in compliance with this appendix shall be produced in accordance with the approved quality management plan.

B.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.

B.4.4 Periodic conformance inspection. Periodic conformance inspection shall consist of inspections specified in the applicable [MIL-PRF-31032](#) specification sheet.

B.5 PACKAGING

B.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 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.

B.6 NOTES

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

B.6.1 Intended use. This appendix is intended to be used by manufacturers certified to [MIL-PRF-31032](#) and qualified to [MIL-PRF-31032/1](#), [MIL-PRF-31032/2](#), [MIL-PRF-31032/5](#), or [MIL-PRF-31032/6](#) to reduce the complexity of maintaining multiple product/process and testing flows (both MIL-PRF-55110 or [MIL-PRF-31032](#)) within a the manufacturing and testing facility.

B.6.2 Application of the QML product assurance level to existing requirements.

B.6.2.1 Use of existing master drawings. The QML printed wiring board manufacturer can use pre-existing master drawing without any modifications. Production masters and tooling may need to be modified to account for type, design, placement, and quantity of test coupons needed for compliance to this appendix.

B.6.2.2 Form, fit, and function. The form, fit, and function of the printed wiring boards, whether the QML product assurance level or the QPL product assurance level is used, will be the same.

B.6.2.3 Certification of conformance. The printed wiring boards can be certified as being compliant to appendix B of this document (MIL-PRF-55110).

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B.6.3 Benefits of the QML product assurance level. Printed wiring boards produced by QML manufacturers using the provisions of this appendix in lieu of previous revisions would be compliant to this specification (MIL-PRF-55110) in accordance with the QML product assurance level with the added benefits as follows:

- a. The QML manufacturer can use pre-existing master drawing without any modifications. Production masters and tooling may need to be modified to account for type, design, placement, and quantity of test coupons needed for compliance to this appendix.
- b. The printed wiring boards, whether the QML option or the QPL option is used, will be the same.
- c. The level of quality will be the same or higher than the QPL product assurance level.
- d. When using the correct verification test (for the design), the cost should be the same or less due to enhancements made to accept/reject criteria.
- e. Customers will be more confident that a QML manufacturer has demonstrated the capabilities to build its design due to its QML certification and qualification rather the generic standardized qualification test vehicle of the QPL quality assurance level portion of previous revisions of this document.

B.6.4 Retention issues. The manufacturer need only to keep the qualifying activity apprised of its total QML program, i.e., their [MIL-PRF-31032](#) QML program and this specification's QML product assurance level. This means that the manufacturer does not have to maintain two separate compliance programs, (i.e., no requirement for a QPL compliance program for this specification to be separate from a QML program for [MIL-PRF-31032](#)).

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APPENDIX B

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APPENDIX C

MIL-PRF-55110H, appendix C, dated 15 September 2014, is hereby canceled. The information that was contained herein is covered by appendix E of [MIL-PRF-31032](#).

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APPENDIX C

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SUPERSESION, CONFORMANCE INSPECTION OPTIONS,
AND USE 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-55110, revisions C, D, and E, cancelled DoD printed board design standards, and superseded industry printed board design standards. 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 requirements of 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	-	Interconnecting and Packaging Electronic Circuits, Terms and Definitions.
IPC-2221	-	Printed Board Design, Generic Standard on.

(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 appendix, 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 (superseded standards). 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.

APPENDIX D

D.4 SUPERSESSION

D.4.1 Superseded specifications.

D.4.1.1 General. The MIL-PRF-31032 specifications sheets for rigid printed boards includes the essential requirements of the previous revision of this document and can be used to supersede the specifications listed in [6.6.4](#).

D.4.1.2 Reference to superseded specifications. All the requirements of this document (MIL-PRF-55110J) can be interchangeable with those of MIL-P-55110. Therefore, existing procurement documents (master drawings or OEM documents) referencing MIL-P-55110 need not be revised, updated, or changed to make reference to MIL-PRF-55110 in order for this document to be used.

