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Edition 1.0 2015-12

INTERNATIONAL STANDARD

IEEE Std 1505™

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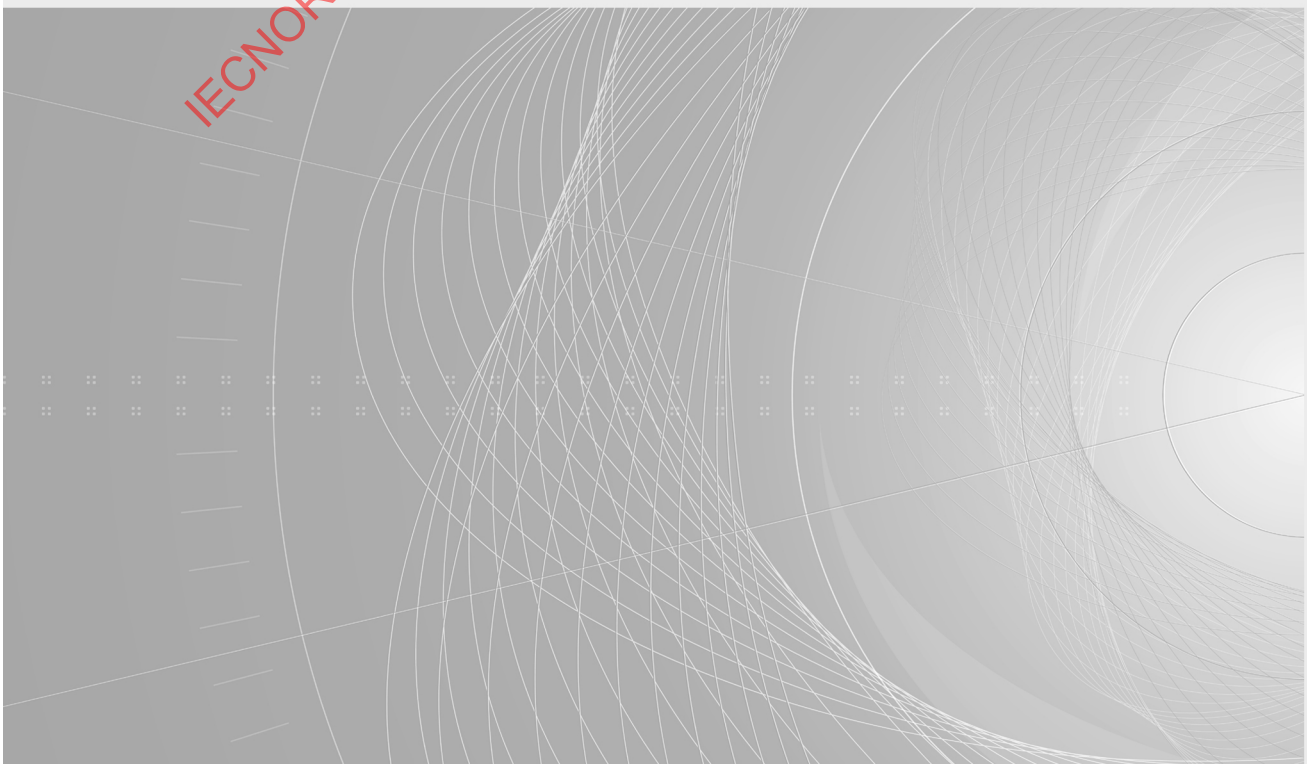
Standard for receiver fixture interface



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Contents

STANDARD FOR
RECEIVER FIXTURE INTERFACE

FOREWORD

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International Standard IEC 63004/IEEE Std 1505-2010 has been processed through IEC technical committee 91: Electronics assembly technology, under the IEC/IEEE Dual Logo Agreement.

The text of this standard is based on the following documents:

IEEE Std	FDIS	Report on voting
IEEE Std 1505-2010	91/1275/FDIS	91/1299/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The IEC Technical Committee and IEEE Technical Committee have decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IEEE Std 1505™-2010
(Revision of
IEEE Std 1505-2006)

IEEE Standard for Receiver Fixture Interface

Sponsor

IEEE Standards Coordinating Committee 20 on Test and Diagnosis for Electronic Systems

Approved 30 September 2010

IEEE-SA Standards Board

Approved 15 July 2011

American National Standards Institute

Abstract: A mechanical and electrical specification for implementing a common interoperable mechanical quick-disconnect interconnect system for use by industry for interfacing large numbers of electrical signals (digital, analog, RF, power, etc.) is provided. These large interface panels (receiver and fixture panels) are employed primarily in test systems between stimulus/measurement assets and a related unit-under-test (UUT), although any application involving high-density contacts requiring a quick disconnect interface could benefit. The *receiver* is a receptacle that is mounted to test system mates with multiple *fixtures*, which serve as the *buffer* between the UUT and automatic test equipment (ATE). Fixtures translate standard input/output (I/O) signal routing offered at the receiver to a wiring interface that directly connects to the UUT. These UUT interfaces can represent cable connectors, direct plug-in (printed circuit board edge connectors), sensor monitoring, or manual feedback from the test technician.

The primary objectives of this standard are: (a) to establish interface standards that permit interchangeability of mechanical/electrical receiver/fixture/connector product assemblies from various manufacturers under an *open architecture*; and (b) to develop within this framework a defined set(s) of interconnecting connector and mechanical specifications that supports available, accepted, low-cost commercial technology to reduced dependence on proprietary designs and extend life-cycle availability.

Keywords: connector, fixture, framework, interface, interoperability, mass-interconnect, quick disconnect, receiver, specification

IEEE Introduction

This introduction is not part of IEEE Std 1505-2010, IEEE Standard for Receiver Fixture Interface.

Historical Background

On September 19, 1996, a group of receiver fixture product vendors/integrators announced the formation of an industry standards group called the RFI Alliance.

The organization later sought to gain identity through a standards organization, which ultimately became the Institute of Electrical and Electronic Engineers, Inc. (IEEE). Under the joint sponsorship of the Instrumentation and Measurement Society TC-5 Connectors/TC-8 Automated Instruments Committees and SCC20 Hardware Interface Subcommittee, an IEEE Std 1505 RFI Working Group was developed and authorized by the IEEE Standards Association. Participation in the IEEE Std 1505 RFI Working Group is open to vendors, integrators, and users.

IEEE Std 1505 Receiver Fixture Interface (RFI) Working Group focus

The IEEE Std 1505 RFI Working Group, sponsored by the IEEE Instrumentation and Measurement Society and IEEE SCC20, Test and Diagnosis for Electronic Systems, was formed to define a common electrical/mechanical interface specifications for applications involving test, production processing, quick-disconnect electrical interfacing, and subassembly mating requirements. The group is made up of technical individuals from industry, government, and academia, which reflect perspective views of a supplier, user, and general interest in the standard. To derive these specifications, the IEEE Std 1505 Working Group utilized the results of a study conducted by the Department of Defense Automatic Test System Research & Development Integrated Product Team (ARD) Critical Interface Working Group (CIWG), which reviewed as part of their tasks the Automatic Test System (ATS) Test Interface and the joint industry/government Common Test Interface (CTI) Working Group. The methodology step process includes: (a) defining the problem, (b) establishing a set of requirements, (c) evaluating available interface designs against a set of parameters that relate to the problem and requirements, and (d) defining a specification that will meet the consensus of the Working Group and industry short- and long-term goals. It was designed upon open standards or functional specifications that are supported by multiple-vendor products.

Cooperative relationship with the Common Test Interface

This document serves as the basis for supplemental pin map configuration standards, such as IEEE Std 1505.1-2008 and others that are expected to meet unique pin map requirements. Future revisions to this document may add new connector styles or types that support RFI needs.

The IEEE Std 1505 Working Group recognizes industry/government end-user integration and maintenance support of a defined CTI, a specific connector/pin map implementation of the standard. This document provides for these CTI end-users, and for its ATE system and hardware integrators, a defined, standardized framework and connector, and configuration specification to enable agency/aerospace interoperability and upward compatibility. The CTI Working Group has developed a *common test interface pin map configuration* (IEEE Std 1505.1) that uses this standard as its basis.

Vendor responsibility

Users and buyers of IEEE-1505-compliant hardware are forewarned that neither the IEEE nor any other referenced agency has responsibility for the warranty or certification of any RFI product compliance. Therefore, purchasers of RFI products are encouraged to request such information from the manufacturer.

Notice to users

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For more information about the IEEE Standards Association or the IEEE standards development process, visit the IEEE-SA web site at http://standards.ieee.org.

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: http://standards.ieee.org/reading/ieee/updates/errata/index.html. Users are encouraged to check this URL for errata periodically.

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Standard for Receiver Fixture Interface

1. Overview

1.1 Scope

The scope of this standard is the development of a common receiver fixture interface (RFI) specification that is based upon available commercial standards integrated under a common *open architecture*. This mechanical/electrical interface is intended to serve government/commercial interest for applications in test, system integration, manufacturing, monitoring, and other functional requirements that demand large contact densities and quick-disconnect mechanical operation.

1.2 Purpose

The purpose of this standard is to permit interchangeability of mechanical/electrical receiver/fixture/connector product assemblies from various manufacturers under an open architecture. The standard shall also define, within this framework, a set(s) of interconnecting connector and mechanical specifications that support available, accepted, low-cost commercial technology to reduce dependence on proprietary designs and extend life-cycle availability. Technical requirements incorporated shall be those identified by government and industry, including maximum flexibility, scalability, and range of application.

1.3 Background

A joint technical forum has been operational since 1997 under the auspices of the IEEE Std 1505 RFI Working Group.

Readers of this document are encouraged to comment on details unclear, contradictory, or undefined to the IEEE 1505 RFI Working Group or the IEEE Standards Association for review and change. These organizations can be contacted at the locations described in the Introduction of this standard.

The RFI Working Group serves to encourage vendors to produce same product class types that are intermatable and interchangeable by adhering to performance specifications of this standard.

The document has been developed in accordance with Institute of Electrical and Electronic Engineers (IEEE) Standards Association Policies and Procedures, per *IEEE-SA Standards Board Bylaws* [B24], *IEEE-SA Standards Board Operations Manual* [B25], *IEEE-SA Standards Companion* [B26], and the *IEEE Standards Style Manual* [B27].[1] Additional guidance and reference was utilized from IEEE/ASTM SI 10™-2002 [B13].

1.4 Annexes overview

Included within this document are three informative annexes: Annex A, an overview of the RFI description, background, and application use to inform new users; Annex B, the results of a study conducted by the Department of Defense Automatic Test System Research and Development Integrated Product Team (ARI) Critical Interface Working Group (CIWG), which reviewed as part of their tasks the automatic test system (ATS) test interface[2];and Annex C, an informative bibliography.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ASTM A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; equivalent to SAE-AMS-QQ-S-766.[3]

ASTM A342, Standard Test Methods for Permeability of Feebly Magnetic Materials; equivalent to MIL-I-17214.

ASTM A484M-03, Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings.

ASTM A581, Standard Specification for Free-Machining Stainless Steel Wire and Wire Rods.

ASTM A582M-05, Standard Specification for Free-Machining Stainless Steel Bars.

ASTM A666-00, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

ASTM A693-06, Standard Specification for Precipitation-Hardening Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

[1] The numbers in brackets correspond to those of the bibliography in Annex C.
[2] For more information, see http://grouper.ieee.org/groups/scc20/HIWG/index.htm.
[3] ASTM publications are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA (http://www.astm.org/).

ASTM A967-1999E1, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts; supersedes SAE AMS QQ-P-35C Passivation Treatments for Corrosion-Resistant Steel (cancelled February 2005).

ASTM B16, Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.

ASTM B36/B36M-08a, Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar.

ASTM B103, Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar.

ASTM B121/B121M, Standard Specification for Leaded Brass Plate, Sheet, Strip, and Rolled Bar; and related Federal Specification QQ-B-626 D, Brass, Leaded and Nonleaded: Rod, Shapes, Forgings, and Flat Products with Finished Edges (Bar and Strip).

ASTM B134, Standard Specification for Brass Wire.

ASTM B139/B139M-07, Standard Specification for Phosphor Bronze Rod, Bar, and Shapes; and related Federal Specification QQ-B-750, Phosphor Bronze Bar, Flat Wire, Plate, Sheet, Strip, and Structural Shapes.

ASTM B159, Standard Specification for Wire Phosphor Bronze.

ASTM B194, Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar; and related Federal Specification for QQ-C-530/533 Beryllium-Copper (BeCu) Bar, Rod, and Wire/Strip.

ASTM B196, Standard Specification for Copper-Beryllium Alloy Rod and Bar.

ASTM B197, Standard Specification for Copper-Beryllium Alloy Wire.

ASTM B206/B206M, Copper-Nickel-Zinc (Nickel Silver) Wire and Copper-Nickel Alloy Wire; and related Federal Specification QQ-W-321, Copper alloy wire).

ASTM B209-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (related to SAE AMS-QQ-A-250/1A, -250/2A, -250/4A, -250/8B, 250/11A, and -250/13 for Aluminum Alloy 3003/ 2024/5052/6061/and 7075, Plate and Sheet).

ASTM B301/B301M-08, Standard Specification for Free Cutting Copper Rod, Bar, Wire and Shapes.

ASTM B441-04, Standard Specification for Copper-Cobalt-Beryllium, Copper-Nickel-Beryllium, and Copper-Nickel-Lead-Beryllium Rod and Bar (UNS Nos. C17500, C17510, and C17465).

ASTM B488-01(2006), Standard Specification for Electrodeposited Coatings of Gold for Engineering Uses (equivalent to SAE AMS-2422 and MIL-G-45204).

ASTM B740-02, Standard Specification for Copper-Nickel-Tin Spinodal Alloy Strip.

ASTM D4067-03, Standard Specification for Reinforced and Filled Poly(Phenylene Sulfide) (PPS) Injection Molding and Extrusion Materials Using ASMT Methods.

ASTM D5927-09, Standard Specification for Thermoplastic Polyester (TPES) Injection and Extrusion Materials Based on ISO Test, Methods.

ASTM D5948-05e1, Standard Specification for Molding Compounds, Thermosetting.

EIA 364E, Electrical Connector/Socket Test Procedures including Environmental Classifications.[4]

EIA 557B, General Standard for Statistical Process Control Systems.

FED-STD-H28, Screw Thread Standards for Federal Services.[5]

IEC 60309-1, Plugs, socket-outlets, and couplers for industrial purposes—Part 1: General Requirements.[6]

IPC-D-275, Design Standard for Rigid Printed Boards and Rigid Printed Board Assemblies.[7]

ISO 10012-1, Quality Assurance Requirements for Measuring Equipment—Part 1: Meteorological Confirmation System for Measuring Equipment.[8]

ISO/IEC 17025:2005/ANSI/NCSL Z540-1, General Requirements for the Competence of Testing and Calibration Laboratories.[9]

MIL-C-24308C, General Specification for Connectors, Electric, Rectangular, Nonenvironmental, Miniature, Polarized Shell, Rack, and Panel. [10]

MIL-C-83517, General Specification for Connector, Coaxial, Radio Frequency for Coaxial, Strip or Microstrip Transmission Line.

MIL-DTL-14072, Finishes for Ground Based Electronic Equipment.

MIL-DTL-16878, General Requirements for Wire, Electrical, Insulated.

MIL-DTL-55302, Connectors, Printed Circuit Subassembly and Accessories,

MIL-HDBK-217F, Reliability Prediction of Electronic Equipment.

MIL-HDBK-454B/4, General Guidelines for Electronic Equipment.

MIL-M-24519E, Military Specification for Molding Plastics, Polyester Thermoplastic, Polyarylether Thermoplastic, Plastic Molding Material, Polyphenylene Sulfide, Glass Fiber Reinforced.

MIL-M-24519/GPT-30F, Thermoplastic polyetherimide compound, 30 percent glass reinforced, flame resistant.

[4] EIA publications are available from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado 80112, USA (http://global.ihs.com/).
[5] Fed-Std publications are available from the Defense Industrial Supply Center, 700 Robbins Avenue, Bldg 3 (Code DISSC-ETT), Philadelphia, PA 19111-5096 (www.wbdg.org/ccb/FEDMIL/fedstdh28a.pdf).
[6] IEC publications are available from the Sales Department of the International Electrotechnical Commission, Case Postale 131, 3, rue de Varembé, CH-121 1, Genève 20, Switzerland/Suisse (http://www.iec.ch/). IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (http:// www.ansi.org/).
[7] IPC publications are available from the Association Connecting Electronics Industries, 3000 Lakeside Drive, 309 S, Bannockburn, IL 60015 or at IPC-D-275 Design Standard for Rigid Printed Boards and Rigid Printed Board Assemblies, IPC-RB-276 Qualification and Performance Specification (www.ipc.org/TOC/IPC-MIL-960.pdf).
[8] ISO publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembé, CH-121 1, Genève 20, Switzerland/ Suisse (http://www.iso.ch/). ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (http://www.ansi.org/).
[9] ISO/IEC publications are also available in the United States from the Sales Department, American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (http://www.ansi.org/). See also www.ecalibration.com/ Resources/17025b.htm.
[10] Copies of specifications, standards, drawings, and publications required by manufacturers in connection with specific procurement functions may be obtained from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, USA (http://www.access.gpo.gov/) or from other sources that may require additional fees. See also http://store.mil-standards.com/.

MIL-M-24519/GST-40F, Thermoplastic polyphenylene sulfide compound, 40 percent glass reinforced, flame resistant.

MIL-PRF-31032, General Specification for Printed Circuit Board/Printed Wiring Board (with Amendment 1) Revision: A, Dated: 24 February 2006.

MIL-PRF-55110, General Specification for Printed Wiring Board, Rigid, (with Amendment 1) FSC 5998.

MIL-STD-1130, Connections, Electrical, Solderless Wrapped (standard has been cancelled with no replacement and should be used for guidance only).

MIL-STD-1285D, Marking of Electrical and Electronic Parts.

MIL-STD-1344A, Test Methods for Electrical Connectors (equivalent standard EIA 364).

MIL-STD-202G, Test Method Standard for Electronic Components.

MIL-STD-2166, Connections, Electrical, Compliant Pin.

MIL-STD-275, Printed Wiring for Electronic Equipment (superseded by IPC-D-275).

MIL-STD-810F, Test Method Standard for Environmental Engineering Considerations and Laboratory Tests.

MIL-STD-889B, Dissimilar Metals.

MS3197, Gage Pin for Socket Contact Engagement Test (superseded by SAE AMS-31971).[11]

OSHA CPL 02-01-038 [CPL 2-1.38] (October 31, 2002), Enforcement of the Electrical Power Generation, Transmission, and Distribution Standard.[12]

OSHA STD 01-16-007 [STD 1-16.7], Electrical Safety-Related Work Practices—Inspection Procedures and Interpretation Guidelines.[13]

OSHA Technical Manual (OTM), TED 01-00-015 [TED 1-0.15A] (January 20, 1999).

SAE AMS-QQ-N-290, Nickel Plating (Electrodeposited).[14]

SAE AMS-QQ-S-763, Steel, Corrosion-Resistant, Bars, Wire, Shapes, and Forgings.

SAE AMS-3197, Gauge Pin for Socket Contact Engagement Test (equivalent to MS-3197).

SAE AMS-P-81728, Plating, Tin-Lead (Electrodeposited) (equivalent to MIL-P-81728).

SAE AMS-2422, Gold Plating for Electronic and Electrical Application (equivalent to ASTM B488 and MIL-G-45204).

[11] This document is available from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado 80112, USA (http://global.ihs.com/).
[12] U.S. Regulatory Guides are available from the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082, USA (http://www.access.gpo.gov/).
[13] Occupational Safety & Health Administration (OSHA) publications are available from OSHA, 200 Constitution Avenue, NW, Washington, DC 20210, at Safety and Health Topics: Electrical—Standards Electrical Safety-Related Work Practices—Inspection Procedures and www.osha.gov/SLTC/electrical/standards.html.
[14] SAE publications are available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096, USA (http://www.sae.org/).

SAE AMS-2418, Copper Plating (Electrodeposited) (equivalent to ASTM B734, MIL-C-14550).

SAE AMS-QQ-A-250/1A, Aluminum 1100, Plate and Sheet (superseded by ASTM B 209, Alloy 1199).

SAE AMS-QQ-A-250/2A, Aluminum Alloy 3003, Plate and Sheet (superseded by ASTM B 209, Alloy 3003).

SAE AMS-QQ-A-250/4A, Aluminum Alloy 2024, Plate and Sheet (related to ASTM B209).

SAE AMS-QQ-A-250/8B, Aluminum Alloy 5052, Plate and Sheet (related to ASTM B209).

SAE AMS-QQ-A-250/11A, Aluminum Alloy 6061, Plate and Sheet (superseded by SAE AMS 4025).

SAE AMS-QQ-A-250/12 (Edition 97), Aluminum Alloy 7075, Plate and Sheet (related to ASTM B209).

SAE AMS-QQ-B-613, Brass, Leaded/Non-Leaded; Rod/Shapes/Forgings/Flat Products with Finished Edges (Bar and Strip) (equivalent to ASTM B16).

SAE AMS-QQ-B-626D, Brass Wire (equivalent to ASTM B16).

SAE AMS-QQ-B-750, Bronze, Phosphor, Bar, Plate, Rod, Sheet, Strip, Flat Wire, and Structural and Special Shaped Sections (equivalent to ASTM B139).

SAE AMS-QQ-C-530, Copper-Beryllium Alloy Bar/Rod/Wire (Copper Alloy Numbers 172/173) (equivalent to ASTM B196).

SAE AMS-QQ-C-533 Copper-Beryllium Alloy Strip (Copper Alloy Numbers 170 and 172) (equivalent to ASTM B194).

SAE AMS-QQ-P-35, Passivation Treatments for Corrosion-Resistant Steel (cancelled February 2005, superseded by AMS2700).

SAE AMS-QQ-S-766, Steel, Stainless and Heat Resisting, Alloys, Plate Sheet (superseded by ASTM A240).

SAE AMS-QQ-W-321, Wire, Metal, Round, Non-Electrical, Copper Alloy 510 (equivalent to ASTM B134).

SAE AS39029, General Specification for Contacts, Electrical Connector, Socket, Crimp Removable.

2.1 Conventions

2.1.1 Order of precedence

Rule 2.1.1a: In the event of a conflict between the text of this document and the references cited herein (except for associated detail specifications, specification sheets, or mil-spec standards), the text of this document shall take precedence.

Rule 2.1.1b: Product qualification requirements shall be as specified herein and related to applicable specifications. In the event of any conflict between the qualification requirements and the specification documents, the latter shall govern.

2.1.2 Reference applicability to this standard

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3. Definitions and special terms

For the purposes of this document, the following terms and definitions apply. *The IEEE Standards Dictionary: Glossary of Terms & Definitions* should be referenced for terms not defined in this clause.[15]

ball-lock mechanism: A pin and socket type of mechanical assembly used in the receiver fixture interface (RFI) frameworks, that when latched together can withstand considerable push-pull force (maximum 159 kg [350 lb] per ball-lock assembly) applied to engage or disengage their respective attached frames.

combination frame interval: A receiver fixture interface (RFI) framework segmentation, in which a combination of a segmented frame and representative continuous frame are applied.

connector module body: A dielectric material that holds the contacts in their proper arrangement and electrically insulates them from each other and is secured to the framework as a single slot, two slot, and four slot wide application.

continuous frame interval: A receiver fixture interface (RFI) framework segmentation in which a frame can be extended to 9, 14, 24, and 29 slots without segmentation or fixture shroud spacing.

end-to-end: Description for placing receiver fixture interface (RFI) frames in an orientation that aligns the connectors in an end-to-end, stacking fashion in either a vertical or horizontal fashion.

Eurocard DIN Standard: The Eurocard Deutsches Industrie Normal (DIN) Standard (German industry connector standard organization), which establishes a signal pin contact definition and connector footprint standard for receiver fixture interface (RFI) mounting, stroke, and interchangeability for RFI connector modules and contact implementation.

fixture: An assembly that integrates a fixture frame, fixture enclosure and any other passive and active components or wiring necessary to interconnect the test system to the unit-under-test (UUT).

[15] *The IEEE Standards Dictionary: Glossary of Terms & Definitions* is available at http://shop.ieee.org/.

fixture enclosure: Typically a metal encasement that is attached to the fixture frame to contain and protect components and cabling.

fixture frame: Receiver fixture interface (RFI) framework element that supports fixture connectors, keying, and ball-lock/release subassemblies.

fixture plug/pin header connector module: A connector module mounted to the fixture framework and typically identified as pins protruding from its housing that is encased by a shroud and recessed within the fixture to protect the pins from damage.

frame interval: The mechanical frame width dimension of 76.20 mm (3.00 in) that identifies with a segmented frame supporting four connector slots and is iterated to create continuous and combination framework.

framework structure: A contoured tongue-and-groove metal or composite structure with different spacing on the top and bottom frame outline for keying and alignment function that supports ball-lock assembly and connector mounting.

mechanical advantage: Mechanical leverage that the receiver drive system is capable of producing, which is represented as the ratio of engagement force versus the force applied by the operator on the manual handle, or motor torque applied to the drive system.

mechanical float: The ability of framework, connector housing, or the contact/termination to adjust position within fixed mechanical limits.

MIL-DTL-55302 military connector standard: A U. S. Department of Defense connector standard to meet higher environmental and electrical performance requirements for avionic board connectors based upon the commercial DIN standard.

pin contact: Male mating contact that is applied typically in the fixture module and may be terminated by direct wire, solder post for printed circuit board (PCB) mounting, or wire-wrap post.

receiver ball-lock receptacle/fixture ball-lock assembly: A mechanical assembly that, when engaged in a pin-and-socket fashion, aligns and automatically latches the receiver and fixture framework together or, when operated upon, can release the frames.

receiver fixture interface (RFI): Represents a mass electrical interconnect system that includes a test interface panel (receiver) mounted to the test system and multiple mating test interface panels (fixtures) that are uniquely designed to adapt the unit-under-test (UUT) to the receiver.

receiver fixture interface (RFI) framework: Consists of two basic mating picture frame halves that support unique multiple functions of the interface, one for the receiver and the other for the fixture.

NOTE—See also Clause 5.[16]

receiver frame: The framework assembly that is fixed to the test system and configured to serve as a common interface for multiple fixtures. It houses the receiver connectors and mechanical actuator subsystem that connects or disconnects the fixture frame to the receiver.

receiver receptacle connector module: Connector assembly that houses the receptacle contacts, which is normally mounted in the receiver in a recessed manner to protect the contact from damage and operator from potential live circuit condition.