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

- a. MIL-STD-275D, dated 26 April 1978.
 1. MIL-STD-275D with notice 1, dated 19 January 1979.
 2. MIL-STD-275D with notice 2, dated 10 October 1979.
 3. MIL-STD-275D with notice 3, dated 5 October 1980.
 4. MIL-STD-275D with notice 4, dated 28 May 1982.
 5. MIL-STD-275D with notice 5, dated 7 February 1984.
- b. MIL-STD-275E, dated 31 December 1984.
 1. MIL-STD-275E with notice 1, dated 8 July 1986.
- c. IPC-D-275, dated September 1991.
 1. IPC-D-275 with amendment 1, dated April 1996.
- d. IPC-2221, dated February 1998.
 1. IPC-2221 with amendment 1, dated January 2000.
- e. IPC-2221A, dated May 2003.
- f. IPC-2221B, dated November 2012.

D.4.2.1 Estimation of design standard used. When no design standard is listed on the master drawing, either the design activity or printed board manufacturer, should be contacted to ascertain which design standard should be used to verify the design parameters during group A or group B inspection.

D.4.2.2 Retooling. Printed wiring boards that were designed using superseded Department of Defense design standards may need to have its test coupons converted to types, designs, placement, and quantity specified in [IPC-2221](#).

APPENDIX D

D.4.3 Testing.

D.4.3.1 Group A testing. Group A testing 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-55110D with amendment 1, MIL-P-55110D with amendment 3, and MIL-P-55110E, 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 (D with amendment 1, D with amendment 3, and E) a requirement for an acceptability criteria or test procedure may be the exact same, it might be slightly different, it may be significantly different, or there may not even be a requirement. Retention of qualification summaries for group A should list the lots produced, grouped by revision, and when applicable, revision with specific 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-55110D, MIL-PRF-55110E with amendment 1, and MIL-PRF-55110F during a given month, and the most complex printed wiring boards produced that month were in the lot ordered to MIL-PRF-55110E with amendment 1, then that should be the lot from which the group B sample should be selected. The samples should be tested in accordance with MIL-PRF-55110E with amendment 1. If during that same month, printed wiring boards were produced to MIL-P-55110A and MIL-P-55110B, 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.4.4 Superseded test coupons. Before MIL-P-55110C, test coupons were only used for first article inspection and not required for production. The production panel test coupons were introduced within MIL-P-55110C its associated design standard and were for the supplier certification program concept. The production test coupons of MIL-P-55110C should be used when already incorporated onto production tooling. New designs or jobs should use the test coupons specified in [IPC-2221](#).

NOTE: There needs to be a sufficient number of test coupons on 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 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 compliance program.

D.4.5.1 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 or test procedures from one revision of MIL-PRF-55110 or MIL-P-55110 to another. Compliance should be either to MIL-P-55110C, MIL-P-55110D, MIL-P-55110E, MIL-PRF-55110E, MIL-PRF-55110F, MIL-PRF-55110G, MIL-PRF-55110H (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.

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APPENDIX D

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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 of 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-31032/1 - Printed Wiring Board, Rigid, Multilayered, Thermosetting Resin Base Material, with or Without Blind and Buried Plated through Holes, for Soldered Part Mounting.
- MIL-PRF-31032/2 - Printed Wiring Board, Rigid, Single And Double Layer, Woven E-Glass Reinforced Thermosetting Resin Base Material, with or without Plated Holes, for Soldered Part Mounting.
- MIL-PRF-31032/5 - Printed Wiring Board, Rigid, Multilayered, Thermoplastic, Thermosetting, or Thermoplastic and Thermosetting Resin Base Material, with Plated Through Holes, for High Frequency Applications.
- MIL-PRF-31032/6 - Printed Wiring Board, Rigid, Single and Double Sided, Thermoplastic Resin Base Material, with or without Plated-Through Holes, for High Frequency Applications.

(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 FOR QUALIFICATION TEST SPECIMENS

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 document 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 [6.4.5](#)). The extent of qualification for base materials types defined in E.4 will apply. EXAMPLE: A type 2 qualification under [MIL-PRF-31032/2](#) or [MIL-PRF-31032/6](#) will not justify a type 3 qualification listing to this document.
- b. Printed board material. The extent of qualification for base materials types defined in [MIL-PRF-31032](#) will apply. EXAMPLE: A thermoplastic metal clad base material qualification under [MIL-PRF-31032/5](#) will justify a thermoplastic flexible metal clad base material qualification listing to this document (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 [QML-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 (see [B.6.4](#)). The QML status report described in [MIL-PRF-31032](#) will cover the retention requirements to this document.