[16] Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

segmented framework: A receiver fixture interface (RFI) framework with a width dimension of 76.20 mm (3.00 in) that supports two ball-lock engagement points, four connector slots 60.96 mm (2.40 in) representing 4 × 15.24 mm (0.60 in) slot width, and 7.62 mm (0.30 in) space on each side of the four slots for the mating fixture protective shrouds.

side-by-side: Description for placing receiver fixture interface (RFI) frames in an orientation that aligns the connectors in a side-by-side pancake fashion in either a vertical or horizontal fashion.

slot: Receiver fixture interface (RFI) term representing a connector footprint designated for one connector type with a footprint measuring 15.24 mm (0.60 in) wide by 0.15 m (5.75 in) long, based upon a MIL-DTL-55302 military connector standard, DIN type, signal module with 200 positions (4 × 50 pin).

socket contact: Female contact that is applied protectively within the housing of a receiver module and may be terminated by direct wire, solder post for printed circuit board (PCB) mounting, or wire-wrap post.

stroke: Length of movement or travel necessary to engage or disengage the receiver fixture interface (RFI) connectors along an axial dimension of a pin-and-socket contact.

termination: Part of a contact that is attached to the printed wiring board or hookup wire.

two-part connector: Defines a mating pair of a receiver connector module and fixture connector module that contains the respective socket or pin contacts, with integral alignment keying to facilitate proper mating of the contacts.

unit-under-test (UUT): The particular equipment being tested (e.g., printed circuit board, electronic device, electrical subassembly).

3.1 Special terms

Observation: Observations spell out implications of rules and bring attention to things that might otherwise be overlooked. They also give the rationale behind certain rules so that the reader understands why the rule must be followed.

Permission: Permissions are included to clarify the areas of the specification that are not specifically prohibited. Permissions inform the reader that a certain approach is acceptable and will minimize potential problems. The word *may* is reserved for indicating permissions.

Recommendation: Recommendations consist of advice to applicants that will affect the usability of the final device. Discussions of particular hardware to enhance throughput would fall under a recommendation. These should be followed to minimize problems and to obtain optimum performance.

Rule: Rules *shall* be followed to ensure compatibility to the standard. A rule is characterized by the use of the words *shall* and *shall not.* These words are not used for any other purpose other than stating rules.

Suggestion: A suggestion contains advice that is helpful but not vital. The reader is encouraged to consider the advice before discarding it. Suggestions are included to help the novice designer with problematic areas of the design.

4. Qualification requirements

4.1 Responsibility for inspection

Rule 4.1: Unless otherwise specified, the manufacturer shall be responsible for the performance of all inspection requirements as specified herein. The referenced specifications and standards apply to the extent that they are referenced herein. Where references overlap, are revised, or are superseded by other equivalent industry references, any one may apply to this standard.

Permission 4.1: Manufacturers may use their own or any other facilities suitable for the performance of the inspection requirements specified herein.

4.1.1 RFI qualification requirements versus standard specification relationships

Rule 4.1.1: Product qualification requirements shall be as specified herein and related to applicable specifications. In the event of any conflict between the qualifications requirements and the specification documents, the latter shall govern.

4.1.2 Reference applicability to this standard

Observation 4.1.2: This document requires a measurement means for evaluating vendor products, but does not intend to impose undue rigorous demands on a COTS product being applied to the RFI specification. This document accepts any equivalent standard (i.e., industrial, military specifications, international) to that referenced, both active or inactive, as long as the vendor applies common criteria referenced within the respective reference. The goal offered by these references is to give vendors a measurement stick for comparing their products to those of another. It is not the intent of the standard to be so rigorous that vendors qualifying product under older standards must continue to requalify that product as the reference is superseded, modified, or discontinued. For this reason both old and new standards are referenced without revision dates.

4.1.3 Inspection conditions

Rule 4.1.3: Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the general requirements of MIL-STD-202G and MIL-STD-1344A or the equivalent methods of EIA 364E.[17]

4.1.4 Test equipment and inspection facilities

Rule 4.1.4: Test and measuring equipment, ISO calibration and inspection facilities, maintained by inspection facility, shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment (i.e., ISO/IEC 17025:2005/ANSI/NCSL Z540-1, ISO 10012-1—Part 1, or comparable standards) shall be required.

4.1.5 Responsibility of the vendor and implementer

Rule 4.1.5: It shall be understood that integrators have full responsibility to accept product with or without understood limitations and shall have responsibility for soliciting from the supplier any and all certifications that the product meets the specifications.

[17] Information on references can be found in Clause 2.

4.2 General requirements

4.2.1 Statistical process control (SPC)

Recommendation 4.2.1: It is recommended that the manufacturer implement and use SPC techniques in the manufacturing process for parts covered by this specification. The SPC program should be developed and maintained in accordance with guidelines of EIA 557B. Where SPC cannot be utilized because of non-continuous production requirements, a lot sampling plan for inspection in accordance with group A lot and sample size with $c = 0$ is recommended. The SPC and $c = 0$ programs may be documented and maintained as part of the overall reliability assurance program as specified in EIA 557B.

4.2.2 Materials

Rule 4.2.2: Suppliers shall identify materials used in the manufacturing of the IEEE 1505 products to the purchaser. When a definite material is not specified, a material shall be used that enables the connectors and accessories to meet the form, fit, function, and performance requirements of this document (see 5.12). Acceptance or approval of any constituent material by the buyer shall not be construed as a guaranty of the acceptance of the finished product from the manufacturer.

4.2.2.1 Reference materials, platings and processes

Rule 4.2.2.1a: The identified reference materials, platings, and processes described in 4.2.2, 5.3, 5.4, 5.5, 5.6, and 6.12 shall be used to enable framework and connectors manufactured to this document to mate to similar industry standard or government-specified framework and connector systems with minimal problems related to electrochemical contamination of critical electrical or mechanical interfaces or generation of incompatible mechanical interface surface wear products.

Permission 4.2.2.1: The manufacturers of framework and connectors supplied to this standard may use alternate recognized industry standard materials, platings, and processes from those identified in 4.2.2, 5.3, 5.4, 5.5, 5.6, and 6.12 of this specification. However, use of alternate materials, platings, and processes shall be coordinated with the respective qualifying activity as part of the qualification process.

Rule 4.2.2.1b: Use of alternates to those referenced guidance items by the supplier shall not result in inferior short- or long-term performance or reliability of supplied framework and connectors as compared with framework and connectors manufactured using the referenced materials, platings, or processes. Short- or long-term failures or reliability problems due to use of these alternates shall be the responsibility of the supplier.

4.2.2.2 Recycled, recovered, or environmentally preferable materials

Recommendation 4.2.2.2: Recycled, recovered, or environmentally preferable 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.

4.2.2.3 Nonmagnetic materials

Rule 4.2.2.3: All direct electrical interconnect/contact assembly parts shall be made from materials which are classed as nonmagnetic (permeability 2μ using indicator in accordance with ASTM A342).

4.2.2.4 Plastic molded materials

Rule 4.2.2.4: Unless otherwise specified (see 6.12), the connector molded body material shall conform to:

a) SDG-F or GDI-30F in accordance with ASTM D5948-05E1 (see 4.2.2) *or*

b) Type TPES013G30 in accordance with ASTM D5927-09 *or*

c) PPS000G40A30330E1F01Y1 1 in accordance with ASTM D4067-03 *or*

d) Type MIL-M-24519E/GPT-30F or GST-40F

e) Reground materials shall not be used.

4.2.3 Metals

4.2.3.1 Aluminum

Rule 4.2.3.1: Where applicable, aluminum shall be as specified in SAE-AMS-QQ-A-250/1A (Aluminum 1100), SAE-AMS-QQ-A-250/2A (Alloy 3003), SAE-AMS-QQ-A-250/4A (Alloy 2024), SAE-AMS-QQ-A-250/8B (Alloy 5052), SAE-AMS-QQ-A-250/11A (Alloy 6061), or SAE-AMS-QQ-A-250/12 (Alloy 7075), and anodized to meet the requirements of MIL-F-14072.

4.2.3.2 Corrosion-resistant steel

Rule 4.2.3.2: Where applicable, corrosion-resistant steel shall be 300 series, low magnetic permeability in accordance with SAE-AMS-QQ-S-763, ASTM A581, ASTM A582M-05, or ASTM A484M-03 and passivated in accordance with SAE-AMS-QQ-P-35, or to finish E300 as specified in MIL-F-14072.

4.2.3.3 Socket contacts, hermaphroditic contacts, and contact terminations

Rule 4.2.3.3: Socket contacts, hermaphroditic contacts, and contact terminations shall be copper-nickel-tin alloy C72900 per ASTM B740-02, or beryllium copper as specified in ASTM B194, ASTM B196, ASTM B197, or C17500 in accordance with ASTM B441-04, or phosphor bronze in accordance with ASTM B103 or ASTM B139M-07, or contact terminations of brass alloy in accordance with ASTM B16 or ASTM B134, or thermocouple materials in accordance with SAE-AS39029, or gold plated per 4.2.3.6.

4.2.3.4 Pin contacts and contact terminations

Rule 4.2.3.4: Pin contacts and contact terminations shall be:

a) Copper-nickel-tin alloy C72900 as specified in ASTM B740-02 *or*

b) Brass as specified in ASTM B16, ASTM B36M-08A, ASTM B134, or ASTM B121 *or*

c) Phosphor bronze, in accordance with ASTM B139 or beryllium copper as specified in ASTM B 159, ASTM B194, ASTM B196, ASTM B197, or C18700 in accordance with ASTM B301M-08 *or*

d) Thermocouple materials in accordance with SAE-AS39029 or gold plated per 4.2.3.6.

4.2.3.5 Connector guide pins and guide bushings

Rule 4.2.3.5: Guide pins and guide bushings shall be:

a) Free-cutting, half-hard brass as specified in ASTM B36M-08A or ASTM B121M *or*

b) Copper alloy as specified in ASTM B134, or ASTM B159, or ASTM B206M *or*

c) Stainless steel as specified in SAE-AMS-QQ-S-763 or ASTM A582M-05 *or*

d) Alternate acceptable materials, which shall be of appropriate physical performance to provide a noncorrosive, nongalling condition and provide adequate wear characteristics in accordance with ASTM-A240, or similar nickel-based materials.

4.2.3.6 Plating

Rule 4.2.3.6: Unless otherwise specified (see Clause 6, Annex A, and Annex B), contacts shall be gold plated 76 µm (30 µin) minimum, in accordance with ASTM B488-01 (2006) Type II, Class 1.27, Grade C, or the equivalent SAE AMS 2422 sections, over suitable underplate (see 4.2.3.3).

4.2.3.7 Nickel underplate

Rule 4.2.3.7: Nickel underplate shall be Class 2, 76 µm (30 µin) to 381 µm (150 µin), as specified in SAE-AMS-QQ-N-290.

4.2.3.8 Localized finish

Rule 4.2.3.8: Localized systems such as selective plating, welded dot, etc., are permitted in lieu of overall plating providing the following conditions are met:

a) Contact engagement end shall be gold plated to 0.076 mm (30 µin) minimum in accordance with ASTM B488-01 (2006), Type II, Class 1.27, Grade C, over nickel underplate per 4.2.3.8.

b) Contact termination end plating (solderless wrap) shall be tin-lead (95%-5%) composition in accordance with SAE-AMS-81728, 254 µm (100 µin) to 762 µm (300 µin) thick over nickel underplate in accordance with 4.2.3.8.

c) Contact termination end plating (crimp), tin-gold (96%-4%) composition, 0.076 mm (30 µin) minimum over nickel underplate in accordance with 4.2.3.8, or tin-lead (955%-5%) composition 254 µm (100 µin) minimum thickness in accordance with SAE-AMS-81728 over nickel underplate in accordance with 4.2.3.8. Solder dipping is permitted, providing it meets procedures and requirements of MIL-STD-202G, Method 208.

d) Nonfunctional areas need not be overplated, provided they have a minimum thickness of 127 µm (50 µin.) of nickel in accordance with SAE-AMS-QQ-N-290, Class 2.

Permission 4.2.3.8: When contacts have been provided in strip form, the absence of plating in the area where the contact was removed from the strip is acceptable provided it is in a nonfunctional area and any corrosion formed as a result of salt spray testing does not creep into the contact mating area.

4.2.4 Restricted materials

4.2.4.1 Flammable, explosive, or toxic

Rule 4.2.4.1: All material shall be nonflammable, nonexplosive, and nontoxic over the operating temperature range (5.21.1, 6.20.1).

4.2.4.2 Corrosion resistance

Rule 4.2.4.2: The framework, connectors, and accessories shall be of corrosion-resistant materials or treated to prevent corrosion.

4.2.4.3 Ferrous

Rule 4.2.4.3: All material containing more than 5% iron shall not be used for current carrying parts.

4.2.5 Dissimilar metals

Rule 4.2.5: Where dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided by means of zinc plating, passivation, coatings, or other

inhibitors. Dissimilar metals shall be as defined in MIL-STD-889B. Dissimilar metals such as brass, copper, or steel (except corrosion-resisting steel, passivated in accordance with 4.2.3.2) shall not be used in intimate contact with aluminum or aluminum alloy.

4.2.6 Fungus resistance

Rule 4.2.6: Finishes and materials used in the construction of all interface components shall be fungus inert in accordance with MIL-STD-810F.

4.3 Qualification inspections

Rule 4.3: Qualification inspections shall be supported by verifying data from the manufacturer that the materials listed in Table 1, used in fabricating the framework, connectors, and accessories, are in accordance with the applicable IEEE 1505 conformance definitions, product drawings, and/or referenced specifications and maintained under equivalent ISO-9001 quality assurance provisions or otherwise agreed by the customer's quality authority where noncompliance occurs.

4.4 Inspection conditions

Rule 4.4: Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified or normal manufacturing expected conditions, whichever is more absolute. All products per advertised specifications shall be maintained under ISO-9000 quality assurance provisions or otherwise noted and agreed by the customer's quality authority.

Table 1—Qualification inspection

Component material	Defined in subclause	Applicable referenced specifications
Plastic, molded materials	5.2, 5.3, 5.4	SDG-F, GDI-30F, MIL-M-24519E/GPT-30F, MIL-M-24519E/GST-40F (equivalent to ASTM-D5927-09/D5948-05E1), ASTM-D4067-03
Framework/connector metal hardware	5.7, 5.10, 5.11	
Copper nickel alloy	5.3, 5.4, 6.7, 6.8	ASTM B740-02, SAE-AMS-2418, and SAE-AMS-QQ-N-290
Phosphor bronze/beryllium copper	5.3, 5.4, 6.7, 6.8	SAE-AMS-QQ-B-750, SAE-AMS-QQ-C-530, or ASTM B139M-07/B194, SAE-AMS-QQ-C-533
Copper alloy wire	5.3, 5.4, 6.7, 6.8	SAE-AMS-QQ-W-321, ASTM B206M/B740-02

Table 1–Qualification inspection *(continued)*

Component material	Defined in subclause	Applicable referenced specifications
Brass (leaded and nonleaded)	5.3, 5.4, 5.5; 6.7, 6.8	SAE-AMS-QQ-B-626D and SAE-AMS-QQ-B-613, ASTM B121, ASTM B134
Aluminum	5.3, 5.4, 5.5; 6.7, 6.8	SAE-AMS-QQ-A-250/1A,/2 A,/4 A,/8B,/11A, and /12; MIL-F-14072, ASTM-B209-07
Steel	5.3, 5.4, 5.5; 6.7, 6.8	SAE-AMS-QQ-P-35, SAE-AMS-QQ-S-763, SAE-AMS-QQ-S-766, (or equivalent to ASTM A240, ASTM A666-00, ASTM A693-06, and ASTM-A967-1999E1), and ASTM-A581/582/484
Dissimilar metals	5.5, 5.7; 6.5	MIL-STD-889B
Fungus resistance	5.3, 6.6	MIL-HDBK-454B/4
Framework/connector body	5.2, 5.3, 5.5, 5.9, 5.10; 6.7, 6.8	FED-STD-H28

4.5 Qualification inspection

Rule 4.5: Qualification inspection shall be performed on sample units produced with equipment and procedures normally applied in production.

4.5.1 Sample

Rule 4.5.1: Mating pairs of the connector product samples to the required sample size shall be inspected per respective testing requirements per 4.6 and related specifications.

4.5.1.1 Sample inspection for RFI product

Rule 4.5.1.1: To qualify normally disassembled product elements described by applicable connector and contact clause specification (see Clause 7 through Clause 12), each supplier shall perform compliance testing to the product level it supports (i.e., contacts only to contact specification that it advertises) or certify in accordance with the inspection criteria in Table 2, Table 3, and Table 4.

4.5.1.2 Sample size and measurements

Rule 4.5.1.2: The sample size of connectors shall be in accordance with respective product element specifications described in Clause 6. All framework sample units shall undergo full inspection requirements in accordance with 4.6. For connector sample units, a total of 15% of the contact positions shall be measured per connector sample for each subgroup. For connectors with 13 or fewer contacts, all positions shall be measured. This shall apply to the requirements as specified in 4.6. The same contact positions shall be monitored throughout the test sequences.

4.5.2 Inspection routine

Rule 4.5.2: Sample units shall be subjected to the inspections specified in Table 2, Table 3, and Table 4. All RFI framework and connector assembly sample units shall be subjected to the visual, dimensional, mechanical, and environmental inspections in accordance with the inspection acceptance criteria in Table 2, Table 3, and Table 4. Connector samples shall further undergo testing in accordance with the connector inspection acceptance criteria in Table 3.

4.5.3 Failures

Rule 4.5.3: All failures shall be documented and reliability data supplied when requested by a purchaser to verify product conformance to this document, or stipulate any deviations to that stated.

Recommendation 4.5.3: MIL-HDBK-217F is the recommended resource for determining reliability for the respective product being supplied under this standard.

Suggestion 4.5.3: Failure history collection is suggested by all product manufacturers, to support goals of continuous improvement/product reliability enhancement.

Table 2—Framework and connector mechanical inspection acceptance criteria

Inspection requirement	Defined in subclause	Method subclause
Visual and mechanical	5.6–5.22; 6.7	4.6.1
Interchangeability and engagement forces[a]	5.14, 5.16, 6.9, 6.11, 6.12	4.6.2.1
Mating and unmating conformance	5.16.3, 5.18, 6.11, 6.12	4.6.2.2, 4.6.2.3
Durability cycling	5.8.2, 5.19, 6.12, 6.19	4.6.2.4, 4.6.2.7
Connector/contact conformance[a]	6.13	4.6.2.4, 4.6.2.5
NOTE—All electrical tests may be performed on same sample(s) in one test group. All mechanical tests may be performed on an additional sample(s) in one test group.		

[a]When applicable (see 4.3 and Table 1).

4.6 Method of examination and test

4.6.1 Visual and mechanical examination

Rule 4.6.1a: An examination shall be made to determine compliance with each of the requirements of 4.3.

Table 3—Connector electrical inspection acceptance criteria

Inspection requirement	Defined in subclause	Method subclause
Contact resistance	6.14, 6.23	4.6.3.1
Electrical characteristics	6.4, 6.7	4.6.3.9
Dielectric withstanding voltage[a] (sea level) 5 s exposure	5.8.1, 6.16	4.6.3.3
Low level contact resistance	6.17	4.6.3.4
Insulation resistance[a]	5.18.2, 6.18	4.6.3.5
Crimp/Wire-wrap termination	7.3.11	4.6.3.6
Crimp tensile strength	6.24	4.6.3.7
Contact retention	6.15	4.6.3.2
Solderability (contacts only)	6.22	4.6.3.8

[a]Applicable to connectors furnished with assembled contacts.

Table 4—Framework and connector environmental inspection acceptance criteria

Inspection requirement	Defined in subclause	Method subclause
Operating temperature	5.21.1, 6.20.1	4.6.4.1
Temperature cycling	5.21.2, 6.20.2	4.6.4.2
Humidity	5.21.3, 6.20.2	4.6.4.3
Vibration	5.21.5, 6.20.3	4.6.4.4
Shock (specified pulse)	5.21.6, 6.20.6	4.6.4.5
Salt spray	5.21.7, 6.20.7	4.6.4.6
Solvent resistance/fluid immersion	5.21.8, 6.20.8	4.6.4.7
Flammability	5.21.9, 6.20.9	4.6.4.8

Rule 4.6.1b: Framework, connectors and accessories shall be visually inspected in such a manner as to be uniform in quality and shall be free from burrs, crazing, cracks, voids, pimples, chips, blisters, pinholes, sharp cutting edges, and other defects that adversely affect life, serviceability, or appearance.

4.6.2 Framework and connector mechanical specification conformance testing

4.6.2.1 Inspection for Interchangeability

Rule 4.6.2.1a: All IEEE 1505 products shall satisfy interchangeability requirements between common or multiple-manufacturer entities by meeting the following:

a) Physical configuration and dimensional measurements of 4.3

b) Related Clause 5 (framework) and Clause 6 (connector) specifications

c) Qualification inspections, as referenced in Table 3

d) Subsequent applicable requirements in accordance with Methods 2013.1 and 2014 of MIL-STD-1344A or equivalent methods of EIA 364E

Rule 4.6.2.1b: The following dimensions shall be gauged or measured to determine conformance to the physical interchangeability requirements of applicable specifications (see 4.3). When a listed dimension is not within specified dimensions and tolerances as defined by this specification, it shall be considered a major defect. Major defects are as follows:

a) External and internal dimensions of cases, covers, and inserted assemblies, when such dimensions affect mating parts.

b) Dimensions of cavities, when such dimensions affect insertion of items.

c) Location of connectors, locking pins, fasteners, adequacy of connector float/mounting screw implementation, and other mountings, as applicable, which receive mating parts of plug-in assemblies and major units, and location of the mating parts on the plug-in assembly or major unit.

Recommendation 4.6.2.1: It is recommended that manufacturers utilize opportunities to mate/unmate products with other manufacturers' products to verify that compatibilities exist. Integrators and/or users may implement their own respective tests with multiple vendors' products to qualify source acceptance.

4.6.2.2 Mating framework conformance specification testing

Rule 4.6.2.2a: Each manufacturer shall conduct and comply with the mating framework conformance specification as established by Clause 5 and test in accordance with Method 2013.1 of MIL-STD-1344A, EIA 364E, or equivalent methods, to verify the specification is being met. An applicable defined/measured compliant mating receiver/fixture test specimen, per 4.6.2.2, is required to perform this test.

Rule 4.6.2.2b: Each manufacturer, or third-party test facilitator, shall conduct mating receiver/fixture conformance tests in accordance with Method 2013.1 of MIL-STD-1344A, EIA 364E, or equivalent methods, to verify 5.8 and 5.16 are being met. The test requires that a test specimen receiver or fixture be applied to a compliant mating frame, with a minimum engagement load of 75% of the advertised engagement capability for a period of 5 s, through a 500-cycle exercise, without causing the following:

a) Mechanical interference, binding, push-back by ball-lock spring actions, and/or visible wear to the receiver or fixture

b) Misalignment of greater than 0.51 mm (0.02 in) to preset alignment connector contact points (minimum of five contact points, four corners and center), per 76.2 mm (3.0 in) increment of the framework

c) Failure to engage, maintain engagement under 75% load of maximum pin load in quantity or force, and disengage the fixture and all related ball-lock mechanisms from their respective receiver receptacles

d) Visible connector gap due to coplanar distortion, ball-lock non-engagement, or other mechanical instability that results in contact electrical “opens” or contact electrical/mechanical resistance beyond the specification

e) Failure to maintain parallel relationships between the receiver and fixture framework that would cause a greater than 2.032 mm (0.080 in) gap between facing surfaces (see 5.10), contact electrical excessive resistance, or contact electrical opens

f) Force being applied to the engagement handle by the operator to exceed 20 kg (40.1 lb), as measured at the end of the handle

g) Other detrimental impact to mating elements

A minimum sample of two units shall be measured to the conformance test.

Rule 4.6.2.2c: Each manufacturer, or third-party test facilitator, shall conduct maximum fixture support weight tests to verify that 5.19 is being met. The test shall require that a compliant test specimen receiver and specified weighted fixture [fixture weight is calculated be applying the specified maximum weight at the center point of the fixture width at 381 mm (15 in) from the face of the fixture framework], with a minimum engagement load of 75% load of maximum pin load in quantity or force, be engaged for a period of 10 s through a 100-cycle exercise, without causing any conditions specified in Rule 4.6.2.2b.

Rule 4.6.2.2d: Maximum fixture support weight rating of framework shall be as specified based upon combined drive and ball-lock engagement capability (holding force) not to be less than 45 kg (100 lb) per ball-lock, reflecting the amount of fixture weight that can be both supported in a cantilevered fashion while also meeting a specified engagement resistance specifications as tested in accordance with 4.6.2.

Rule: 4.6.2.2e: Fixture footprints shall not exceed dimensions described in 5.20 (see Figure 35) that would intrude on the (right side) manual handle and (bottom) lower fixture support areas.

4.6.2.3 Mating contact/receptacle conformance specification testing

Rule 4.6.2.3a: To meet IEEE 1505 requirements, each manufacturer shall conduct and comply with a mating contact/receptacle conformance specification established within each respective connector/contact

specification described in Clause 7 through Clause 12. An applicable defined/measured compliant mating pin or receptacle contact test specimen per Clause 7 through Clause 12 is required to perform this test.

Rule 4.6.2.3b: Each manufacturer, or third-party test facilitator, shall conduct mating contact/receptacle conformance tests as described herein, in which compliant test contact pins are applied to sample contact sockets of the connector, or the reverse for a period of 10 s/cycle, through a 500-cycle exercise, without causing the following:

a) Visible wear to the socket or pin

b) Loss of memory to spring-loaded receptacle features to maintain surface contact

c) Nonconformance to mechanical engagement resistance (per 6.17) across mating surfaces

d) Nonconformance to electrical resistance or reduced parametric performance (per 6.19) across mating surfaces

e) Mechanical pushback (greater than 15%) within connector housing cavity

f) Other detrimental impact to mating elements

A minimum sample of seven mating connector sets shall be measured to satisfy conformance tests.

Rule 4.6.2.3c: Each manufacturer or third-party test facilitator shall conduct mating connector conformance tests as described in Rule 4.6.2.3b. During 500 cycles of insertion and withdrawal, the force required to fully insert and withdraw a fully populated connector plug from the mating receptacle shall be measured after 25, 100, 250, and 500 cycles. Each fully populated connector plug and receptacle so mated shall be considered as one test specimen, with a minimum of three mated pairs being required to satisfy conformance tests. The measuring equipment shall conform to the following specifications:

a) Axis of insertion of the pin contacts and mating receptacle contacts or hermaphroditic contacts as applicable shall coincide during insertion and withdrawal.

b) Speed of insertion of the plug into the receptacle contacts shall not exceed 6 cycles per minute for constant speed machines, or the rate of loading shall not exceed 80 lb per min for constant-rate-of-force machines.

c) Scale mechanisms shall have no dashpots or other damping devices.

d) Scales shall be calibrated in 56.7 g (0.13 lb) steps or less and shall be accurate to within 56.7 g (0.13 lb).

NOTE—When mating and unmating tests are required by another test such as contact life, the preconditioning cycles are not required.

4.6.2.4 Oversized pin exclusion (pins only) test

Rule 4.6.2.4: The oversized pin exclusion (contact pins only) requirement, which determines RFI product pin dimension conformance, shall be met by inserting a test sample pin into the mating end of the socket test fixture that excludes the entry of a test sample pin larger than the allowable maximum pin dimensions, as specified in Clause 6 and related detailed specifications in Clause 7 through Clause 12.

4.6.2.5 Oversized pin/probe damage socket test

Rule 4.6.2.5: The *oversized pin/probe damage socket test* requirement determines RFI connector socket/receptacle test sample ability to maintain dimension conformance when an oversized pin or probe is inserted in accordance with Method 2006-1 of MIL-STD-1344A, EIA 364E, or equivalent methods. The connector and mating socket contact entry opening shall prevent an oversized pin or probe that exceeds the tolerances, as specified in Clause 6 and related annex descriptions, from entering the socket. The

receptacle/socket test sample and oversized pin shall be fixtured to verify that concentric relationships are maintained during the insertion test.

4.6.2.6 Framework durability cycling

Rule 4.6.2.6a: To meet IEEE 1505 requirements, each manufacturer shall subject the test specimen receiver and fixture to a *durability cycle test* in accordance with Method 2016 of the MIL-STD-1344A, EIA 364E, or equivalent methods. A minimum durability cycle objective of 25 000 repetitions shall be used. Each manufacturer or third-party test facilitator shall establish a defined mechanical/electrical setup to provide a comprehensive test and data collection that verifies the manufacturer's product specifications and meets minimum requirements of IEEE Std 1505-2010. The framework cycle test shall validate reliability of the framework to achieve its advertised capabilities under subsequent MIL-STD-1344A requirements.

Rule 4.6.2.6b: For the framework durability cycle test of fixture engagement, insertion, and withdrawal, the force shall be sufficient to fully insert and withdraw from the receiver. If the force is manually applied, it shall be measured at the operating handle and shall not exceed 16 kg (35 lb). Each plug and receptacle so mated shall be considered as one test specimen when further testing of the plug or receptacle is indicated. The measuring equipment shall conform to the following specifications:

a) Axis of insertion of the pin contacts and mating receptacle contacts or hermaphroditic contacts as applicable shall coincide during insertion and withdrawal.

b) Speed of insertion of the plug into the receptacle contacts shall not exceed six cycles per minute for constant speed machines, or the rate of loading shall not exceed 80 lb per min for constant-rate-of-force machines.

c) Scale mechanisms shall have no dashpots or other damping devices.

d) Scales shall be calibrated in 56.7 g (0.13 lb) steps or less and shall be accurate to within 56.7 g (0.13 lb).

4.6.2.7 Connector durability cycling

Rule 4.6.2.7a: To meet IEEE 1505 requirements, each manufacturer shall conduct and comply with an mating contact/receptacle conformance specification established within each respective connector/contact specification described in Clause 6 through Clause 12; MIL-STD-1344A, Method 2002.1; EIA 364E; or equivalent methods.

Rule 4.6.2.7b: Each unit shall be subjected to 10 000 insertion and withdrawal cycles. The following items shall apply:

a) Axis of the pin contacts and mating receptacle contacts shall coincide during insertion and withdrawal.

b) Durability cycle rate shall not exceed six cycles per minute.

c) Contact electrical resistance continuity measurements shall be measured at each 2500-cycle interval to 5% of the pins in equal pattern across the beam of the mating connectors, maintaining requirements established in 6.19.

d) Connector mating and unmating forces shall be measured and maintained in accordance with respective connector requirements (see 6.17 and connector detailed specifications in Clause 7 through Clause 12).

4.6.3 Connector electrical specification conformance testing

Rule 4.6.3: Advertised connector electrical specifications by manufacturers shall be supported by documented test results conducted by the manufacturer, or third-party test labs in accordance with Clause 6, and the respective connector detailed specifications in Clause 7 through Clause 12).

4.6.3.1 Contact electrical resistance

Rule 4.6.3.1: The *contact electrical resistance* shall be measured individually between each mated pair of contacts. A minimum of six mated pairs of contacts shall be measured on each test specimen, in accordance with Method 3004 of MIL-STD-1344A, EIA 364E, or equivalent methods.

a) **Method of connection:** Attach current-voltage leads at extreme ends of contacts. For crimp-type contacts, attach current-voltage leads to wires at closest point to contact without touching contact.

b) **Test current:** See respective contact rated current (see Clause 7 through Clause 12).

4.6.3.2 Contact retention/float within connector housing

Rule 4.6.3.2: Connectors shall be tested to meet minimum contact retention requirements per Method 2007 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details and exceptions shall apply:

a) **Number of samples:** A minimum of seven contacts per test specimen shall be tested.

b) **Applied axial load:** 1 lb/s until the load specified in individual specification supplements has been reached. Maintain load for 5 s. (When hookup wire is used, the wire shall be large enough to withstand the applied load).

c) **Maximum allowable contact displacement:** During application of specified force and after removal of specified force, per respective contact displacement-float tolerance (see the connector specifications in Clause 6 through Clause 12).

d) **Axial direction:** Straight.

e) **Removable type contacts:** Shall withstand an axial load (see 4.3) applied in the normal removal direction after 10 insertions and withdrawals from the same contact hole.

4.6.3.3 Dielectric withstanding voltage

Rule 4.6.3.3: Mated connectors shall be tested to meet dielectric-withstanding-voltage requirements in accordance with Method 3001 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details and exceptions shall apply:

a) **Preparation:** Mated, and may be mounted to printed wiring board.

b) **Magnitude of test voltage:** As specified (see Clause 6 through Clause 12).

c) **Nature of potential:** AC (rms).

d) **Duration of application of test voltage:** 60 s.

e) **Points of application of test voltage:** Between the closest contacts and between the contacts and all other metallic parts connected together.

f) **Method of connection of test voltage to specimen:** Affix test probes to terminations described in 4.6.3.1 by clips or solder.

4.6.3.4 Low-Level circuit

Rule 4.6.3.4: A minimum of seven mated pairs of contacts on each test specimen shall be individually measured in accordance with Method 3002.1 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details shall apply:

a) Method of connection: Attach current-voltage leads at extreme ends of contacts. For crimp-type contacts, attach current-voltage leads to wires, at closest point to contact without touching contact.

b) Not to exceed 100 mA at 20 mV dc open circuit.

c) Respective specification measured as maximum contact resistance level that is described in associated maximum contact resistance tables.

4.6.3.5 Insulation resistance

Rule 4.6.3.5: Mated connectors shall be tested in accordance with Method 3003 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details and exceptions shall apply:

a) Special preparation:

1) The connector shall be mated and may be mounted on a printed wiring board.

2) The printed wiring board may be conformal coated or otherwise protected.

b) Point of measurement: Check between pins and hardware, between pin and pin, and between pins and shell (on shell-constructed connectors).

4.6.3.6 Crimp/wire-wrap termination

Rule 4.6.3.6: Each terminal, except wire-wrap post and crimp, shall be subjected to Method 208 of MIL-STD-202G.

4.6.3.7 Crimp tensile strength (applicable to crimp contacts only)

Rule 4.6.3.7: The test shall be performed in accordance with Method 2003 of MIL-STD-1344A, EIA 364E, or equivalent methods. Samples for test shall be placed in a standard tensile testing machine and the load applied at an approximate rate as specified to pull the wire out of the sample or break the wire sample. Values shall be in accordance with the respective connector clauses (Clause 6 through Clause 12). Note that these values are for MIL-DTL-16878 wire used in conjunction with the proper crimp contact. Ten samples of each wire size (both pin and receptacle types) shall be tested.

4.6.3.8 Solderability

Rule 4.6.3.8: All connectors with solder terminations shall be tested in accordance with Method 210 of MIL-STD-202G, Condition C, except connectors with solder cup terminations, which shall be tested in accordance with the following details:

a) The applicable wire size properly prepared for the solder cup size shall be inserted into the contact termination. A minimum of seven contacts shall be tested.

b) An appropriately prepared resistance soldering iron with an appropriate tip shall be applied to the lower portion of the solder cup configuration where the wire enters the termination.

c) The solder shall be applied in the normal manner.

d) The resistance soldering iron shall be applied to the system. The wattage shall be adjusted as to allow a proper solder fillet to be formed or for a 4 s minimum time limit, whichever is more.

e) After application, the soldering iron shall be removed and a visual/mechanical inspection performed.

f) Visual inspection shall be at magnification power times 10. The connector shall show no evidence of distortion or damage to any area of the connector housing. The contact shall meet the contact retention requirement The contact shall not interfere with normal floating conditions as applicable and shall meet applicable location dimensions.

4.6.3.9 Contact electrical characteristics

Rule 4.6.3.9a: Coaxial standing wave ratio (SWR) measurements in accordance with Method 3005 of MIL-STD-1344A, EIA 364E, or equivalent methods, if applicable, shall be applied on all coaxial connector assemblies and included in any connector specification and contact rating.

Rule 4.6.3.9b: Coaxial radio frequency (RF) transmission loss, leakage, and RF high potential withstanding voltage measurements, in accordance with 4.6.12, 4.6.13, and 4.6.16 of MIL-C-83517, respectively, shall be included in any coaxial connector specification and contact rating.

Rule 4.6.3.9c: Power current rating measurements, in accordance with IEC 60309-1, shall be included in any power connector specification and contact rating.

Rule 4.6.3.9d: Power creepage/dielectric resistance measurements, in accordance with Method 3003.1 of MIL-STD-1344A, EIA 364E, or equivalent methods, shall be included in any connector specification and contact rating.

4.6.4 Environmental test compliance

4.6.4.1 Operating Temperature

Rule 4.6.4.1: Conformance to the temperature cycling requirements per applicable specification supplements (see 4.3) shall constitute verification of the product operating temperature.

4.6.4.2 Temperature cycling

Rule 4.6.4.2: Mated connectors shall be tested in accordance with Method 1003 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details shall apply:

a) **Special mounting:** The connector halves shall be mounted on mounting framework.

b) **Test condition:** A, except that the minimum temperature shall be 10 °C +0/–5 °C and the maximum temperature shall be 50 °C +3 /–0 °C.

c) **Test measurement:** The connector shall be capable of mating and unmating the temperature extremes (force shall not be monitored) during the fifth cycle.

d) **After test examination:** Connectors shall be examined for evidence of cracking, crazing, or other physical damage, and the contact resistance shall be measured in accordance with 4.6.3.1.

4.6.4.3 Humidity

Rule 4.6.4.3: Connectors shall be tested in accordance with Method 1002, Type II of MIL-STD-1344A, except steps 7a and 7b shall not be required. Alternatively, equivalent methods of EIA 364E shall be used. The mated pairs shall be connected as specified in 4.6.2.3. The printed wiring board may be conformal coated or otherwise protected. The loading voltage shall be 100 V dc. Insulation resistance shall be measured in accordance with 4.6.3.5, upon completion of step 6 of the final cycle, after removal of surface moisture from connector.

4.6.4.4 Vibration

Rule 4.6.4.4a: Framework shall be tested in accordance with Method 2005 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details shall apply:

a) **Mounting:** Specimen mating receiver/fixture connectors shall be mounted in a fully populated four-slot receiver and fixture configuration with the receiver framework mounted with standard mounting screws to the receiver mounting plate, which is firmly mounted on the vibration table.

b) **Stabilization:** Arrangement of a fully mated receiver and fixture shall be provided, which prevents the mated connectors from mechanically separating, or electrically opening during vibration tests. The resisting medium shall contact the receiver framework mounting surfaces on the test jig only, and no initial load shall be imparted to the connector.

c) **For connector saver connectors:** The mated pairs shall be mounted per integration specifications.

d) **Monitoring circuit:** Shall be provided to detect any interruption greater than 1 µs.

e) **Electrical load condition:** 100 mA.

f) **Test condition:** Frequency requirement for 5 Hz to 55 Hz at a maximum of 29.4 m/s for vibration. (6.86 m/s at 5 Hz to 15 Hz, 12.74 m/s at 16 Hz to 25 Hz, 29.4 m/s at 26 Hz to 55 Hz).

g) **After test examination:** Connectors' mounting hardware shall be visually examined for loosening, fracture, or other deterioration.

Rule 4.6.4.4b: Mated connectors shall be independently tested in accordance with Method 2005 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details shall apply:

a) **Stabilization:** Arrangement shall be provided as indicated on Figure 2 of Method 2005 of MIL-STD-1344A, EIA 364E, or equivalent methods, such that a resisting force shall exist through a compliant material (rubber with a Shore A durometer of about 25), which prevents the mated connectors from separating during vibration and shock. The resisting medium shall contact the top and side surfaces on the test jig only, and no initial load shall be imparted to the connector other than the weight of the test jig.

b) **For straight-through connectors:** A mated pair shall be mounted an individual parallel wiring boards and secured by bolts and standoffs as indicated on Figure 3 of Method 2005 of MIL-STD-1344A, EIA 364E, so that the distance between the wiring boards is equal to the height of the assembled connectors.

c) **Monitoring circuit:** Shall be provided to detect any interruption greater than 1 µs.

d) **Electrical load conditions:** 100 mA

e) **Test condition:** III

f) **After test examination:** Connectors and mounting framework shall be visually examined for loosening, fracture, or other deterioration.

4.6.4.5 Shock (specified pulse)

Rule 4.6.4.5: Mated four-slot receiver and fixture framework with full population of specimen mating connectors shall be tested in accordance with Method 2004 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details shall apply:

a) Mounting method and accessories: In accordance with item a) in 4.6.4.4 and suitable monitoring circuit to detect any interruption greater than 1 µs.

b) Test condition: Pulse requirement for 5 ms of 49 m/s for shock.

c) Number of blows: One blow in both directions along each of three mutually perpendicular axes for a total of six shocks.

d) Test current: 100 mA

e) After test examination: Connectors and mounting framework shall be visually examined for loosening, fracture, or other deterioration.

4.6.4.6 Salt spray (corrosion)

Rule 4.6.4.6: Mated connectors shall be tested in accordance with Method 1001 of MIL-STD-1344A, EIA 364E, or equivalent methods. The following details shall apply:

a) Applicable salt solution in accordance with MIL-STD-1344

b) Test condition: B

4.6.4.7 Solvent resistance and fluid immersion

Rule 4.6.4.7: Mated connectors shall be tested in accordance with Method 1016 of MIL-STD-1344A, EIA 364E, or equivalent methods.

4.6.4.8 Flammability

Rule 4.6.4.8: Mated connectors shall be tested in accordance with Method 1012 of MIL-STD-1344A, EIA 364E, or equivalent methods.

4.6.4.9 Human Safety

Rule 4.6.4.9: Mechanical and electrical components shall be reviewed and marked accordingly per the following Occupational Safety and Health Administration (OSHA)[18] regulations governing human safety and use of IEEE 1505 apparatus during operation. These include the following:

a) OSHA Enforcement of the Electrical Power Generation, Transmission, and Distribution Standard, CPL 02-01-038 [CPL 2-1.38] (October 31, 2002). Also available as a 948 kb PDF, 51 pages. Provides information to assist compliance personnel in performing inspections in electric power generation, transmission, and installations, including that of distribution lines and other equipment.

b) OSHA Technical Manual (OTM), TED 01-00-015 [TED 1-0.15A] (January 20, 1999). Assists OSHA Compliance Safety and Health Officers (CSHOs) in hazard recognition and provides guidance in accident prevention. Serves as a source of advice for CSHOs on safety and health issues.

c) Inspection Guidelines for 29 CFR 1910, OSHA STD 01-06-006 [STD 1-6.6] (June 16, 1995). Provides inspection assistance related to personal protective equipment (PPE) (29CFR1910, Subpart I) to assist OSHA CSHOs performing inspections in general industry.

d) Electrical Safety-Related Work Practices—Inspection Procedures and Interpretation Guidelines. OSHA STD 01-16-007 [STD 1-16.7] (July 1, 1991). Establishes policies and provides interpretive guidelines for uniform enforcement of the standard for electrical safety-related work practices, 29CFR1910.331 through 29CFR1910.335.

[18] For countries other than the U.S. application of alternate, appropriate safety-related standards shall be used.

5. Framework specification

5.1 Framework specification introduction

5.1.1 General

This clause serves the function of defining framework application, styles, performance, dimensional, and environmental specifications for satisfying IEEE Std 1505-2010. It is presented in two subsections: (a) first as a general definition describing common framework attributes and requirements for meeting the standard, and (b) a second, more detailed specification unique to the respective framework style or subset of the RFI system. Within each of those subsections there is a further definition between receiver and fixture elements. The general and specific specifications combine to form the RFI framework definition of the standard that otherwise could not stand alone.

The framework is described in two supplier versions: (a) segmented and (b) continuous framework designs. Where under the segmented framework specification, the RFI framework may be fabricated or assembled in separate four connector slot frame elements with ribs/spacings (voided connector slot) at the mating frame points. Whereas under continuous framework, the framework design may be constructed as an integral unit of multiple conductor slots that permits voided connector slot (ribs/spacings) required for segmented integration to be used. Integrators/suppliers may combine both framework designs to support a specific test interface requirement. In each approach, the body contour, alignment points, hole patterns, surface areas, and actuator elements of either framework shall remain constant with each 76.2 mm (3.0 in) increment of the framework.

Another descriptive view of the framework is related to how multiple frames are integrated to create multiple tier horizontal or vertical implementation. Orientation is first addressed as either *end-to-end* and *side-by-side* integration. Neither approach changes any framework specification, other than illustrate how frames are iterated to create multi-tier system (see 5.8.3 for more information).

End-to-end design describes the placement of RFI frames in an orientation that aligns the connectors in an end-to-end, stacking multi-tier fashion in either a vertical or horizontal fashion (see 5.8.3 for more information). Side-by-side design places in adjacent fashion to align the connectors in a side-by-side manner (see 5.8.3 for more information). Either design can be placed in a *horizontal* or *vertical* implementation.

5.2 Framework general specification

5.2.1 Framework physical footprint options

Rule 5.2.1a: The physical footprint of a segmented framework shall be in accordance with 5.5.2 and 5.8.3.1. The physical footprint of a continuous framework is illustrated in Figure 2, and can be applied as shown in Figure 3.

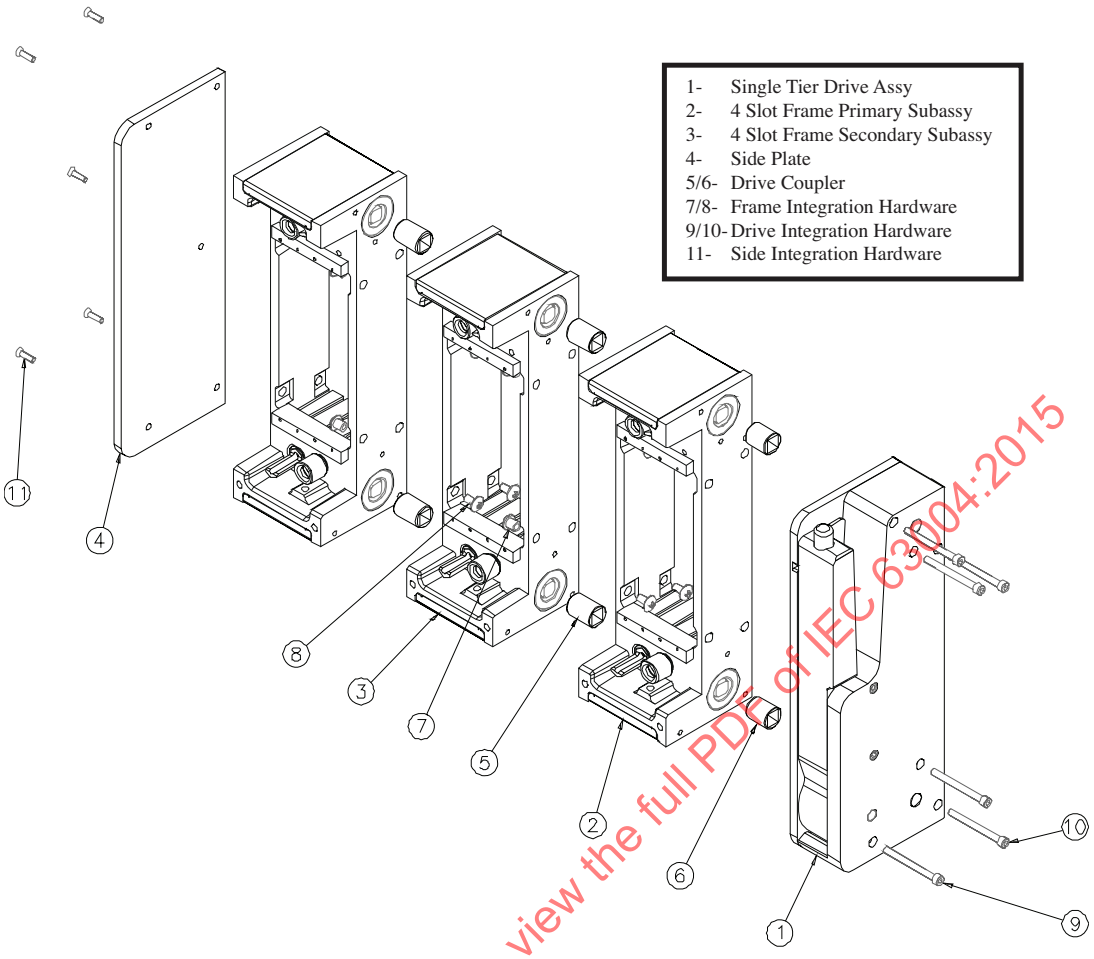


Figure 1—Receiver segmented framework layout design

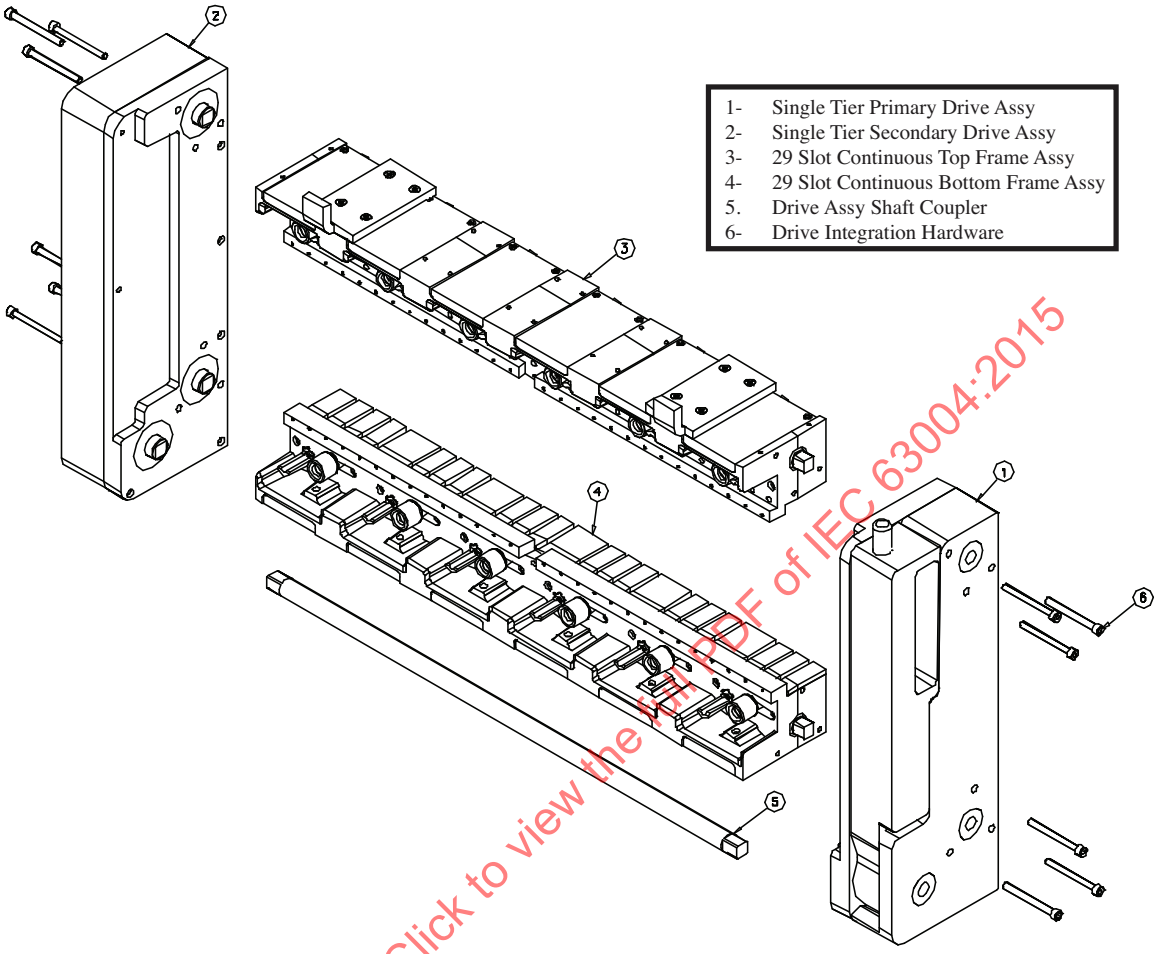


Figure 2—Receiver continuous framework layout design

Rule 5.2.1b: The framework assembly shall include alignment, keying, securing, and mechanical engagement devices and elements to permit user-friendly operation and to promote safety. Framework shall support the following:

a) Scalable integration of the fixture frames to the receiver frame in connector slot increments of 1, 4, 9, 14, 19, 24, and 29 slots based upon 76.2 mm (3.0 in) wide framework segmentation and 15.24 mm (0.6 in) connector slot widths

b) Reconfigurable integration of the multiple type/width connectors (1, 2, and 4 slot wide), at each slot or multiple slots

c) Fixture protective shroud intervals at framework/slot intervals 5, 10, 15, 20, and 25, where required

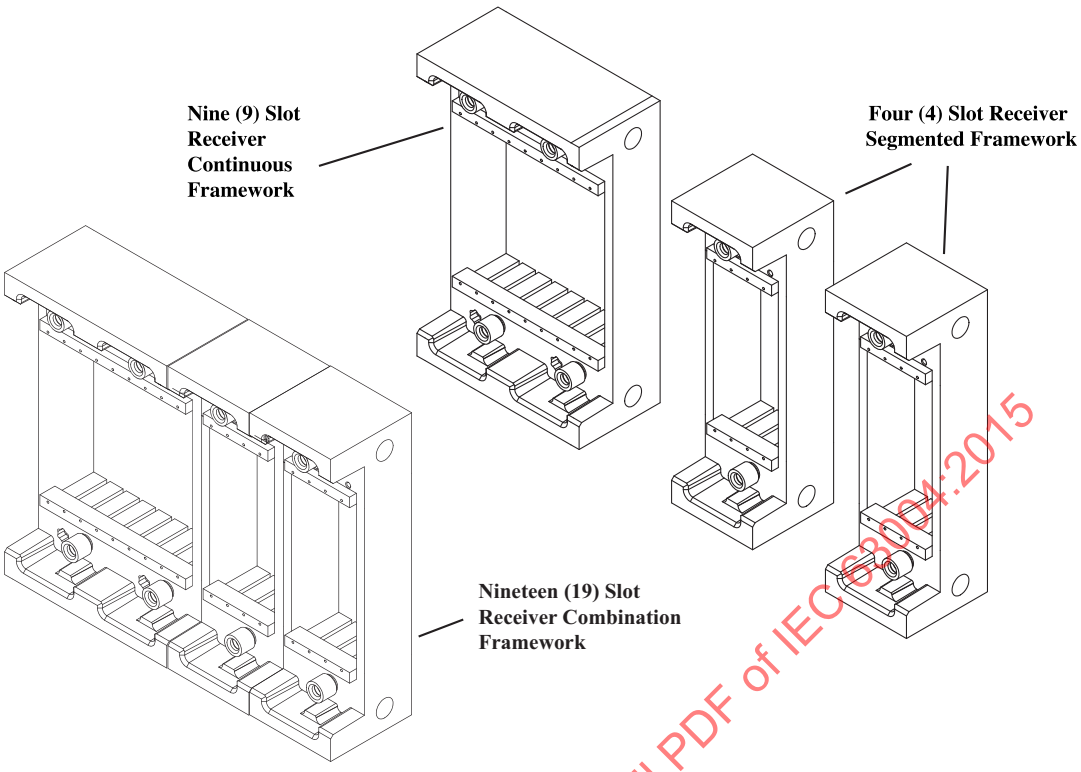


Figure 3—Receiver combination framework layout design

Rule 5.2.1c: The segmented framework specification (see Figure 1) shall use four connector module mounting slots and a 7.62 mm (0.30 in) shroud connector module keep-out space on each side. If incremented in four-slot sections under the segmented specification, a shroud spacing shall be provisioned at slot 5, 10, 15, 20, and 25 in the framework, to accommodate the protective shrouds of two adjoining fixtures.