E.4 EXTENT OF QUALIFICATION

E.4.1 Extent of qualification. The extent of qualification shall be in accordance with the following ranges specified in E.4.1.1 through [E.4.1.5.4](#).

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 ([MIL-PRF-31032/1](#) or [MIL-PRF-31032/5](#)) shall be extended to cover types 1, 2 and 3 printed wiring boards.
- b. Qualification of type 3 printed wiring boards ([MIL-PRF-31032/1](#) or [MIL-PRF-31032/5](#)) shall be extended to cover types 1 and 2 printed wiring boards.
- c. Qualification of type 2 printed wiring boards ([MIL-PRF-31032/2](#) or [MIL-PRF-31032/6](#)) shall be extended to cover type 1 printed wiring boards.

APPENDIX E

E.4.1.2 Base material types. Printed wiring board designs using different base material types (mixed base materials) shall be fabricated by manufacturers qualified for all base materials required by the design. Qualification using base material (laminates) shall be as follows:

- a. Qualification with woven glass reinforced thermosetting epoxy resin base material type FR-4 (legacy type GF) shall be extended to cover types G-11 and FR-5 (legacy types GB and GH) of woven glass reinforced thermosetting epoxy resin base materials.
- b. Qualification with woven glass reinforced thermosetting polyimide resin base material type GPY (legacy type GI) shall be extended to cover all other types of woven glass reinforced thermosetting polyimide resin base materials.
- c. Qualification with nonwoven glass reinforced thermoplastic polytetrafluoroethylene resin base material types (legacy type GR) shall be extended to cover all other types of nonwoven glass reinforced thermoplastic resin base materials (legacy type GP).
- d. Qualification with woven glass reinforced thermoplastic polytetrafluoroethylene resin base material types (legacy type GY) shall be extended to cover all other types of woven glass reinforced thermoplastic resin base materials (legacy type GT and GX).
- e. Qualification with non-woven glass reinforced thermoplastic polytetrafluoroethylene resin base material legacy type GX shall be extended to cover legacy type GT.
- f. Qualification with woven glass reinforced thermosetting cyanate ester resin base materials shall be extended to cover all other types of woven glass reinforced thermosetting cyanate ester resin base materials.
- g. Qualification using any other base materials shall qualify only that base material.

E.4.1.3 Conductor surface finish. The qualification of a conductor surface finish shall be extended to cover all compositions or thicknesses of that specific conductor surface finish material.

E.4.1.4 Solder mask. Qualification of any printed wiring board type shall be extended to cover the approved type with solder mask.

E.4.1.5 Processes.

E.4.1.5.1 Etchback. Qualification using etchback shall be extended to cover non-etchback. Manufacturer qualifying using contract service etchback shall submit two additional qualification test specimens fabricated using their own internal desmear process.

E.4.1.5.2 Foil lamination. Qualification using foil lamination shall be extended to cover cap lamination.

E.4.1.5.3 Mass lamination. Qualification of a contract service lamination (four conductor layers) shall be extended to cover a contract service lamination of up to four conductor layers. Qualification of a contract service lamination (ten conductor layers) shall be extended to cover a contract service lamination of five or more conductor layers.

E.4.1.5.4 Process changes. Any changes to a manufacturer's qualified base material type, equipment, or processes will be reviewed by the qualifying activity for determination if partial or full requalification is necessary.

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APPENDIX E

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APPENDIX F

MIL-PRF-55110H, appendix F, dated 15 September 2014, is hereby canceled without replacement.

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APPENDIX F

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APPENDIX G

MIL-PRF-55110H, appendix G, dated 15 September 2014, is hereby canceled without replacement.

MIL-PRF-55110J

APPENDIX G

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APPENDIX H

MIL-PRF-55110H, appendix H, dated 15 September 2014, is hereby canceled without replacement.

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APPENDIX H

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

Preparing activity:
DLA – CC

(Project 5998-2020-007)

Review activities:
Army – AR, MI
Navy – AS, CG, MC, OS, SH
Air Force – 16, 19
NSA – NS

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>.