Rule 5.2.1d: The continuous fixture and receiver framework specification (see Figure 2) is a side-by-side design implementation of multiple slot frames that expands connector side-by-side slots without applying blank spacing [representing combined adjoining fixture frames, 7.62 mm (0.30 in) fixture shroud connector keep-out space] for connector modules at slot 5, 10, 15, 20 and 25 in the framework in accordance with 5.8.3.1.

Permission: 5.2.1a: Integrators may apply a combination of segmented and continuous framework specifications (see Figure 3) or any combination of the connector module groups as determined by the specific application.

Rule 5.2.1e: The RFI framework shall be scalable in a side-by-side design from a minimum frame increment (four connector module slots) width of 76.2 mm (3.0 in), 279.4 mm (11.0 in) high, and 88.9 mm (3.5 in) deep, as illustrated in Figure 1, in 76.2 mm (3.0 in) frame increments per Clause 5. Integrators are permitted to increment side-by-side design fixed widths in 152.4 mm (6.0 in), 228.6 mm (9.0 in), 304.8 mm (12.0 in), 381 mm (15 in), up to a maximum 457.2 mm (18.0 in) [max supports 29 connector module slots including 7.62 mm (0.30 in) blank spacings as shown in Figure 2] to meet standard EIA equipment rack specifications.

Rule 5.2.1f: The RFI framework shall be scalable in an end-to-end design from a minimum frame increment (four connector module slots) width of 76.2 mm (3.0 in), 279.4 mm (11.0 in) high, and 88.9 mm (3.5 in) deep, as illustrated in Figure 7, in 279.4 mm (11.0 in) high frame increments per Clause 5.

Permission 5.2.1b: Integrators are permitted to increment end-by-end design in either fixed heights of 279.4 mm (11.0 in) (see Figure 7), or arbitrary heights to meet system integration requirements.

Rule 5.2.1g: Integrators or users may add incremental receiver framework at anytime to satisfy any mix of fixture requirements, as shown in Figure 3.

5.3 Materials

Rule 5.3: Manufacturer shall identify materials used and the level of qualification met by the respective materials, as specified in 4.2. When a definite material is not specified, a material shall be used that enables the connectors and accessories to meet the form, fit, function, and performance requirement. Acceptance or approval of any constituent material by the buyer shall not be construed as a guaranty of the acceptance of the finished product from the manufacturer.

5.4 Restricted materials

Rule 5.4: Manufacturer shall limit the use of restricted materials and the level of qualification met by the respective materials, as specified in 4.2.4.

5.5 Dissimilar metals

Rule 5.5: Where dissimilar metals are used, they shall meet requirements as specified in 4.2.5.

5.6 Workmanship

Rule 5.6: Frameworks and accessories shall be uniform in quality and free from burrs, crazing, cracks, voids, pimples, chips, blisters, pinholes, sharp cutting edges, and other defects that adversely affect functionality or appearance of the product.

5.7 Design and construction

Rule 5.7: Frameworks shall be of the design, construction, and physical dimensions specified (see 5.8 for detailed product specifications). Compliance is a function of matching dimensional requirements of the standard where noted, and verification by the supplier or buyer that the product satisfies fit, form, and function interoperability in accordance with this standard's requirements (see 4.3).

5.7.1 Threaded parts

Rule 5.7.1: Unless otherwise specified, all threaded parts shall be in accordance with FED-STD-H28. Where practicable, all threads shall be in conformity with the coarse-thread series. The fine-thread series shall be used only for applications that might show a definite advantage through their use.

5.7.1.1 Engagement of threaded parts

Rule 5.7.1.1: All threaded parts shall engage in accordance with ASME bolt criteria that establishes 1.5 to 2 times the diameter of the thread size, or a minimum of three full threads, unless otherwise specified in this document to be greater.

5.8 Framework assembly

5.8.1 Framework dimensional compliance

Rule 5.8.1a: The framework shall be designed to fully comply with the dimensional specifications described in 5.8.3 for proper electrical/mechanical operation under alignment (see 5.11), interchangeability (see 5.16), and durability requirements, in accordance with 5.21.

Rule 5.8.1b: The framework shall be designed to refine the engagement requirements with minimum dependence on mechanical float, through a telescopic alignment process (described and illustrated in Figure 4, Figure 5, and Figure 6), so that no misalignment or excessive force (see 5.18) is transmitted to the mating contact during engagement evolutions, per RFI qualification requirements (see 4.6.2).

Rule 5.8.1c: Critical interoperability areas, as illustrated in Figure 4, Figure 5, and Figure 6, represent key interface points that shall be met in accordance with this document's requirements (see 4.6.2.2) for interoperability between vendor products. These interoperability points shall serve as alignment between the mating surfaces of the receiver and fixture assemblies as previously discussed in 2.1.2. Detail descriptions are shown in subsequent Figure 4, Figure 5, and Figure 6.

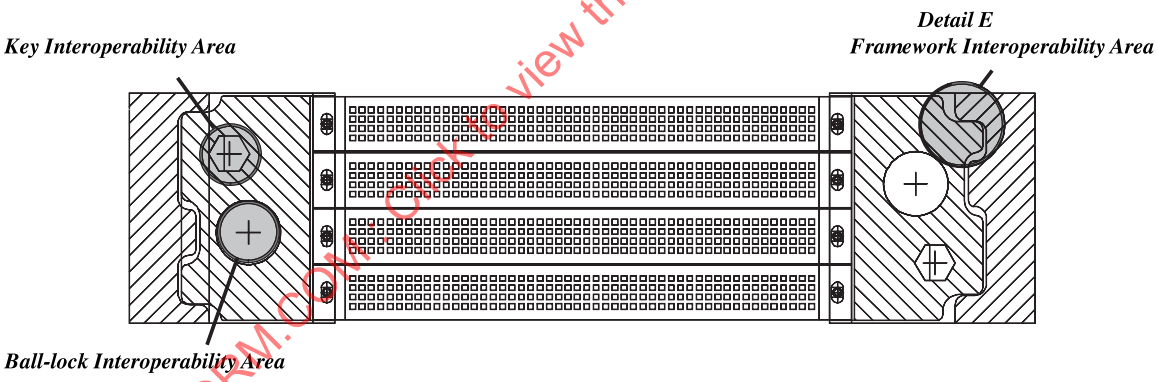


Figure 4—Segmented receiver/fixture top view, critical interoperability areas

Rule 5.8.1d: Dimensional tolerance shall be, unless otherwise stated, understood to be the following:

a) ±0.02 mm (± 0.10 in/± 0.1°), when linear/angular dimensional measurements in inches are to one decimal place

b) ±0.013 mm (± 0.050 in/± 0.05°), when linear/angular dimensional measurements in inches are to two decimal places

c) ±0.0013 mm (± 0.005 in/± 0.005°), when linear/angular measurements are to three decimal places

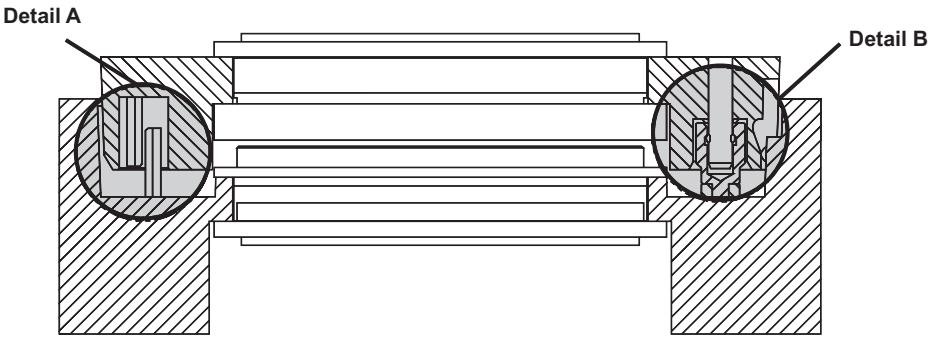


Figure 5—Receiver/fixture side view, signal modules disengaged, framework-critical interoperability areas

Figure 6—Receiver/fixture side view, signal modules engaged, framework-critical interoperability areas

5.8.2 Framework durability compliance

Rule 5.8.2: The framework shall be designed for proper operation without dependence on adjustment so that a minimum force is transmitted to the handle during mating and unmating under specified loads and environment conditions through a duration cycle test of 25 000 revolutions, without display of looseness, stroke/alignment dimensional change, or permanent displacement from its original, normal, fitted position at completion of the specified tests. Manufacturers shall validate conformance to this document per RFI qualification requirements in 4.6.2.4, Clause 5, and MIL-STD-1344A, Method 2002.1.

5.8.3 Body design

Rule 5.8.3a: Framework bodies shall be designed and constructed with proper sections and radii to prevent cracking, chipping, or breaking in assembly or in normal service. The framework shall be constructed in a side-by-side iteration, a placement of a four-slot frame next to another, or an end-to-end iteration, a placement of four slot frame on top of another, in accordance with Rule 5.8.3b and Rule 5.8.3c, to support scalable integration of the test interface as illustrated in Figure 7.

Permission 5.8.3: Framework bodies may be separated to accommodate instrument chassis alignment for direct coupling requirements, or building block and adjacent rack mounting schemes (see Figure 8). Implementation should attempt to define the space separating the framework, in accordance with increments established under the side-by-side and end-to-end iteration rules.

Rule 5.8.3b: Side-by-side body integration, which places one four-slot frame in row next to one another or in multiple frames, shall be in accordance with this document *side-by-side segmented framework* design having ribs/spacings (voided connector slot), or *side-by-side continuous framework* without ribs, or combination of both. The body contour, alignment points, hole patterns, surface areas, and actuator elements of either framework remain constant. The side-by-side segmented framework and side-by-side continuous framework shall be dimensioned and iterated at 76.2 mm (3.0 in) intervals, as described in 5.8.3.1, 5.8.3.2, and 5.8.3.3, and utilize materials as specified in 5.3. As stated earlier, differences in the framework relate only to the presence of a connector at every 15.24 mm (0.60 in) spacing (slot) under side-by-side continuous framework, versus the side-by-side segmented framework specification that may or may not restrict use of a connector, at 76.2 mm (3.0 in) frame intervals, to provision for *receiver frame side supports,* and/or application of adjacent fixtures that have protective shroud sidewalls.

Rule 5.8.3c: End-to-end multi-tier body, which stacks frame on ends in either a horizontal and vertical integration, as illustrated in Figure 7, shall be in accordance with this document *end-to-end multi-tier framework* design having all of the side-by-side framework features related to body contour, alignment points, hole patterns, surface areas, actuator elements, and ribs/spacings (voided connector slot), where applicable. *multi-tier framework* shall be dimensioned and iterated at a minimum 245.75 mm (9.675 in) intervals, as described in 5.8.3.2, and utilize materials as specified in 5.3.

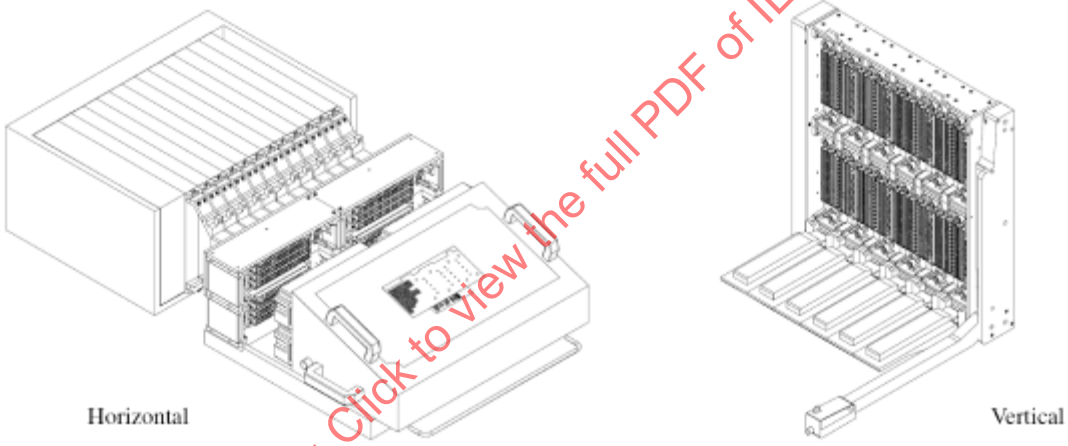


Figure 7—IEEE 1505 receiver, end-to-end multi-tier body horizontal and vertical integration based upon minimum increment 245.75 mm (9.675 in) spacing

5.8.3.1 Side-by-side receiver frame layout design

Rule 5.8.3.1: Receiver frame side-by-side layout design shall conform to the drawing specification illustrated in this document as either segmented framework (see Figure 8 and Figure 9); side-by-side continuous framework (see Figure 12 and Figure 13); side-by-side combination framework (see Figure 14 and Figure 15); side view framework, or combination of both, as also described in Figure 10 and Figure 11. Detailing contours and draft angles of the frame shall be adhered to in order to support alignment, as described in 5.8.1 casting/molding dimensional provisions.

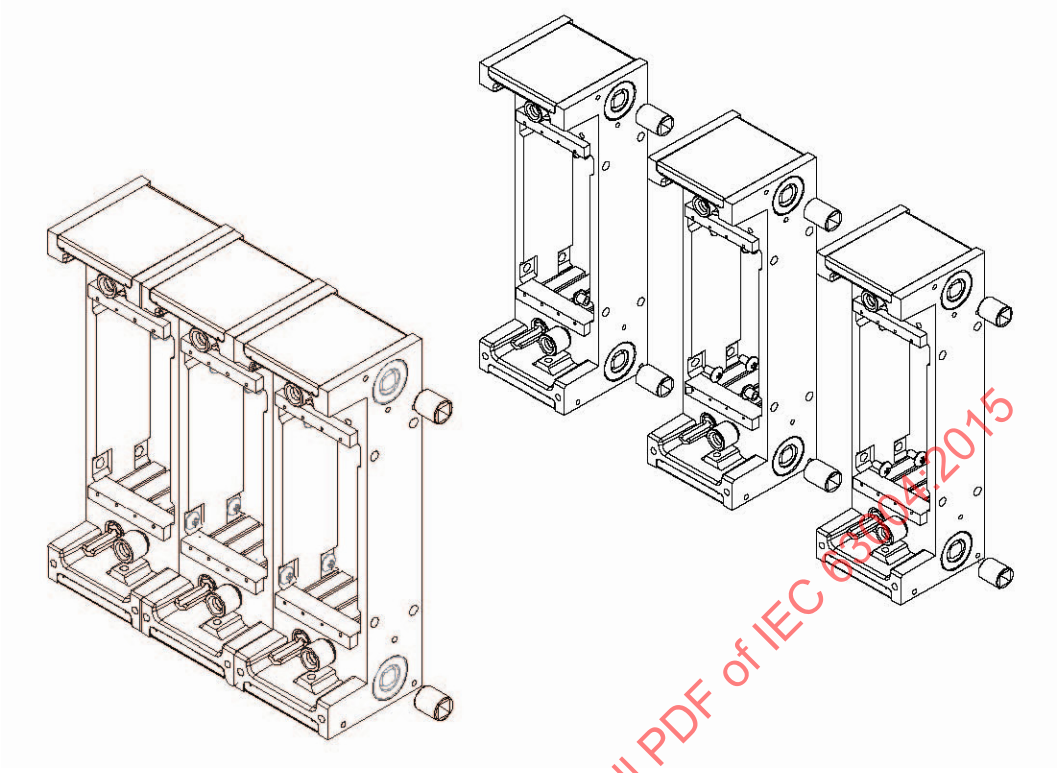


Figure 8—Segmented framework receiver layout design, perspective view, with connector mount spacing of 15.24 mm (0.60 in) and nonconnector slot for frame rib at 76.2 mm (3.0 in) spacings

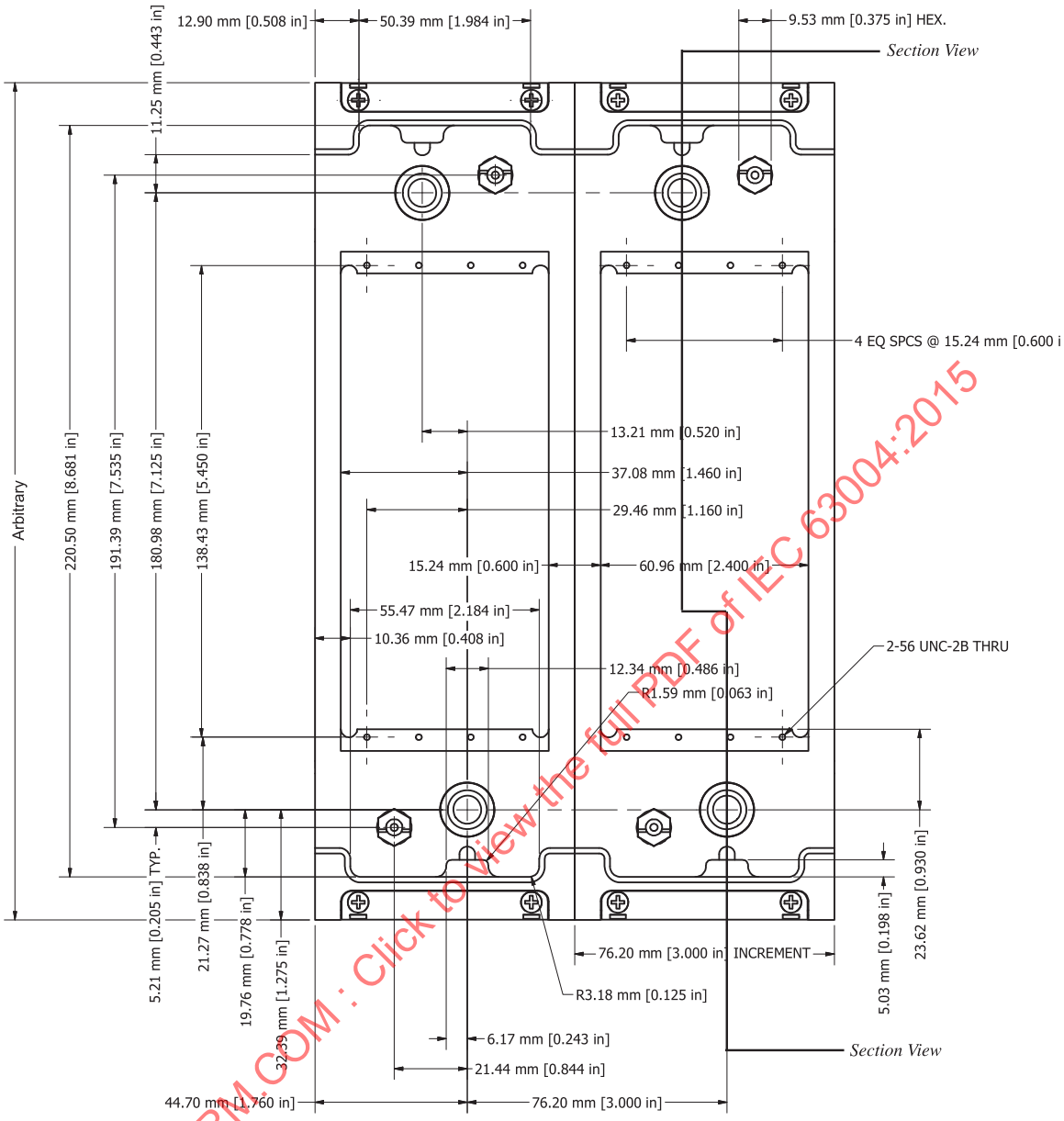


Figure 9—Segmented framework receiver layout design, top view, with connector mount spacing of 15.24 mm (0.60 in) and nonconnector slot for frame rib at 76.2 mm (3.0 in) spacings

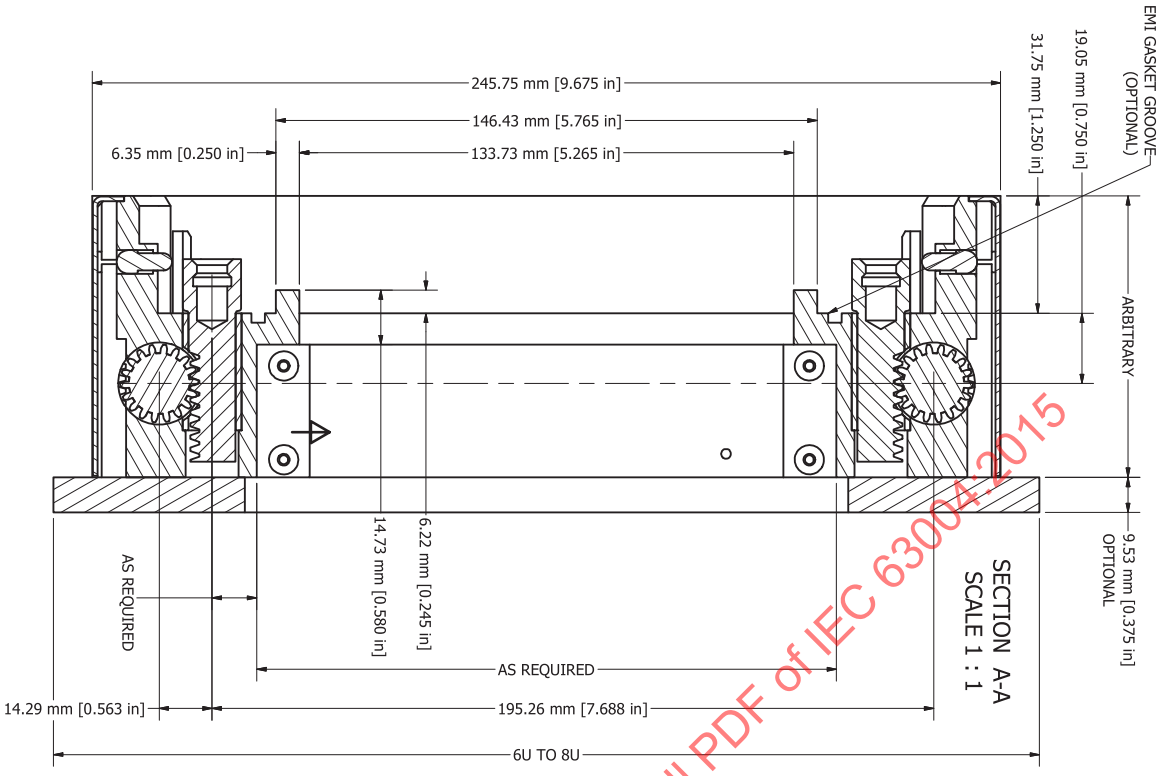


Figure 10—Segmented, continuous, or combination framework receiver design, sectional view

NOTE 1—Nondimensioned features that are shown in Figure 10 are arbitrary and reflective of one method for actuating the system, or vendor applied for esthetic/functional implementation of nonstandard requirements. These nondimensioned features or illustrations should not be construed as mandatory or recommended as requirements for implementing the standard.

NOTE 2—IEEE 1505 framework shall be mounted to a common plate, or multiple plates that maintain a flat planar relationship with all framework elements that does not exceed 2.54 mm (0.10 in) deviation across the mounting surface(s).

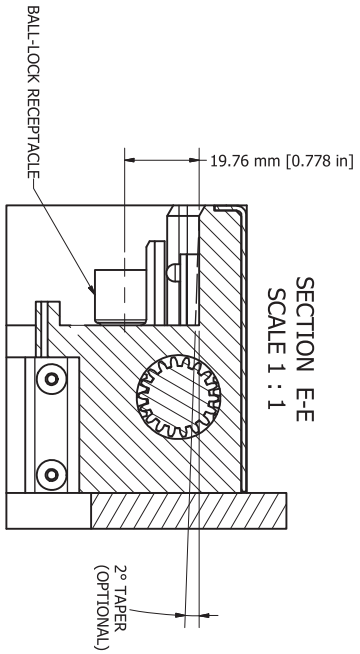


Figure 11—Segmented, continuous, or combination framework receiver design, cross-sectional view

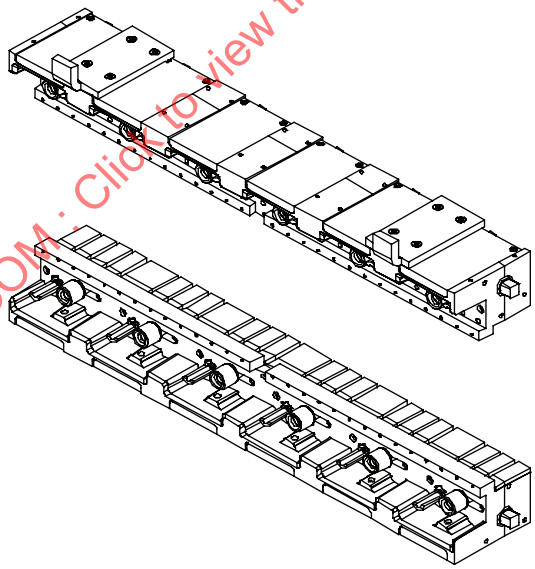


Figure 12—Continuous framework receiver layout design, perspective view, with connector mount spacing of 15.24 mm (0.60 in) and no frame rib at 76.2 mm (3.0 in) spacings

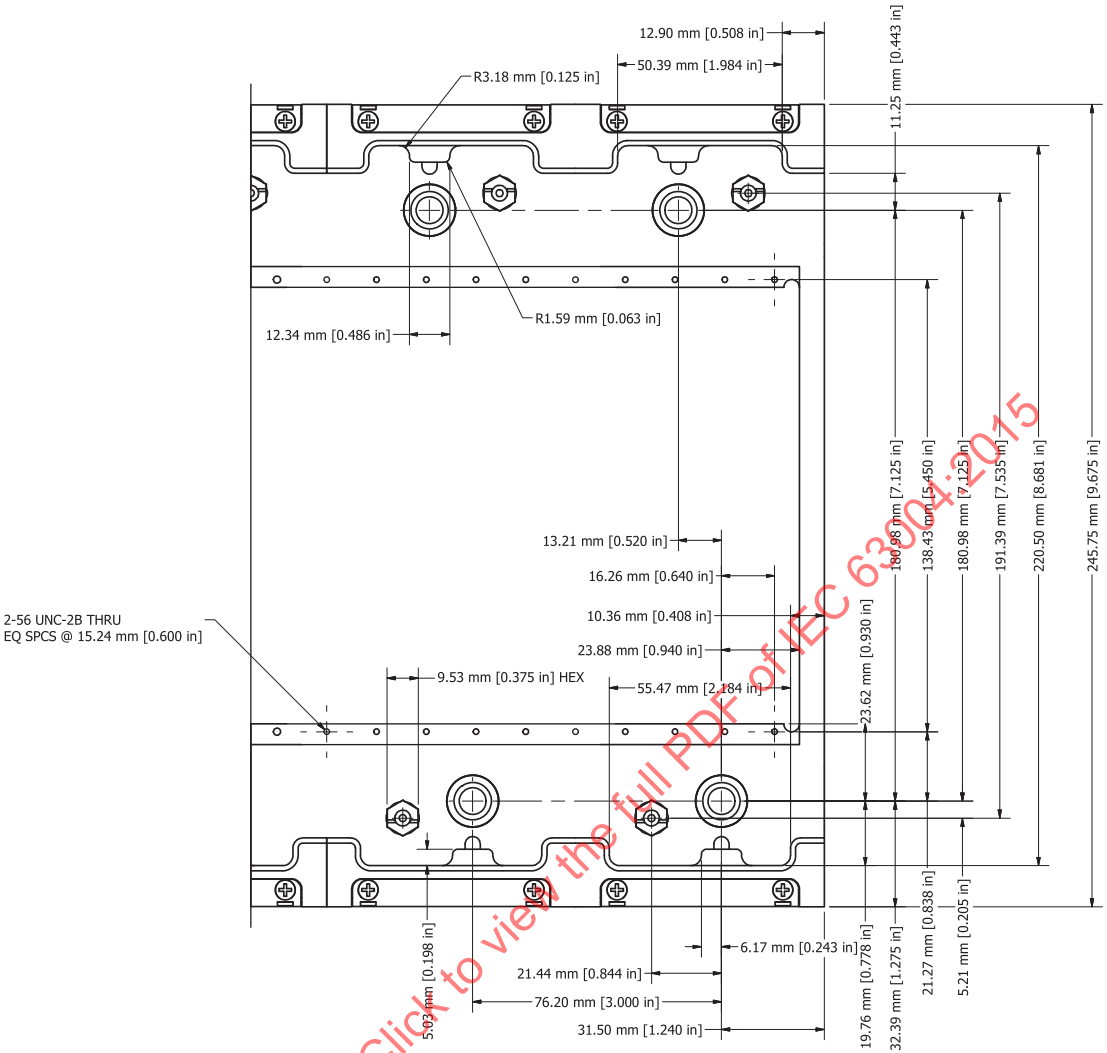


Figure 13—Continuous framework receiver layout design, top view, with connector mount spacing at 15.24 mm (0.60 in) slot spacings without frame rib at 76.2 mm (3.0 in) spacings

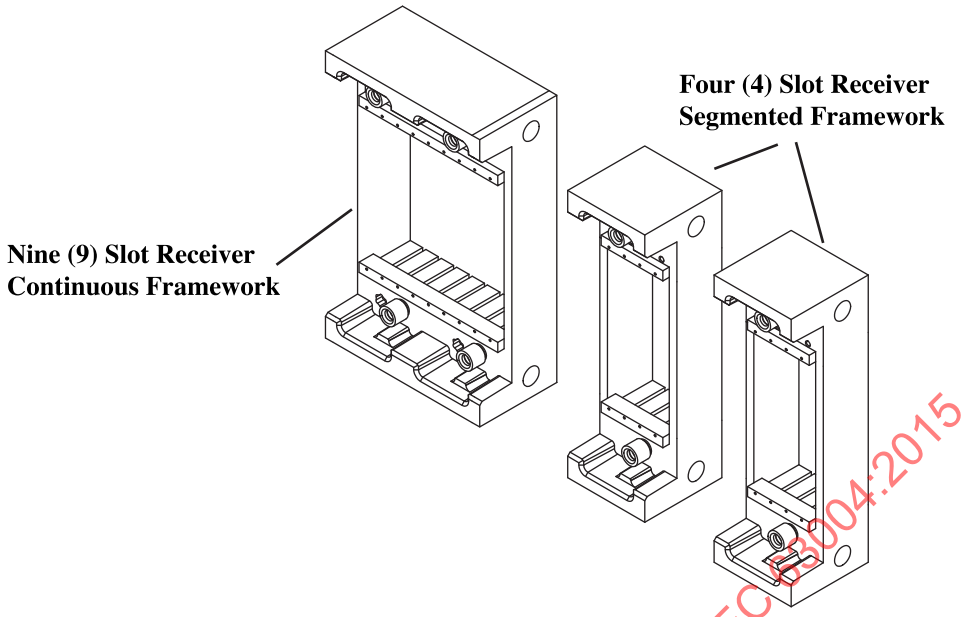


Figure 14—Combination 9-4-4 slot framework receiver layout design, perspective view, connector mount 15.24 mm (0.60 in) slot spacings with and without frame rib at 76.2 mm (3.0 in) spacings

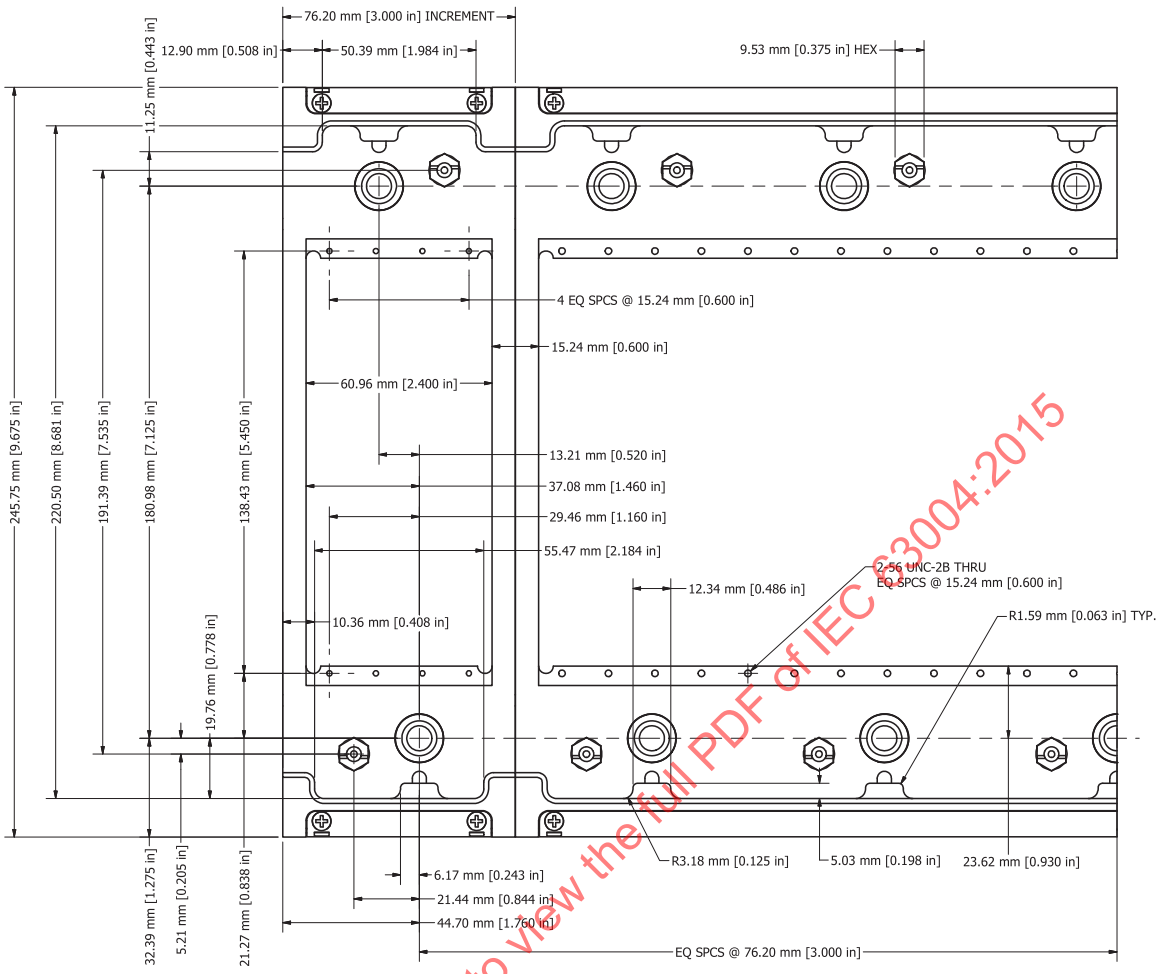


Figure 15—Combination framework receiver layout design, top view, with connector mount spacing at 15.24 mm (0.60 in) slot spacings with or without frame rib at 76.2 mm (3.0 in) spacings

5.8.3.2 End-to-end, multi-tier receiver frame layout design

Rule 5.8.3.2a: Receiver frame end-to-end layout design shall conform to this document illustrated in end-to-end multi-tier framework, Figure 16. Contours and draft angles of the frame shall be adhered to in order to support alignment, as described in 5.8.3 casting/molding dimensional provisions.

Rule 5.8.3.2b: Mounting of receiver end-to-end multi-tier framework shall maintain the 245.75 mm (9.675 in) interval as a minimum requirement, or 491.50 mm (19.35 in) for two tier combined dimensional requirement, or 737.25 mm (29.025 in) for three tier combined dimensional requirement.

Permission 5.8.3.1: End-to-end, multi-tier receiver frame layout bodies may be separated to accommodate instrument chassis alignment for direct coupling requirements, or building block and adjacent rack mounting schemes, as illustrated in Figure 17. Implementation should attempt to define the space separating the framework, in accordance with increments established under the side-by-side and end-to-end iteration rules.

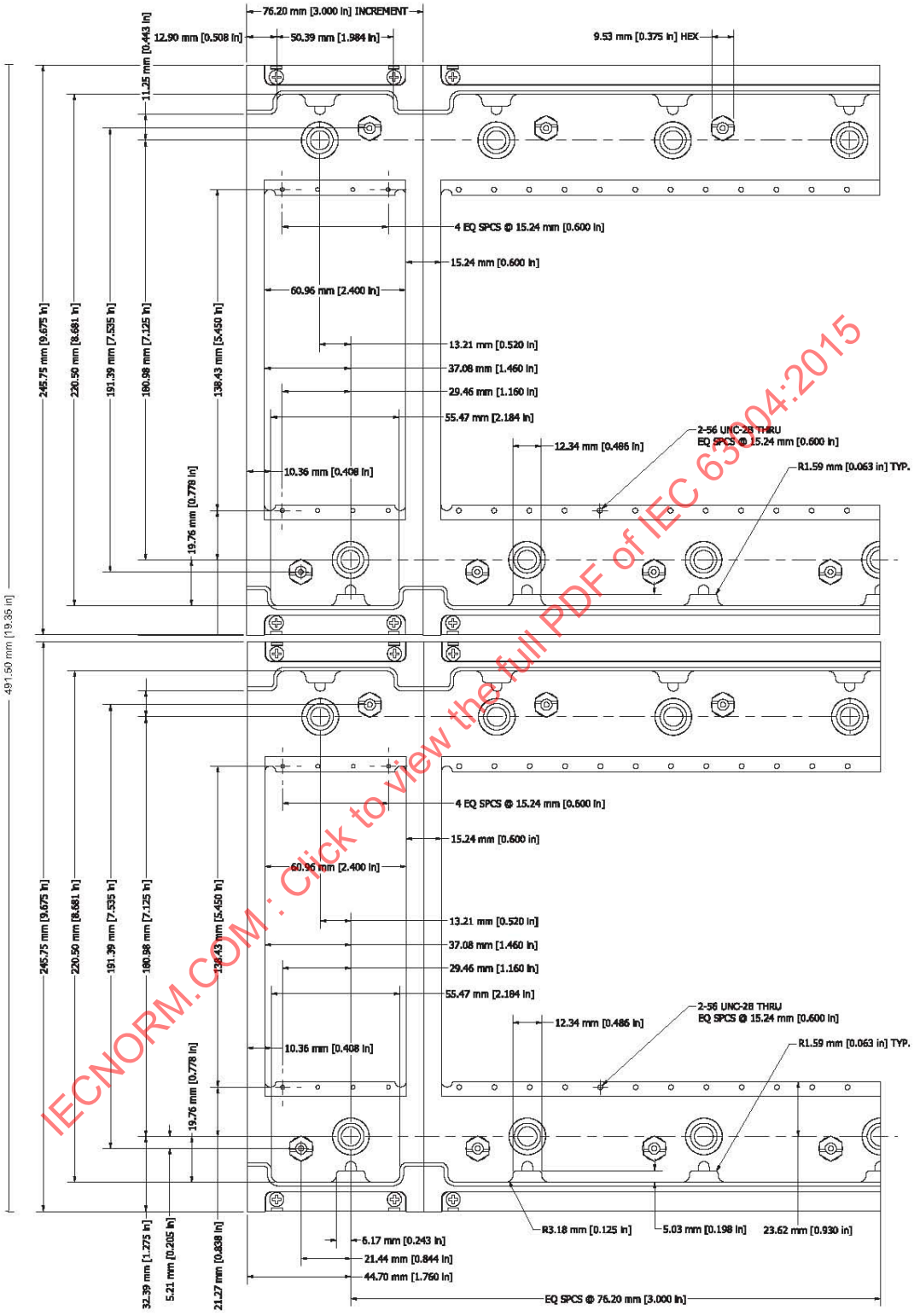


Figure 16—End-to-end multi-tier with side-by side combination framework receiver layout design, top view, with minimum interval spacing of side-by-side 76.2 mm (3.0 in) and end-to-end 245.75 mm (9.675 in) spacing spacings.

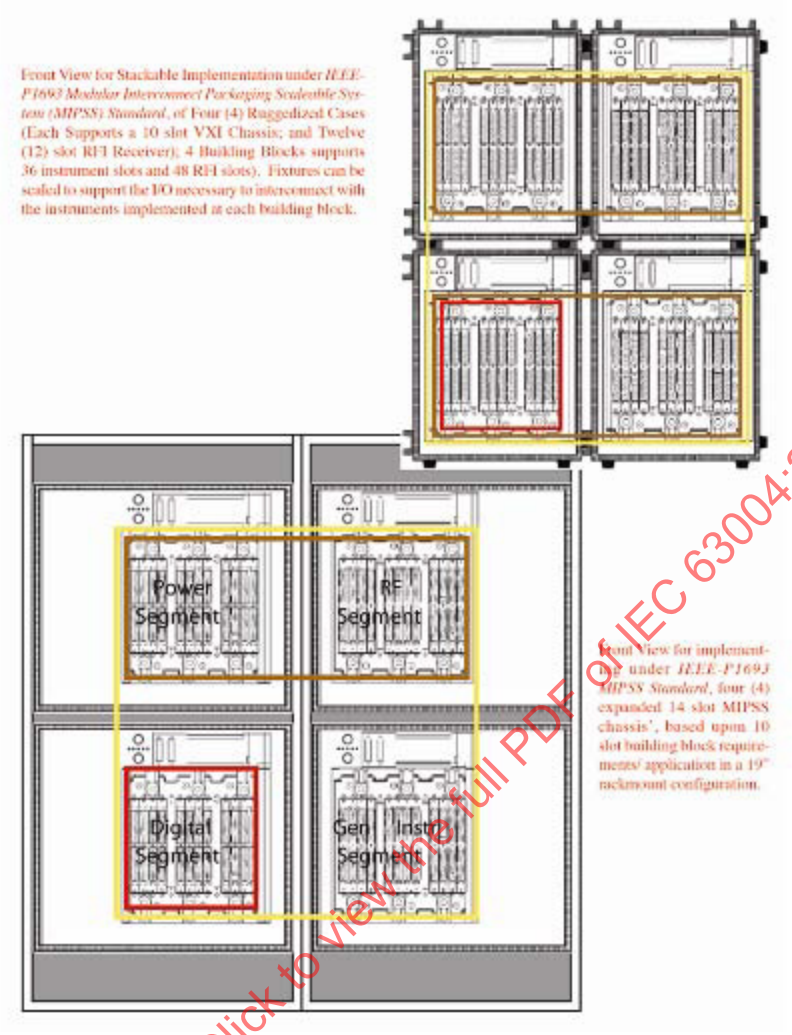


Figure 17—End-to-end multi-tier with side-by-side segmented framework receiver layout design, front view, with minimum interval spacing of side-by-side 76.2 mm (3.0 in) and end-to-end 245.75 mm (9.675 in) and arbitrary separations between frames

5.8.3.3 Framework mounting surface plate planar requirements

Rule 5.8.3.3: IEEE 1505 framework shall be mounted to a common plate, or multiple plates, that maintain a flat planar relationship with all framework elements that does not exceed 2.54 mm (0.10 in) deviation across the entire mounting surface(s).

5.8.3.4 Fixture frame layout design

Rule 5.8.3.4: Fixture frame layout design shall conform to this document segmented framework (illustrated in Figure 18, Figure 19, and Figure 20), or continuous framework drawing specifications (shown in Figure 22 and Figure 23), or combination framework in which both designs are implemented (specified in Figure 24 and Figure 25). Connector mount provisions detailed in Figure 18 through Figure 25 shall be used to satisfy segmented framework or continuous framework drawing specifications.

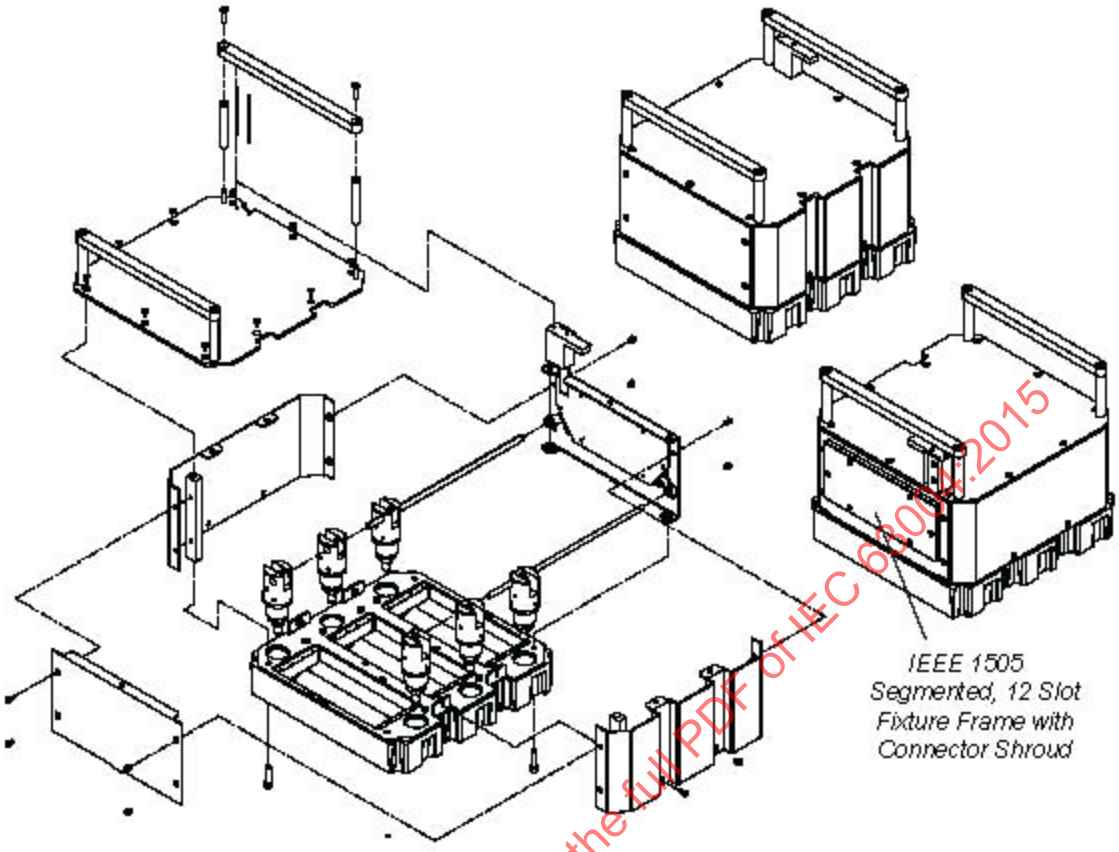


Figure 18—Segmented 3 x 4 slot framework fixture layout design, perspective view, with connector mount spacing at 15.24 mm (0.60 in), slot spacings with frame rib at 76.2 mm (3.0 in) spacings

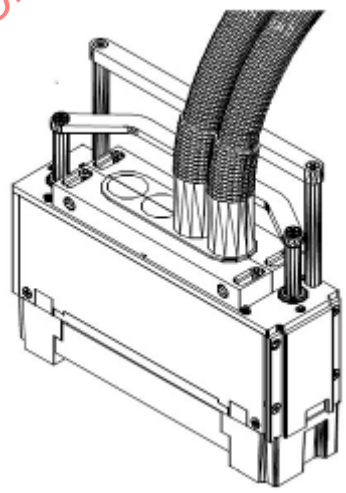


Figure 19—Segmented, four-slot fixture frame without connector shroud and with 101.6 mm (4.0 in) cable strain relief enclosure

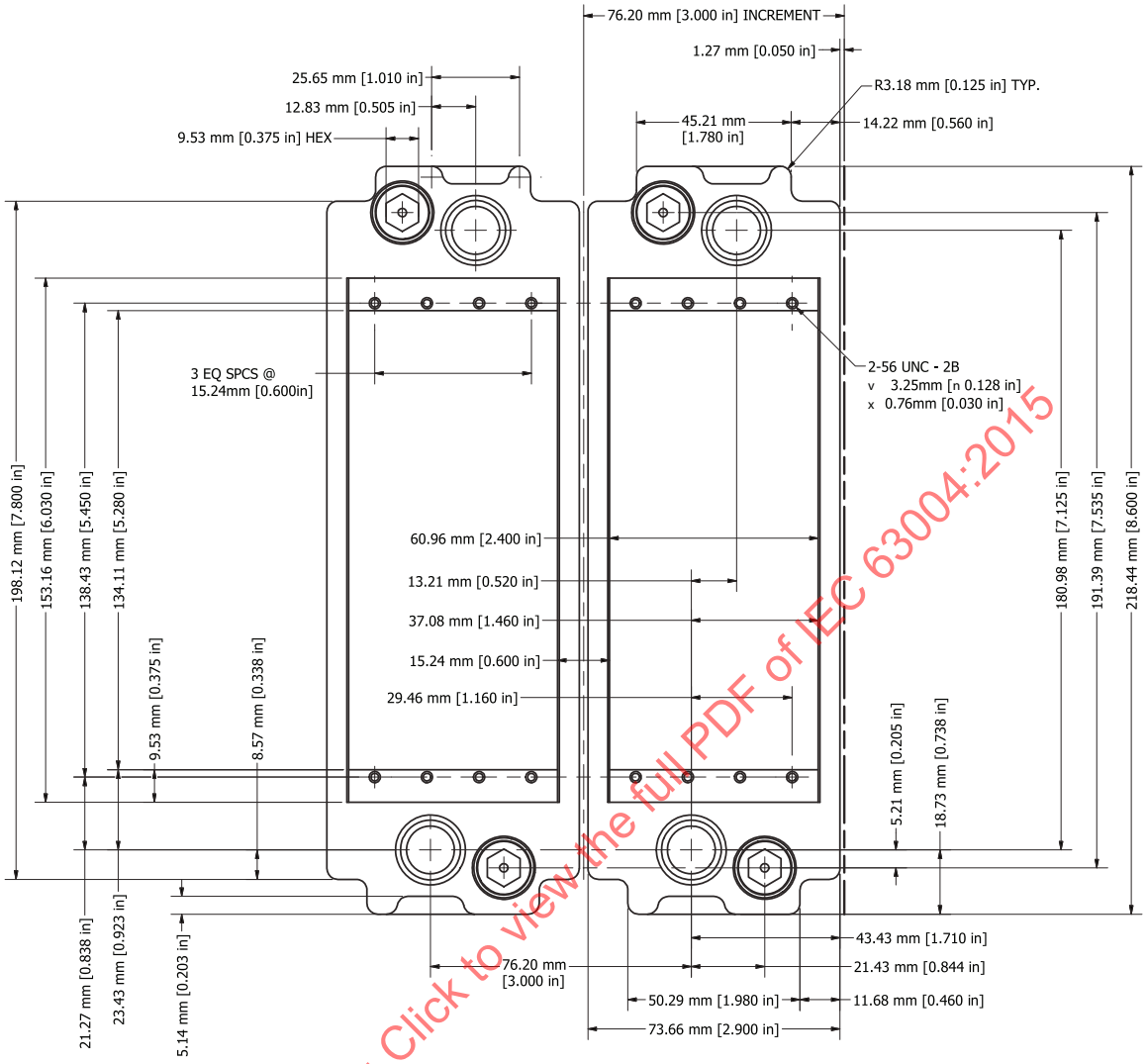


Figure 20—Segmented framework fixture layout design, top view, with connector mount spacing at 15.24 mm (0.60 in), slot spacings with frame rib at 76.2 mm (3.0 in) spacings

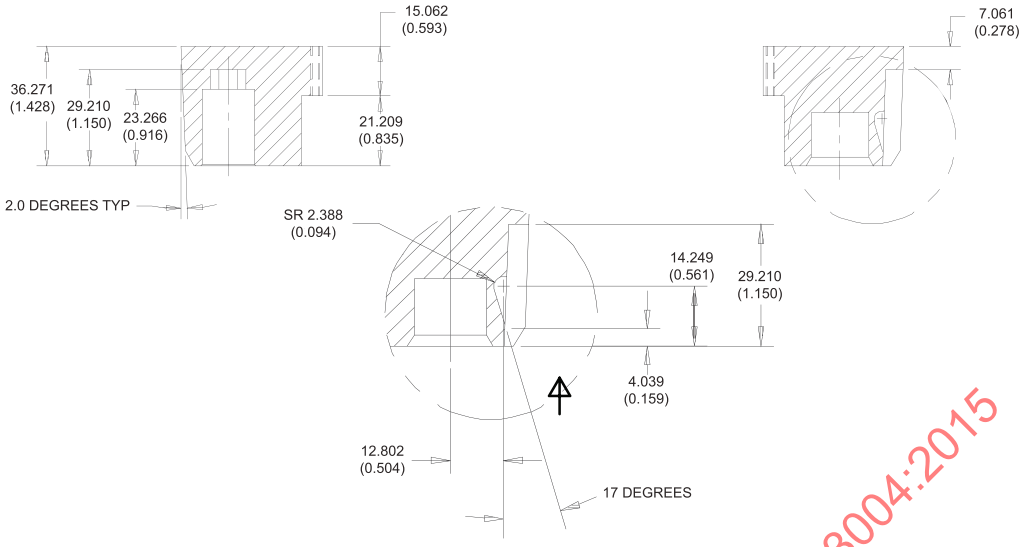


Figure 21—All framework fixture layout design, side view, with connector mount spacing at 15.24 mm (0.60 in), slot spacings with frame rib at 76.2 mm (3.0 in) spacings

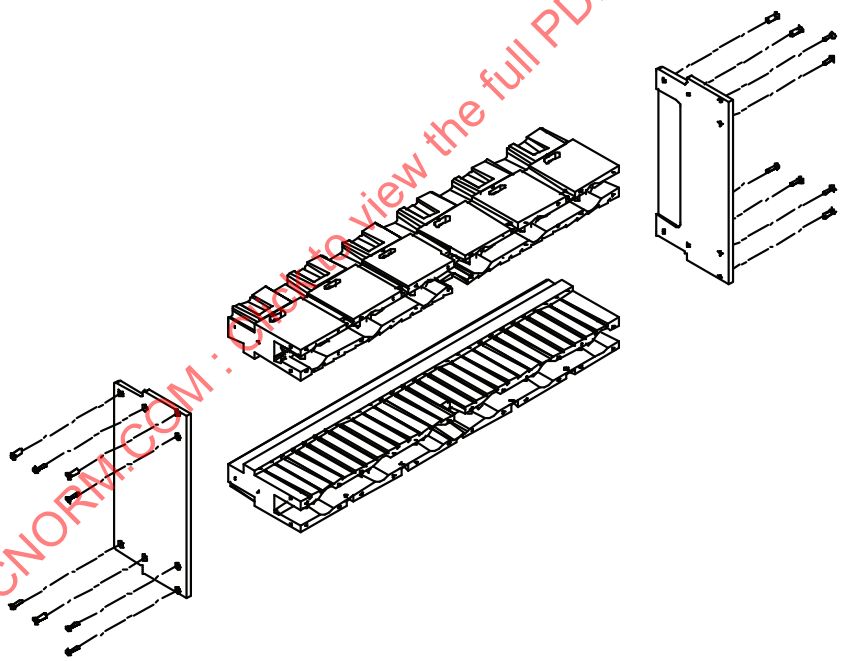


Figure 22—Continuous 29-slot framework fixture layout design, perspective view, with connector mount spacing at 15.24 mm (0.60 in), slot spacings with no frame rib at 76.2 mm (3.0 in) spacings

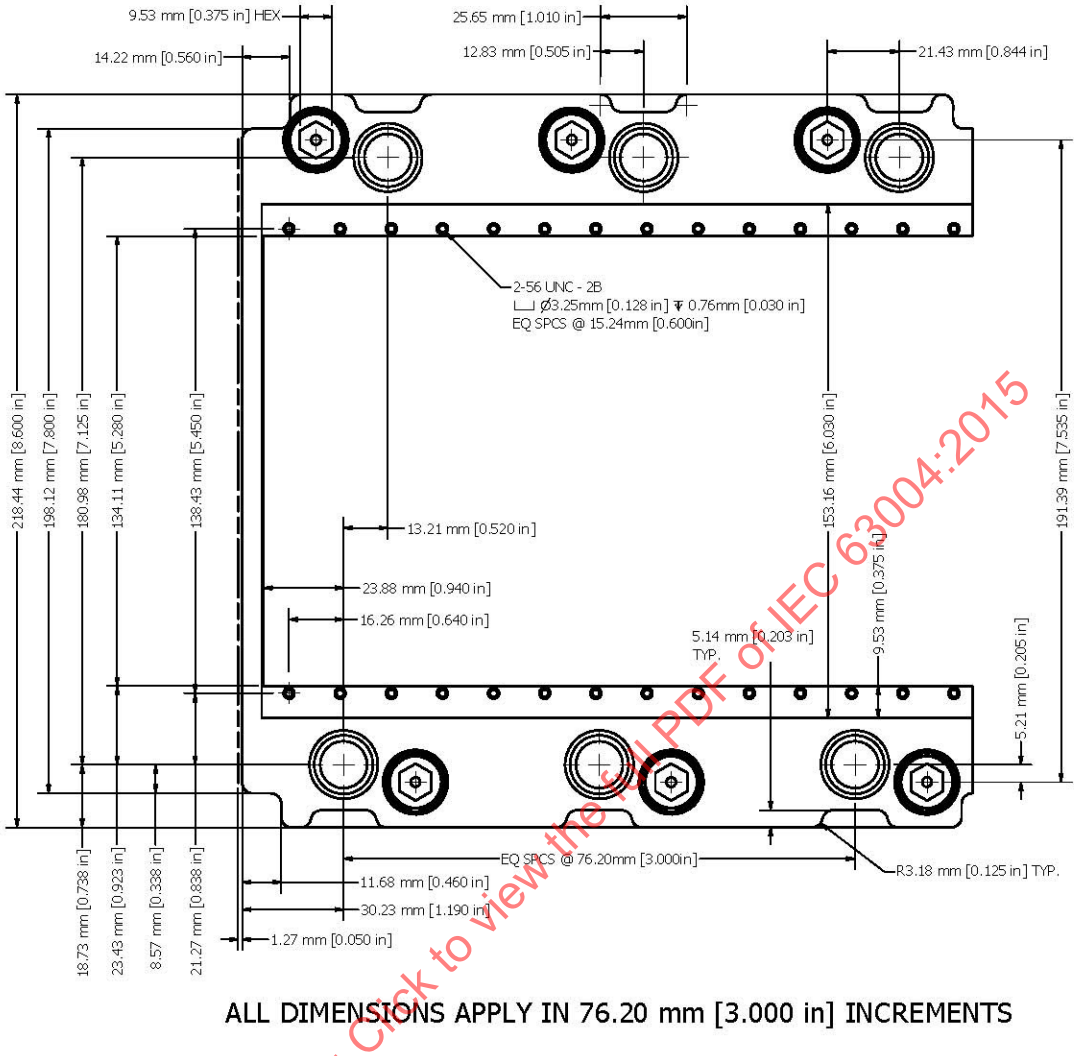


Figure 23—Continuous framework fixture layout design, top view, with connector mount spacing at 15.24 mm (0.6 in), slot spacings with no frame rib at 76.2 mm (3.0 in) spacings

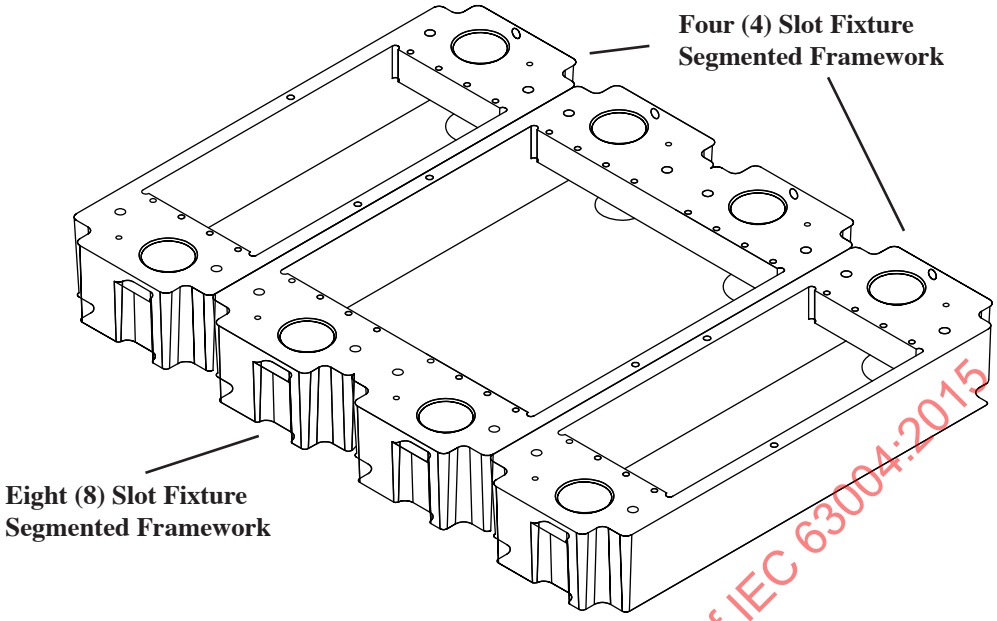


Figure 24—Combination 4-9-4 slot framework fixture layout design, perspective view, with connector mount spacing at 15.24 mm (0.60 in), slot spacings with or without frame rib at 76.2 mm (3.0 in) spacings

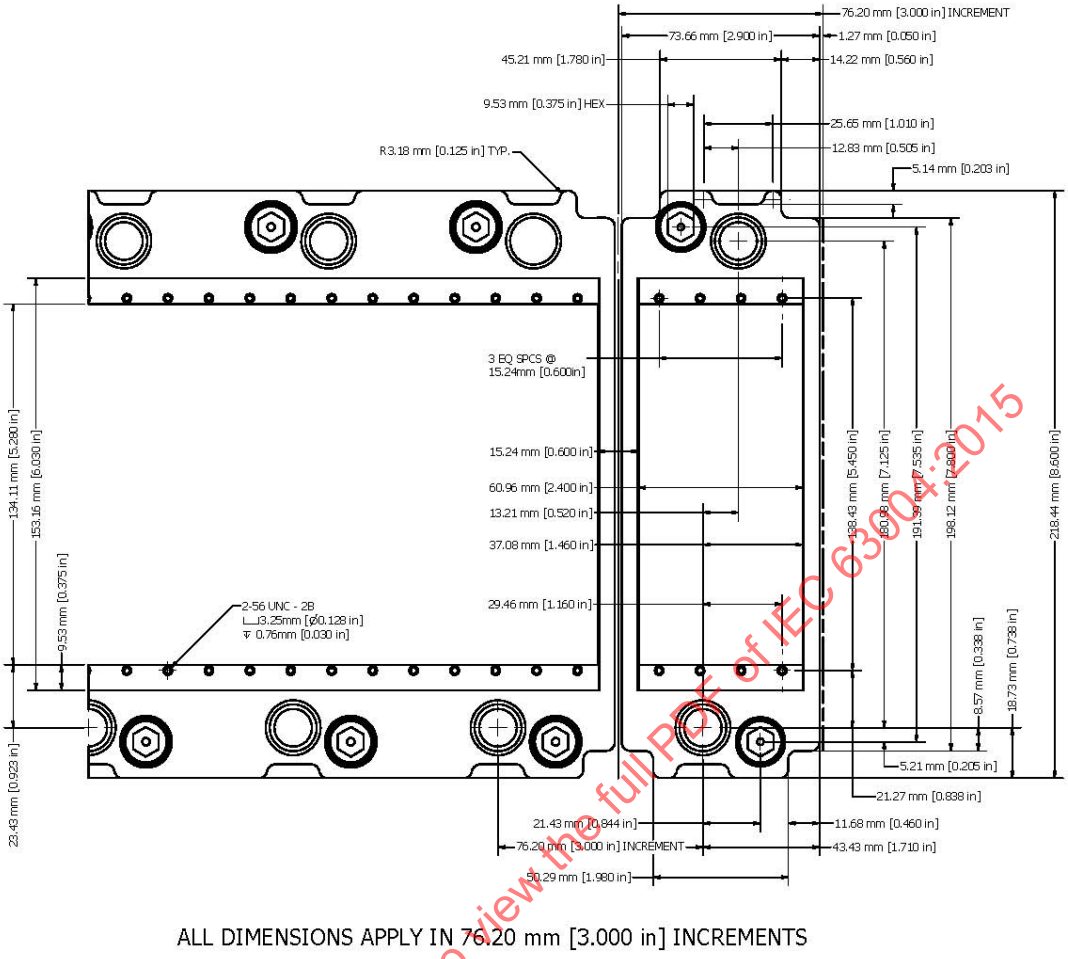


Figure 25—Combination framework fixture layout design, top view, with connector mount spacing at 15.24 mm (0.60 in), slot spacings with or without frame rib at 76.2 mm (3.0 in) spacings

5.9 Framework alignment/keying cavities

5.9.1 Framework alignment cavities

Rule 5.9.1: Alignment/keying cavities shown in Figure 26, Detail Design Views A, C, and E, shall be provided within the body of frameworks as specified (see 5.8, 5.9.2, and Figure 18 through Figure 25 for further details). Each alignment/keying cavity shall align the receiver and fixture assembly in a confined manner, as to prevent any accidental engagement of the fixture in an improper position with the receiver.

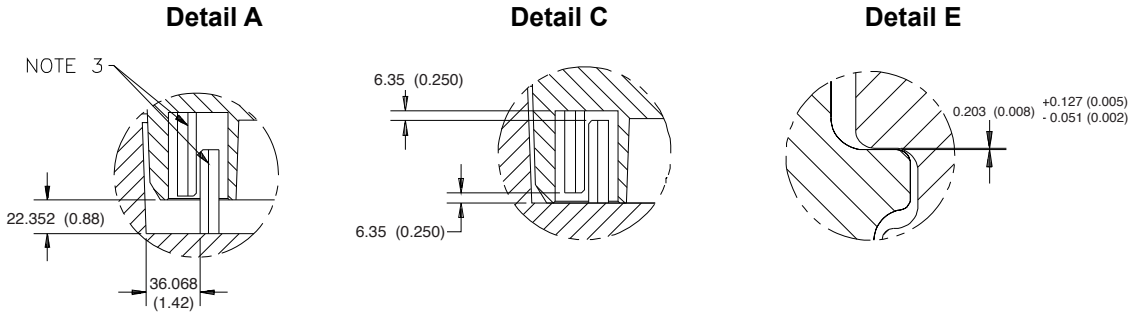


Figure 26—Frame alignment cavity/keying design

5.9.2 Framework keying devices

Rule 5.9.2: A six-position hex split keying device shall be provided within the body of frameworks as specified in the drawing specification, illustrated in Figure 27 (see 5.8 and 5.9 for further specification definitions), in a confined manner, as to prevent any accidental engagement of the fixture in an improper position. Each keying device shall be reconfigurable to support the minimum number of 12 unique positions for each four-slot receiver/fixture framework intervals that may be applied by the receiver assembly.

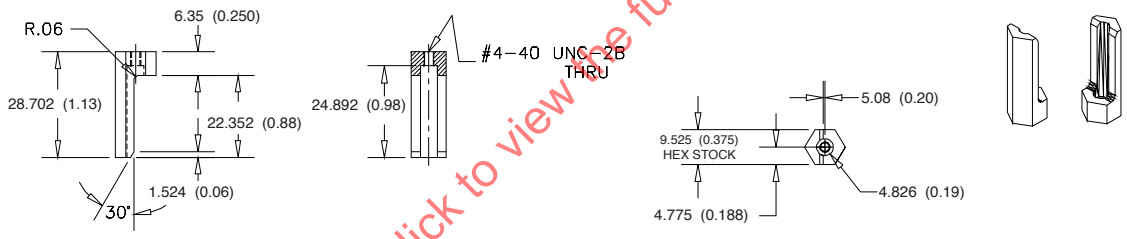


Figure 27—Six position hex split keying device

Recommendation 5.9.2: Keying configuration is not mandatory and is at the discretion of the user. However, where no specific alternative keying is required, it is recommended that the user apply the configuration described in Figure 28 in which a four-slot fixture can be placed in only one position in a two tier system.

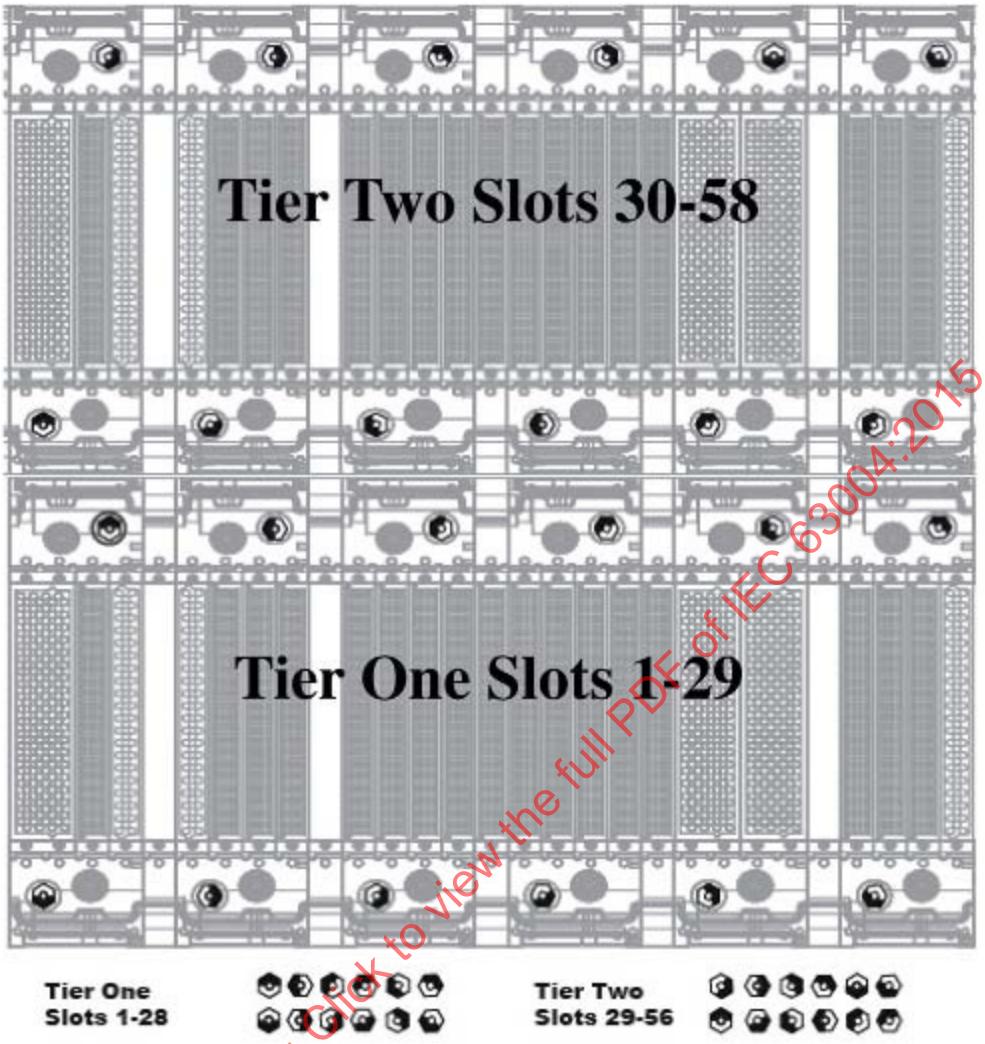


Figure 28—Vertical two tier end-to-end framework implementation keying device recommended configuration

NOTE—The configuration shown in Figure 28 is one application of an end-to-end implementation. Description of tier one and two and slot identification is arbitrary. However it is recommended that where it can be implemented, the tiers should be applied in a vertical application as shown (one on bottom and two on top) with slots 1 through 29, beginning from left and sequentially to the right. In a horizontal application this may be implemented differently.

5.10 Framework ball-lock mechanism

Rule 5.10: A ball-lock mechanism, illustrated in Figure 29, functions as the primary engagement device that locks the fixture to the receiver and locking-pin mechanism and shall be supported within the body of frameworks as specified in the drawing specification (see 5.8). The critical dimensional attributes of the ball-lock, shown in Figure 30, shall be supported.

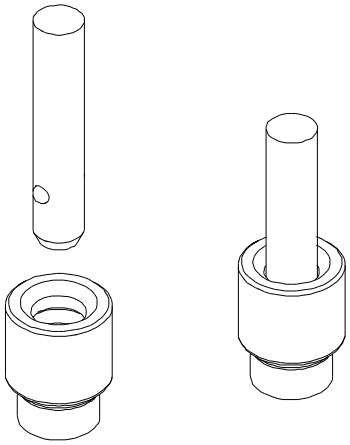


Figure 29—Ball-lock mechanism, perspective view

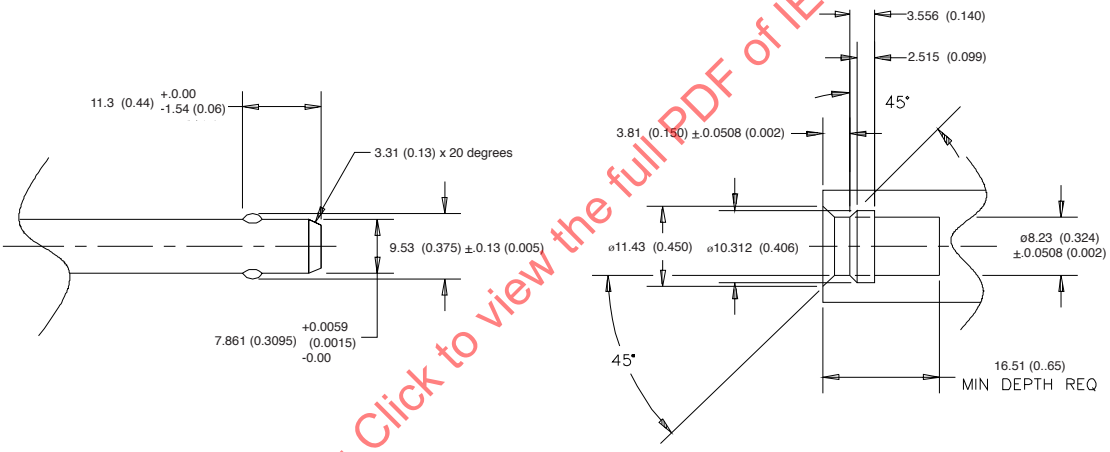


Figure 30—Ball-lock mechanism, detail view

5.11 Framework ball-lock/safety-lock pin devices

Rule 5.11: The framework shall provide a ball-lock and locking-pin mechanism within the body of frameworks as specified in the drawing specification (Figure 31) to:

a) Prevent engagement when the receiver mechanism is not positioned to accept the fixture.

b) Initially latch the fixture to the receiver in preparation for engagement of the connectors.

c) Lock fixture to the receiver to prevent an inadvertent release of the ball-lock.

d) Support the mechanical push/pull force of the engagement mechanism to the framework.

e) Ultimately connect and disconnect the electrical contacts of the IEEE 1505 system.

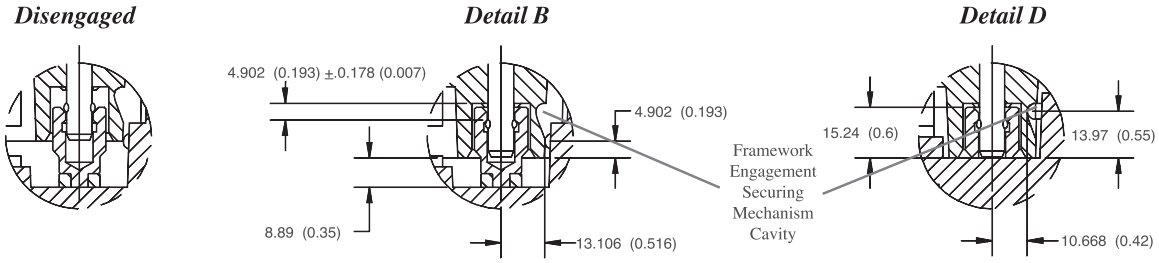


Figure 31—Ball-lock/safety lock pin devices

5.12 Framework protective cover

Rule 5.14: A framework protective cover shall be provided for each framework assembly to maximize operator safety and protection of the connectors. Each device can be constructed or implemented under vendor discretion.

5.13 Method of mounting

Rule 5.13a: A method of mounting receiver frames to their mounting panels (see Figure 32), shall be to a common plate or multiple plates that maintain a flat planar relationship with all framework elements without distorting or effecting framework operation, not to exceed 2.54 mm (0.10 in) deviation across the mounting surface(s).

Permission 5.13: Mounting method can be constructed or implemented in vertical, horizontal, separated, or otherwise under vendor discretion, providing requirements specified in Rule 5.13b are adhered to.

Rule 5.13b: Each receiver framework interval shall provide mounting points as specified in Figure 33, using standard 10-32 machine screws and mounting points capable of supporting receiver and fixture support weight requirements per 5.17.

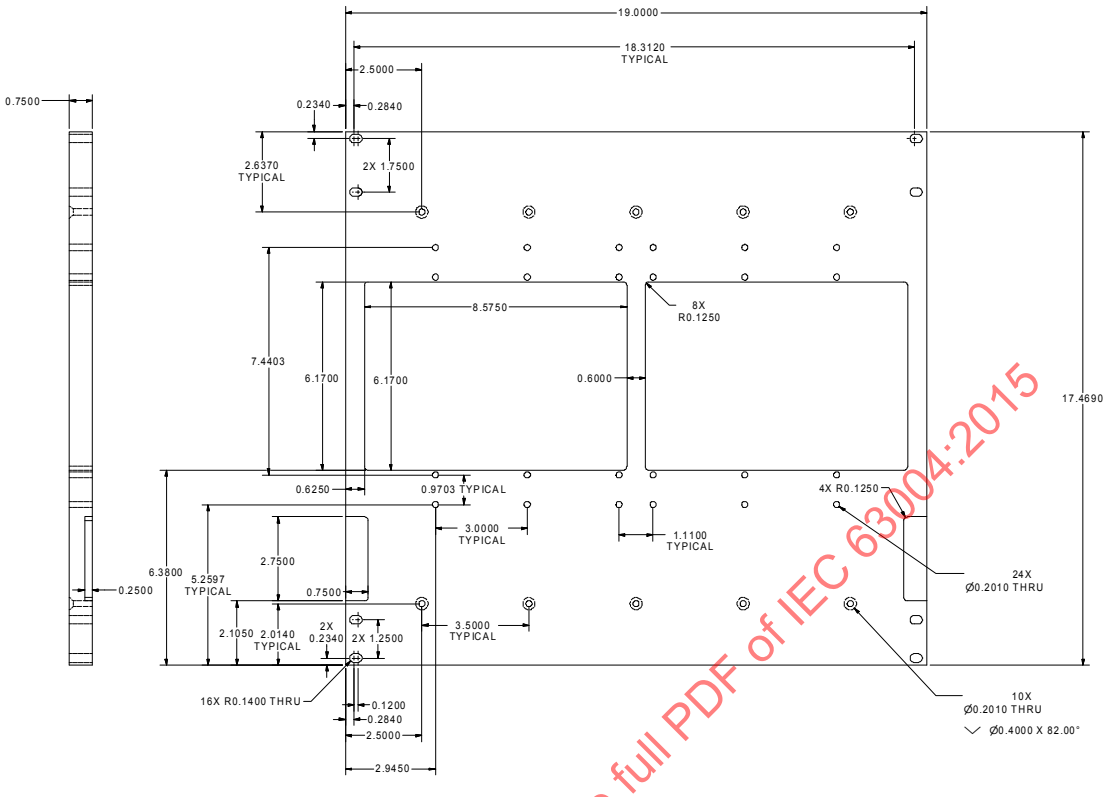


Figure 32—Twenty-nine slot receiver rack mounting plate implementation example

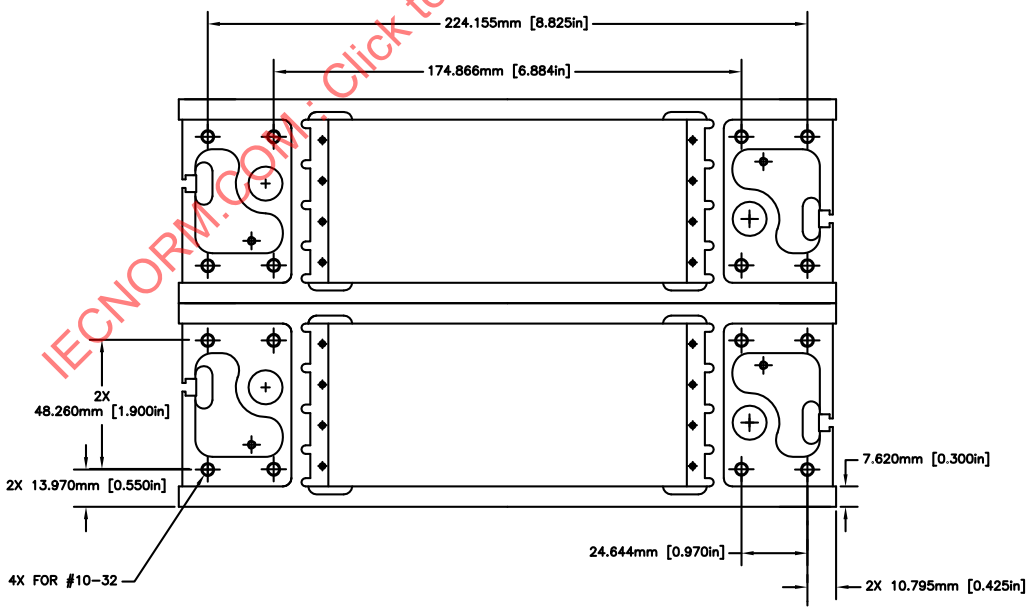


Figure 33—Receiver framework interval mounting point specifications

5.14 Interchangeability

Rule 5.14: Receivers of a given scale shall be capable of being mated with associated fixtures meeting the requirements of this specification. The mated frameworks and individual fixtures and receivers having related part numbers shall be directly and completely interchangeable with each other with respect to installation and performance as specified in RFI qualification requirements (see 4.6.2).

5.15 Framework stroke

Rule 5.15: The framework shall provide a minimum stroke of 14.986 mm (0.59 in) for full disengagement and engagement of the receiver and fixture contacts across the diagonal aspects of the frameworks. The subsequent illustration, Figure 34, details dimensional information and requirements necessary to meet contact mechanical engagement.

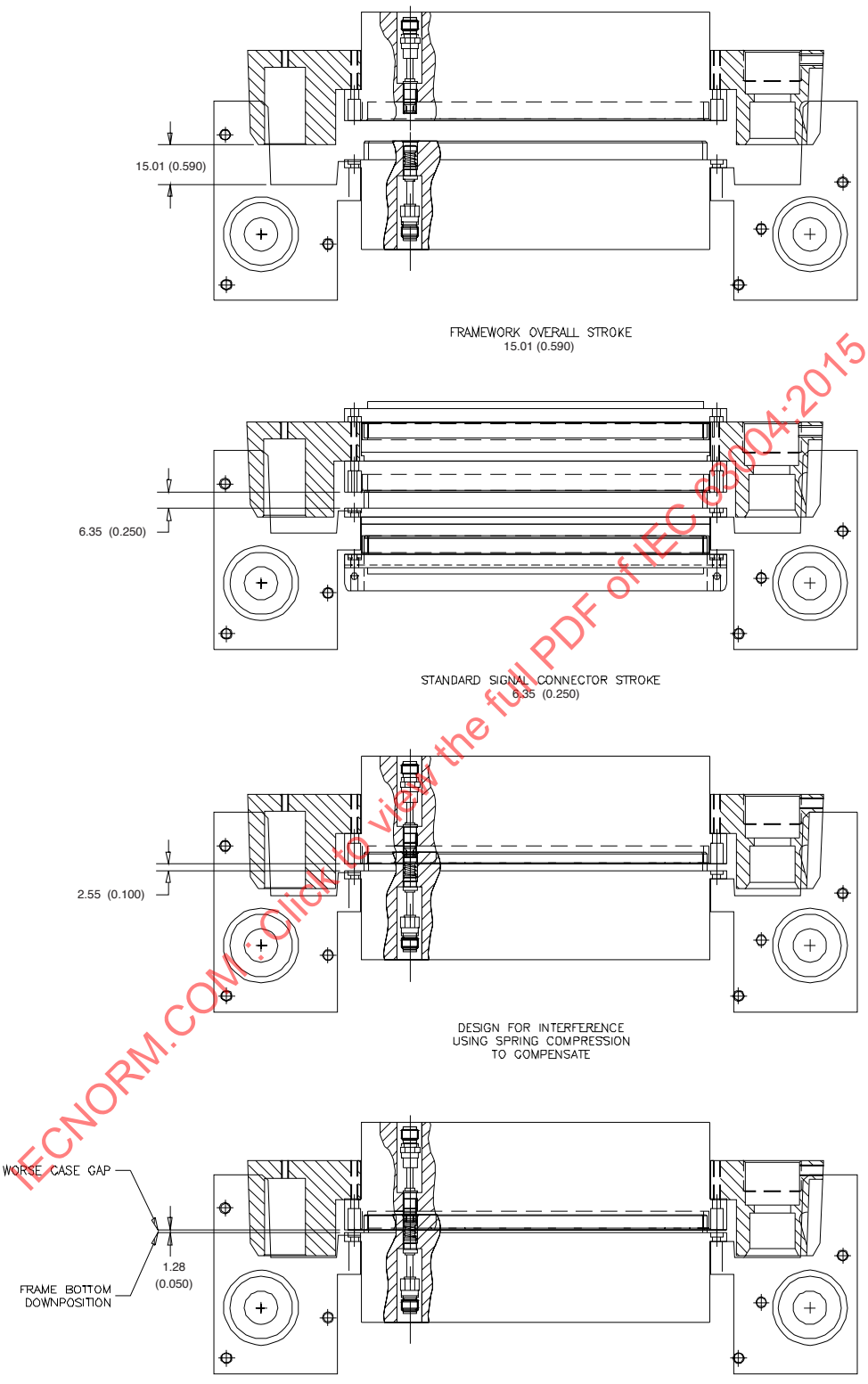


Figure 34—Framework and connector stroke requirements

5.16 Framework engagement and separation forces

5.16.1 General requirements

Rule 5.16.1: When tested as specified in this document's requirements (see 4.5 and 4.6) framework forces shall conform to that defined in drawing specification (see 5.8).

5.16.2 Engagement mechanism mechanical advantage

Observation 5.16.2: The mechanical advantage of a receiver mechanism is the ratio of force applied to the receiver ball-lock actuators via the drive subsystem employed to overcome the engagement resistance of the connector/contacts. In a manual system this force is applied by the operator to the operating handle, and a motor is substituted in an electrical-mechanical drive.

Rule 5.16.2: When tested as specified in accordance with this document's requirements [see item b) in 4.6.2.2], the framework engagement mechanism mechanical advantage shall support a minimum force to the handle not to exceed 16 kg (35 lb), to achieve engagement forces required by the application employed. The manufacturer of the receiver product shall specify the mechanical advantage of the product.

5.16.3 Framework mating and unmating forces

Rule 5.16.3: When tested in accordance with this document's requirements (see 4.6.2.2), the maximum and minimum mating and unmating forces shall be as specified to vendor-stipulated specification data for user information.

Connectors assembled to frameworks shall not move or display looseness after assembly, or during and after mate and unmate cycles, or add resistance to engagement process due to framework dimensional instability, torquing, bowing, or other mechanical anomalies.

5.17 Framework fixture support weight rating

Rule 5.17: Maximum fixture support weight rating of framework shall be as specified, based upon combined drive and ball-lock engagement capability (holding force) not to be less than 45 kg (100 lb) per ball-lock, reflecting amount fixture weight that can be both supported in a cantilevered fashion while also meeting a specified engagement resistance specifications as tested in accordance with this document's requirements (see 4.6.2).

5.18 Electrical conditional requirements

5.18.1 Dielectric withstanding voltage

Rule 5.18.1: When tested in accordance with this document's requirements (see 4.6.3.3), there shall be no evidence of breakdown of insulation or flashover.

5.18.2 Insulation resistance

Rule 5.18.2: When tested in accordance with this document's requirements (see 4.6.3.5), the initial insulation resistance shall be not less than 5000 M3/4.

5.19 Framework durability

Rule 5.19: To meet this document's requirements, each manufacturer shall subject the test specimen receiver and fixture to a durability cycle test in accordance with 4.6.2.6. A minimum durability cycle objective of 25 000 repetitions is required. Each manufacturer or third-party test facilitator shall establish a defined mechanical/electrical set-up to provide a comprehensive test and data collection that verifies the manufacturer's product specifications and meets minimum requirements of IEEE Std 1505-2010. The framework cycle test shall validate reliability of the framework to achieve its advertised capabilities under Clause 4 requirements (MIL-STD-1344A, EIA 364E, or equivalent methods).

5.20 Oversize fixture framework

Rule 5.20: Fixture manufacturers that offer large fixture footprints shall not exceed dimensions, described in Clause 5, and Figure 18 through Figure 25, that would intrude on the (right side) manual handle and (bottom) lower fixture support areas, as stated in Rule 4.6.2.2e and further illustrated in Figure 35. Fixture design may be extended beyond the right side and upper side of the receiver, without interfering with handle and support functions.

CAUTION

Manufacturers should be cognizant of cantilevered weight and other surrounding interference factors that may impact implementation when standard footprints are exceeded.

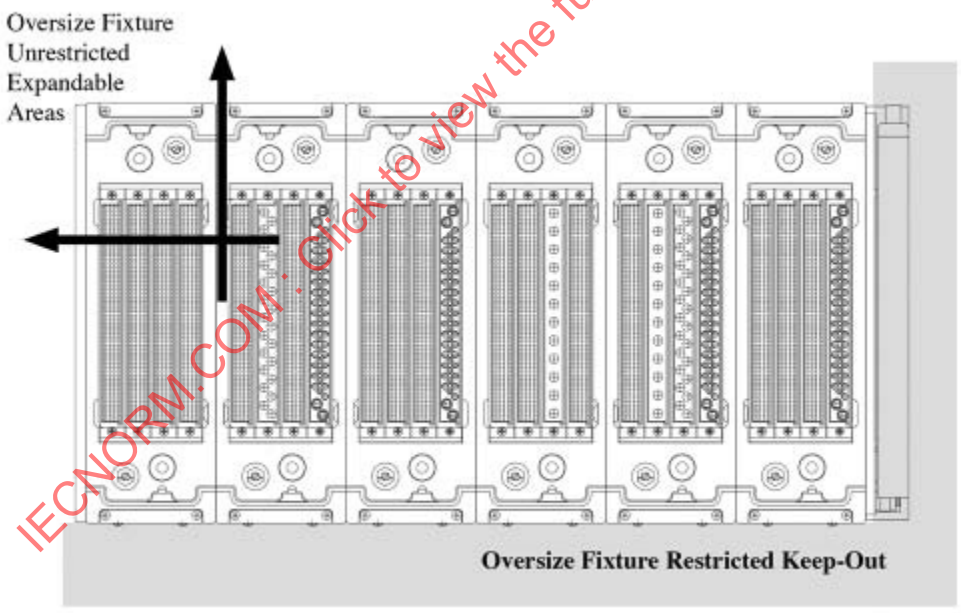


Figure 35—Oversize fixture keep-out areas

5.21 Environmental requirements

Rule 5.21: Framework shall meet the environmental tests in accordance with this document's requirements (see 4.6.4).

5.21.1 Operating temperature

Rule 5.21.1: Unless otherwise specified, frameworks shall have an operating temperature of a minimum 10 °C, as deviated +0 and –5 °C, and the maximum temperature shall be 50 °C, as deviated +3° and –0 °C, in accordance with this document's requirements (see 4.6.4.1)

5.21.2 Temperature cycling

Rule 5.21.2: When a mated pair of frameworks undergo temperature cycle testing in accordance with this document's requirements (see 4.6.4.2), there shall be no evidence of cracking, crazing or warping of the framework body or other physical damage to the framework assembly.

5.21.3 Humidity

Rule 5.21.3: When tested in accordance with this document's requirements (see 4.6.4.3), insulation resistance shall be greater than 1000 M3/4.

5.21.4 Metal surfaces and environmental exposure protection

Rule 5.21.4: When mated framework pairs are environmentally tested in accordance with this document's requirements (see 4.6.4.1 through 4.6.4.4), there shall be no peeling, chipping, or blistering of metal surfaces or corrosion/rusting of exposed base metal.

5.21.5 Vibration

Rule 5.21.5: When tested in accordance with this document's requirements (see 4.6.4.4), there shall be no physical or mechanical damage to the framework body or contacts. During vibration tests the framework shall maximize dampening of vibration transmission to connector assembly and prevent interruption in continuity greater than 1 µs of the test circuit that incorporates mated contacts. After the vibration test, the framework and related mounting hardware shall show no signs of loosening, fracture, or other deterioration.

5.21.6 Shock (specified pulse)

Rule 5.21.6: When shock tested in accordance with this document's requirements (see 4.6.4.5), the framework and related mounting hardware shall show no signs of loosening, fracture or other deterioration. During shock tests the framework shall maximize dampening of shock transmission to connector assembly and prevent interruption in continuity greater than 1 µs of the test circuit that incorporates mated contacts.

5.21.7 Salt spray (corrosion)

Rule 5.21.7: When mated connector pairs are tested in accordance with this document's requirements (see 4.6.4.6), there shall be no peeling, chipping, or blistering of metal surfaces or exposure of base metal.

5.21.8 Solvent resistance and fluid immersion

Rule 5.21.8: Mated framework shall be tested in accordance with this document's requirements (see 4.6.4.7 and Method 1016 of MIL-STD-1344A, EIA 364E, or equivalent methods).

5.21.9 Flammability

Rule 5.21.9: Mated framework shall be tested in accordance with this document's requirements (see 4.6.4.8 and Method 1012 of MIL-STD-1344A, EIA 364E, or equivalent methods).

5.22 Auxiliary parts

Rule 5.22: Mechanical, nonelectrical parts, such as polarizing keys, keying accessories, covers, cable clamps, etc., shall be as specified on the individual specification sheet.

5.23 Riveting, upsetting, and spinning over

Rule 5.23: When riveting, upsetting, or spinning-over processes are employed, there shall be no evidence of fatigue or deformation of noninvolved surfaces of the material being riveted, upset, or spun over.

6. Connector module specification

6.1 Connector module specification introduction

The connector specification is a primary element of this standard. This specific specification is presented in two subsections: (a) first as a general definition describing common connector attributes and requirements for meeting the standard, and (b) a second, more detailed specification unique to the respective connector style or subset of the RFI system. The general and specific specifications combine to form the RFI connector definition of the standard that otherwise could not stand alone. This section serves the function of defining common connector application, styles, performance, dimensional, and environmental specifications for satisfying this standard.

The connector/module subelement houses and electrically mates the signal paths between the automatic test system (ATS) and unit-under-test (UUT), as illustrated in Figure 36. It shall also identify with many of the design performance objectives defined previously. The following describes the specific dimensional and parametric requirements for producing and conforming to IEEE Std 1505-2010.

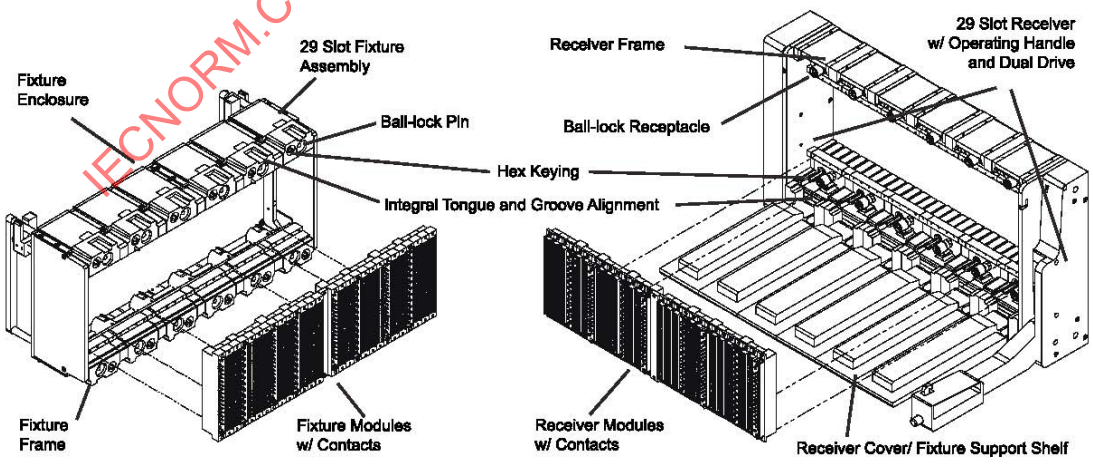


Figure 36—IEEE 1505 connector module interface

6.2 Connector specification system

As the standard evolves, additional connector types may be adopted and included in this document by the IEEE Std 1505 RFI Working Group and subsequently approved by the IEEE ballot process. IEEE 1505 system application and use of these connectors is intended to be arbitrary for the integrator and user. The RFI standards organization intends to minimize connector proliferation by maintaining open architecture, generic connector type classes (signal, power, low RF, high RF, etc.), and performance specifications under the subsequent clauses defined herein. This serves to encourage vendors to produce the same class types that are intermatable. Where user need and technology dictate alternate connector type classes, connector vendors may apply to the IEEE Std 1505 RFI Working Group for inclusion of a new connector type class and specification.

6.3 Quality

Permission 6.3: The contractor may implement and use SPC techniques in the manufacturing process for parts covered by this specification. The SPC program should apply guidelines specified with EIA 557B. Where SPC cannot be utilized because of noncontinuous production requirements, a lot-sampling plan for inspection in accordance with group A lot and sample size with $c = 0$ can be utilized. The SPC and $c = 0$ programs shall be documented and maintained as part of the overall reliability assurance program as specified in EIA 557B. Evidence of such compliance shall be verified by the qualifying activity of this document as a prerequisite for qualification.

6.4 General and specific connector contact specification relationships

6.4.1 Specification relationships

Rule 6.4.1: The individual connector type style requirements shall be as specified in the general connector requirements in 6.6 and in accordance with the respective specification in Clause 7 through Clause 11. In the event of any conflict between the general connector requirements in Clause 6 of this document and the respective connector/contact specifications in subsequent Clause 7 through Clause 11, the latter shall govern.

6.4.2 Selected connector footprint

Observation 6.4.2: The Eurocard DIN/MIL-DTL-55302 standard signal connector design, shown in Figure 37 and Figure 38, was selected as the basic footprint for all IEEE 1505 connector designs. It was selected because of its prequalification as a rugged, highly durable design under MIL-DTL-55302/179-1 80 and “open system availability.”

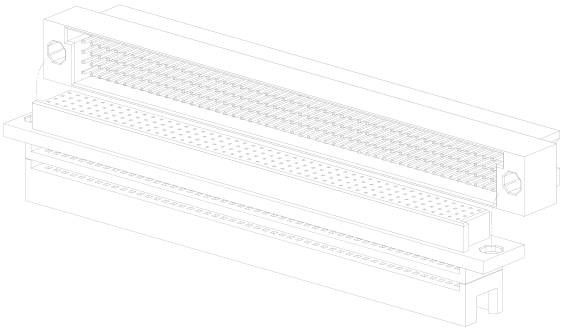


Figure 37—Eurocard DIN/MIL-DTL-55302 four-row signal connector design specifications

Rule 6.4.2: The connector footprint establishes outer dimensional envelopes that shall not exceeded length, width, and mounting points for UNC 2-56 screws as specified in Figure 39.

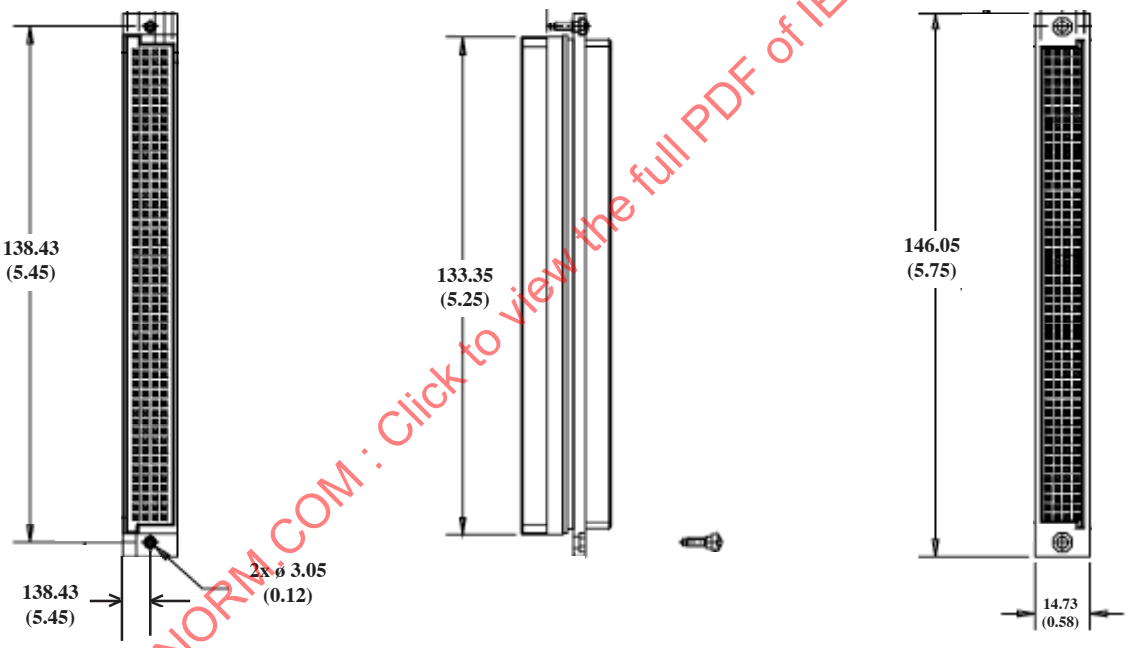


Figure 38—Eurocard DIN/MIL-DTL-55302/four-row signal connector design specifications

6.5 Materials

Rule 6.5: Manufacturers shall identify materials used. When a definite material is not specified, a material shall be used that enables the connectors and accessories to meet the form, fit, function, and performance requirement. Acceptance or approval of any constituent material by the buyer shall not be construed as a guaranty of the acceptance of the finished product from the manufacturer.

6.6 Reference materials, platings, and processes

Rule 6.6a: The identified reference materials, platings, and processes described in 4.2.2 shall be used to enable proper interfacing of connectors manufactured to this document, to similar industry standards, or government-specified connector systems with minimal problems related to electrochemical contamination of critical electrical, mechanical interfaces, or generation of incompatible mechanical interface surface-wear products.

Permission 6.6: The manufacturers of connectors supplied to this document may use alternate recognized industry standard materials, platings, and processes from those identified in 4.2.2 of this specification. However, use of alternate materials, platings, and processes shall be coordinated with the qualifying activity as part of the qualification process.

Rule 6.6b: Use of alternates to those referenced guidance items by the supplier shall not result in inferior short- or long-term performance or reliability of supplied connectors as compared with connectors manufactured using the referenced materials, platings, or processes. Short- or long-term failures or reliability problems due to use of these alternates shall be the responsibility of the supplier.

6.7 Design and construction

Rule 6.7: Connectors shall be of the design, construction, and physical dimensions as specified by the respective connector clause in Clause 7 through Clause 12.

6.7.1 Threaded parts

Rule 6.7.1: Unless otherwise specified, all threaded parts shall be in accordance with FED-STD-H28. Where practicable, all threads shall be in conformity with the coarse-thread series. The fine-thread series shall be used only for applications that might show a definite advantage through their use.

6.7.1.1 Engagement of threaded parts

Rule 6.7.1.1: All threaded parts shall engage by at least three full threads, unless otherwise specified.

6.8 Connector assembly

Rule 6.8: No parts of the connector assembly shall be permanently displaced from their original, normal, fitted position at completion of the specified tests.

6.8.1 Contact compliance

Rule 6.8.1: The contact shall be designed for proper operation without dependence on mechanical float, so that minimum force is transmitted to the connection joining the contact to the interconnecting media during mating and unmating. Contacts assembled to printed circuit boards (PCBs) shall not move or display looseness after assembly, or during and after mate and unmate cycles.

6.8.2 Contact cavities

Rule 6.8.2: The arrangement of contact cavities in the insulator body of connectors shall be as specified by the respective connector clause. Each contact cavity shall be fitted with a contact assembly so confined within the cavity that accidental removal is prevented, and positive alignment of the respective contacts, including the contact termination, is effected.

6.8.3 Contact clearance

Rule 6.8.3: The tops of the pins and sockets, in their uppermost position, shall be below the upper edge of the pin header shroud and contact cavity wall, respectively.

6.8.4 Printed wiring terminations

Rule 6.8.4: Printed wiring terminations for both plug and receptacle shall be as specified by the respective connector clause. The termination layout shall be in accordance with the printed wiring requirements of MIL-STD-275, MIL-PRF-55110, IPC-D-275, and MIL-PRF-31032.

6.8.5 Hookup wire termination

Rule 6.8.5: The form factor and dimensions of wire termination contacts for those connectors shall be as specified by the respective connector clause.

6.8.6 Contact identification

Rule 6.8.6: Contact positions shall be identified by legible letters, numbers, or symbols, molded or stamped on the front face of the connector body adjacent to each contact and on the front and back of wire type terminals or on the side where front/rear provisions are not accommodated.

6.8.7 Body design

Rule 6.8.7a: Connector bodies shall be designed and constructed with proper sections and radii to provide for no cracking, chipping, or breaking in assembly or in normal service. The insulator body of each plug and receptacle shall be of molded or bonded one-piece construction. Depressions, when used to achieve longer creepage paths, shall not cause structural weakness. Construction shall support engagement resistance without causing contact mating.

Rule 6.8.7b: Connector bodies shall be designed and constructed as defined by the respective connector/contact requirements (see Clause 7 through Clause 12) to support contact: mounting/securing, axial concentricity, axial movement tolerances, mating pre-alignment, and float tolerances during engagement/disengagement. Where rear-mount printed board mounted connectors are applied, the connector housings shall be secured to the printed wiring board by additional means other than the circuit solder connections.

6.8.8 Polarization

Rule 6.8.8: A polarization feature shall be incorporated in each connector housing assembly as defined by the respective connector/contact requirements (see Clause 7 through Clause 12) for correct insertion and prevent mis-orientation, or to prevent non-mating connector engagement.

6.8.9 Alignment

Rule 6.8.9: Each connector shall provide housing and contact features, as defined by the respective connector/contact requirements (see Clause 7 through Clause 12) to support pre-alignment of the connector housings and contacts prior to mating.

6.8.10 Method of mounting/connector float

Rule 6.8.10a: A method of mounting connectors to the receiver/fixture framework shall be limited to the footprint and connector mounting dimensional provisions established by the receiver/fixture framework body design specifications per 5.8.3, mounting methods described in 5.13, and by the respective connector/contact requirements (see Clause 7 through Clause 12).

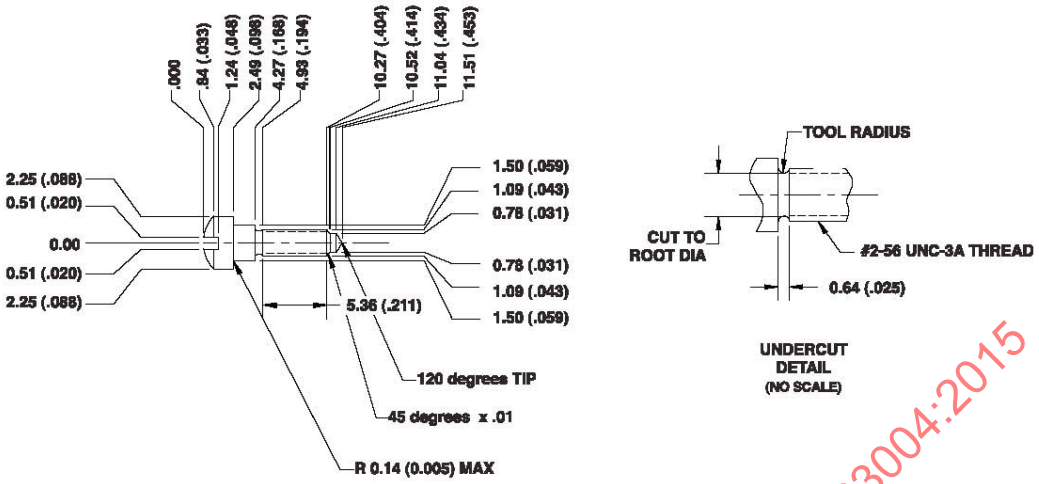
Rule 6.8.10b: Respective receiver and fixture shoulder screws as specified in Figure 39 shall be used to secure the connector modules to the framework and provision 0.08 mm (0.003 in) minimum axial float for alignment adjustment.

Rule 6.8.10c: The alignment and float of mating modules on respective connector mounting dimensional locations (0.600 in spacings), shall be sufficient to satisfy engagement force, contact electrical resistance, and eliminate contact stubbing and push-outs caused by mounting/rigid connector misalignment, when tested to this document's requirements (see 4.6.2.3).

6.9 Interchangeability

Rule 6.9: Receptacle connectors of a given type shall be capable of being mated with associated plug connectors meeting the requirements of this specification, and as defined by the respective connector/contact requirements (see Clause 7 through Clause 12). The mated connectors and individual plugs and receptacles having related part numbers shall be directly and completely interchangeable with each other with respect to installation and performance as specified in this document's requirements (see 4.6.2.1).

a. **Receiver Connector Mounting Shoulder Screw**



b. **Receiver Connector Mounting Shoulder Screw**

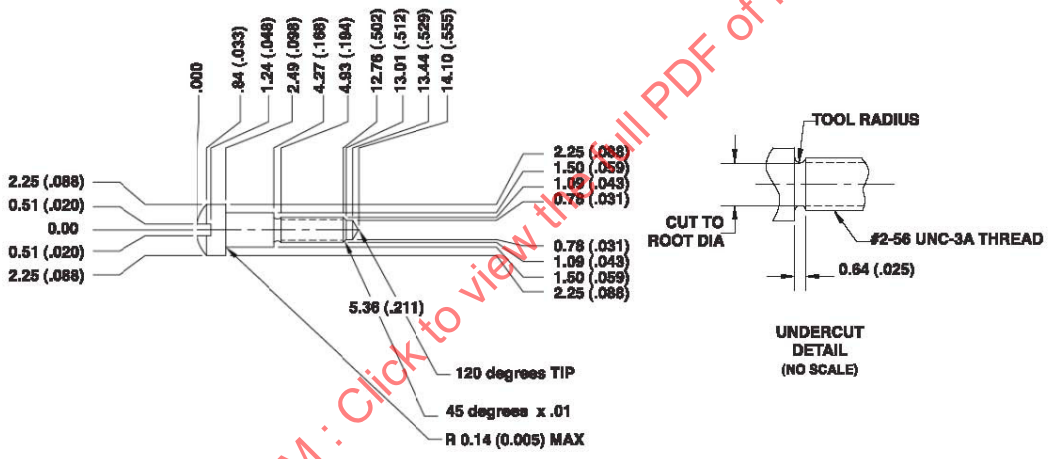


Figure 39—Receiver and fixture connector module mounting screw specification

6.10 Oversized pin exclusion test

6.10.1 Oversized pin exclusion (pins only) test

Rule 6.10.1: Contact pins shall be constructed to meet the oversized pin exclusion (per 4.6.2.4) of this document's requirements so that contact pins do not damage mating sockets by excluding entry of a pin larger than the maximum allowable pin dimensions, as further specified by Clause 6 and related connector clause descriptions.

6.10.2 Oversized pin exclusion (sockets only) test

Rule 6.10.2: The mating end of the socket contacts shall exclude the entry of a test pin larger than the allowable maximum pin diameter tolerance, as defined by the respective connector/contact requirements

(see Clause 7 through Clause 12), in the connector when tested in accordance with this document's requirements (see 4.6.2.5).

6.10.2.1 Oversized pin/probe damage socket test

Rule 6.10.3: When testing the socket contact in accordance with the oversized pin/probe damage socket test requirement of this document's requirements (see 4.6.2.5), the connector and mating socket contact entry opening shall prevent an oversized pin or probe that exceeds the specified tolerance of the test sample specification from entering the socket, as further related in Clause Connector module specification and related connector Clause 7 through Clause 12 descriptions.

6.11 Contact engagement and separation forces

Rule 6.11: When tested as specified in this document's requirements (see 4.6.2.3), contact forces shall conform to the forces defined in the respective connector/contact requirements (see Clause 7 through Clause 12), unless otherwise specified. The maximum contact engagement and separation force for the respective pin and related pin size shall not exceed force requirements defined in Table 5, unless specified otherwise by the respective connector/contact requirements (see Clause 7 through Clause 12).

Table 5—Contact engagement/separation force requirements

Contact type	Maximum engagement force (g/oz)	Maximum separation force (g/oz)
Signal pin/receptacle	113 (4)	99 (3.5)
Size 8 coax pin/receptacle	1361 (36)	1134 (30)
Size 16 coax pin/receptacle	680 (24)	510 (18)
Size 8 power pin/receptacle	1361 (36)	1134 (30)
Size 16 power pin/receptacle	680 (24)	510 (18)
Fiber-optic pin/receptacle	680 (24)	567 (20)
Pneumatic pin/receptacle	680 (24)	567 (20)

6.12 Connector mating and unmating

Rule 6.12: When tested in accordance with this document's requirements (see 4.2.3), connector module forces shall conform to the forces defined in the respective connector/contact requirements (see Clause 7 through Clause 12, unless otherwise specified. The maximum fully populated connector module mating and unmating forces shall be as defined by Table 6, unless specified otherwise by the respective connector/contact requirements (see Clause 7 through Clause 12).

Table 6—Connector engagement/separation force requirements

Connector type	Maximum engagement force (kg/lb)	Maximum separation force (kg/lb)
Signal module	22.7 (50)	20.4 (45)
Size 8 universal module, 1 slot	22.7 (50)	20.4 (45)
Size 8 universal module, 2 slot	45.4 (100)	40.8 (90)
Size 8 universal module, 4 slot	115.7 (255)	104.3 (230)
Size 16 coax/power module, 1 slot	27.2 (60)	22.7 (50)
Size 16 coax/power module, 2 slot	79.4 (175)	72.6 (160)
Size 16 coax/power module, 4 slot	158.8 (350)	149.7 (330)
Fiber optic module	22.7 (50)	20.4 (45)

6.13 Contact rating

Rule 6.13: Maximum current rating of contacts shall be as specified by the respective connector/contact requirements (see Clause 7 through Clause 12).

6.14 Contact resistance

Rule 6.14: When tested in accordance with this document's requirements (see 4.6.3.1), the contact resistance requirements shall be as defined by Table 7, unless specified otherwise by the respective connector/contact requirements (see Clause 7 through Clause 12).

Table 7—Contact resistance

Wire size, AWG Type E per MIL-W-16878	Test current (A)	Maximum contact resistance (m3/4)	Maximum potential drop (mV)
8 to 14	7.5	5.0	37.5
16.18	5.0	8.0	40.0
20 to 22	3.0	10.0	30.0
26	2.0	14.0	28.0
28	1.5	16.0	24.0
30	1.0	20.0	20.0

6.15 Contact retention

Rule 6.15: When tested as specified in this document's requirements (see 4.6.3.2), unless otherwise specified, contacts shall withstand an axial load in accordance with the respective connector/contact requirements (see Clause 7 through Clause 12), without damage to the contact, insert, or contact retaining clip, if applicable.

6.16 Dielectric withstanding voltage

Rule 6.16: When tested in accordance with this document's requirements (see 4.6.3.3), there shall be no evidence of breakdown of insulation or flashover.

6.17 Signal low-level circuit

Rule 6.17: When tested in accordance with this document's requirements (see 4.6.3.4), the contact resistance shall be in accordance with the respective connector/contact requirements (see Clause 7 through Clause 12), unless otherwise specified.

6.18 Insulation resistance

Rule 6.20: When tested in accordance with this document's requirements (see 4.6.3.5), the initial connector module insulation resistance shall be not less than 5000 M3/4, unless otherwise defined by the respective connector/contact requirements (see Clause 7 through Clause 12).

6.19 Contact durability/cycle test

Rule 6.19a: To meet IEEE 1505 requirements, each manufacturer shall subject the test specimen receiver and fixture connector to a *durability cycle test* in accordance with this document's requirements (see 4.6.2.7). A minimum durability cycle objective of 10 000 repetitions is required, unless otherwise defined in the respective connector/contact requirements (see Clause 7 through Clause 12).

Rule 6.19b: When tested in accordance with this document's requirements (see 4.6.2.6), connectors shall show no evidence of cracking or breaking, the contact resistance requirements (see 6.19) shall not be exceeded, and mating and unmating requirements (see 6.17) shall be met.

6.20 Environmental requirements

Rule 6.22: RFI connectors as further defined in shall meet the environmental tests in accordance with this document's requirements (see 4.6.4).

6.20.1 Operating temperature

Rule 6.20.1: Unless otherwise defined in the respective connector/contact requirements (see Clause 7 through Clause 12), connectors shall have an operating temperature of +100 °C maximum and –10 °C minimum in accordance with this document's requirements (see 4.6.4.1).

6.20.2 Temperature cycling

Rule 6.20.2: When a mated pair of connectors undergoes temperature cycle testing in accordance with this document's requirements (see 4.6.4.2), there shall be no evidence of cracking, crazing or warping of the connector body or other physical damage to the connector assembly.

6.20.3 Humidity

Rule 6.20.3: When tested in accordance with this document's requirements (see 4.6.4.3), insulation resistance shall be greater than 1000 M3/4, unless otherwise defined in the respective connector/contact requirements (see Clause 7 through Clause 12).

6.20.4 Metal surfaces and environmental exposure protection

Rule 6.20.4: When mated connector pairs are environmentally tested in accordance with this document's requirements (see 4.6.4.1 through 4.6.4.4), there shall be no peeling, chipping, or blistering of metal surfaces or corrosion/rusting of exposed base metal.

6.20.5 Vibration

Rule 6.20.5: When tested in accordance with this document's requirements (see 4.6.4.4), there shall be no physical or mechanical damage to the connector body or contacts. During vibration there shall be no interruption in continuity greater than 1 µs of the test circuit that incorporates mated contacts. After the vibration test, the mounting hardware shall show no signs of loosening, fracture, or other deterioration.

6.20.6 Shock (specified pulse)

Rule 6.20.6: When shock tested in accordance with this document's requirements (see 4.6.4.5), there shall be no physical damage to the connector. During the test there shall be no interruption in continuity greater than 1 µs of the test circuit that incorporates mated contacts.

6.20.7 Salt spray (corrosion)

Rule 6.20.7: When mated connector pairs are tested in accordance with this document's requirements (see 4.6.4.6), there shall be no peeling, chipping, or blistering of metal surfaces or exposure of base metal.

6.20.8 Connector module solvent resistance and fluid immersion

Rule 6.20.8: Mated connectors shall meet solvent/fluid immersion requirements established by this document's requirements (see 4.6.4.7) and Method 1016 of MIL-STD-1344A.

6.20.9 Connector module flammability

Rule 6.20.9: Mated connectors shall not exhibit flammability conditions when tested in accordance with this document's requirements (see 4.6.4.8) and Method 1012 of MIL-STD-1344A.

6.21 Contacts supplied in reels

Rule 6.21: When contacts are separated from the carrier strip, base metal may be exposed. Following the salt spray test any corrosion that may occur in the region of the separation shall not interfere with the ability of the contacts to meet the subsequent test requirements, either for contacts tested separately, or as part of the connector, including the ability to mate or unmate the connectors.

6.22 Contact solderability

Rule 6.22: Contact terminations shall withstand the test specified in this document's requirements (see 4.6.3.8), and MIL-STD-1344A, Method 1016.

6.23 Contact resistance to soldering heat/flammability

Rule 6.23: Contacts shall withstand the test specified in this document's requirements (see 4.6.3.8) and MIL-STD-1344A, Method 1016.

6.24 Contact crimp tensile strength

Rule 6.24: When any type contacts are tested as specified in this document's requirements (see 4.6.3.7), the contact-to-wire crimp shall not break nor pull out at less than the minimum tensile strength specified in the respective connector/contact requirements (see Clause 7 through Clause 12) for the applicable wire size.

6.25 Auxiliary parts

Rule 6.25: Mechanical, nonelectrical parts, such as polarizing keys, keying accessories, covers, cable clamps, etc., shall be as specified on the individual specification sheet.

6.26 Marking

Rule 6.26: Connectors and accessories shall be marked in accordance with MIL-STD-1285D.

6.27 Workmanship

Rule 6.27: Connectors and accessories shall be processed in such a manner as to be uniform in quality and shall be free from burrs, crazing, cracks, voids, pimples, chips, blisters, pinholes, sharp cutting edges, and other defects that adversely affects life, serviceability, or appearance.

6.27.1 Riveting, upsetting, and spinning-over

Rule 6.27.1: When riveting, upsetting, or spinning-over processes are employed, there shall be no evidence of fatigue or deformation of noninvolved surfaces of the material being riveted, upset, or spun over.

7. Signal module

7.1 Introduction

Clause 7 and the related Clause 6 of this standard describe specifications for developing and integrating signal module receptacle and pin connector assembly, (connector saver) receiver module, contacts, and accessories for: (a) 4 row by 50 pin configuration, 200 contact positions; (b) 10 row by 50 pin configuration, 500 contact positions, with DIN contact layout 2.54 mm (0.10 in) center spacing with 0.64 mm (0.025 in) square post, or 0.60 mm (0.024 in) circular post, for discrete wire or two-wire coaxial wiring, in vertical mount or printed wiring board (PWB) scheme.

7.2 General specifications

Rule 7.2: The signal module receptacle receiver and fixture pin connector assembly shall conform to the following subclauses and illustrations. These design specifications provide address connector/contact physical dimensions, vertical interconnect scheme implementations, electrical and environmental performance specifications, and applicable PCB layout requirements. The information presented in Clause 7 is not stand-alone and shall coexist with the information presented in Clause 6 and conform to the related sections of Clause 4.

Figure 40 presents implementations of the signal module connector pin and receptacle assembly under the specifications described herein. Figure 41 through Figure 45 reflect detailed dimensions required.

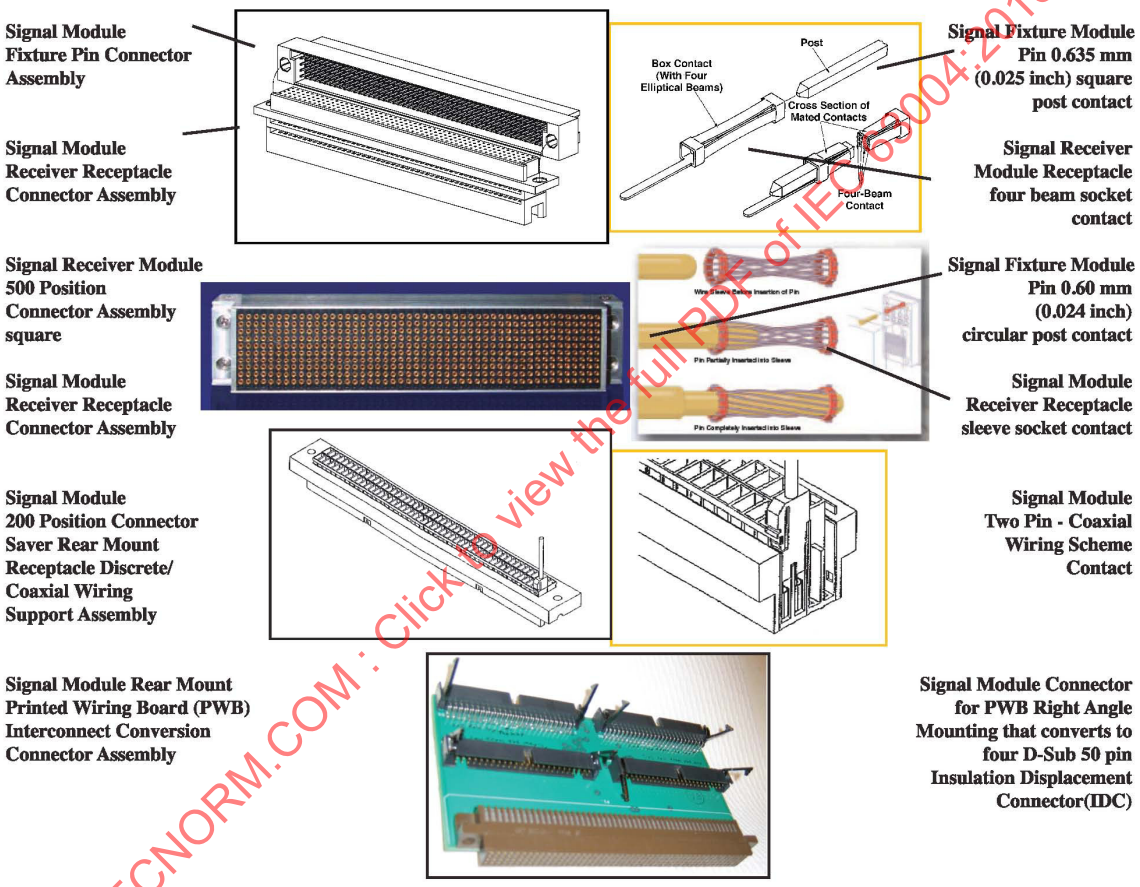
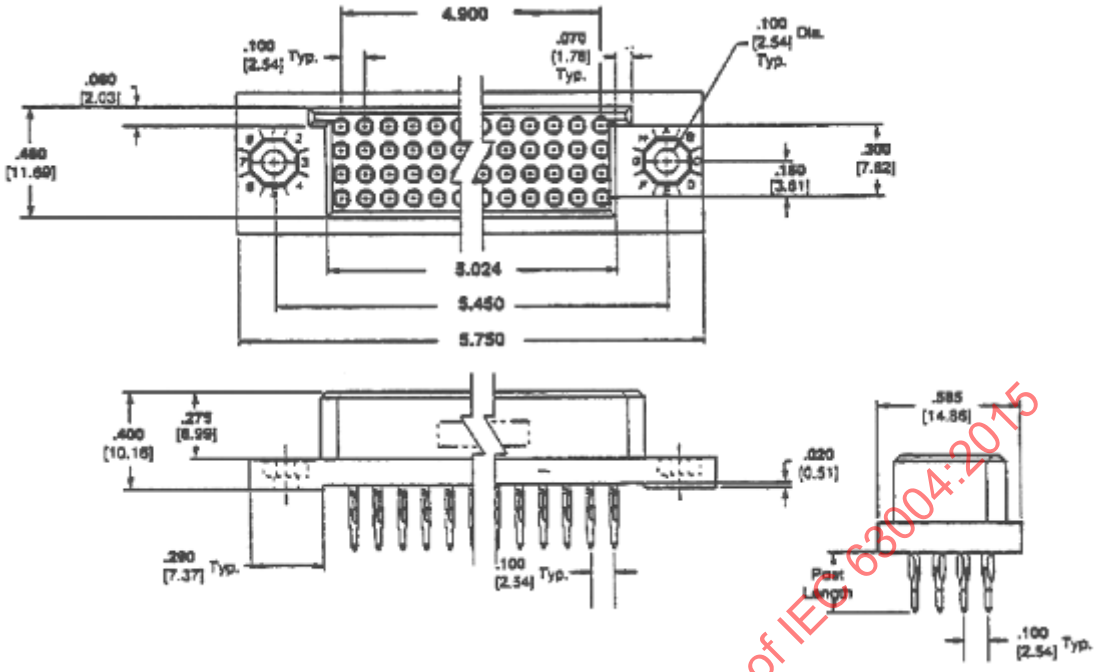


Figure 40—Square-post signal module connector pin and receptacle assembly implementation



NOTE 1—Dimensions shown are shown as inches with metric measurements in millimeters in parentheses.

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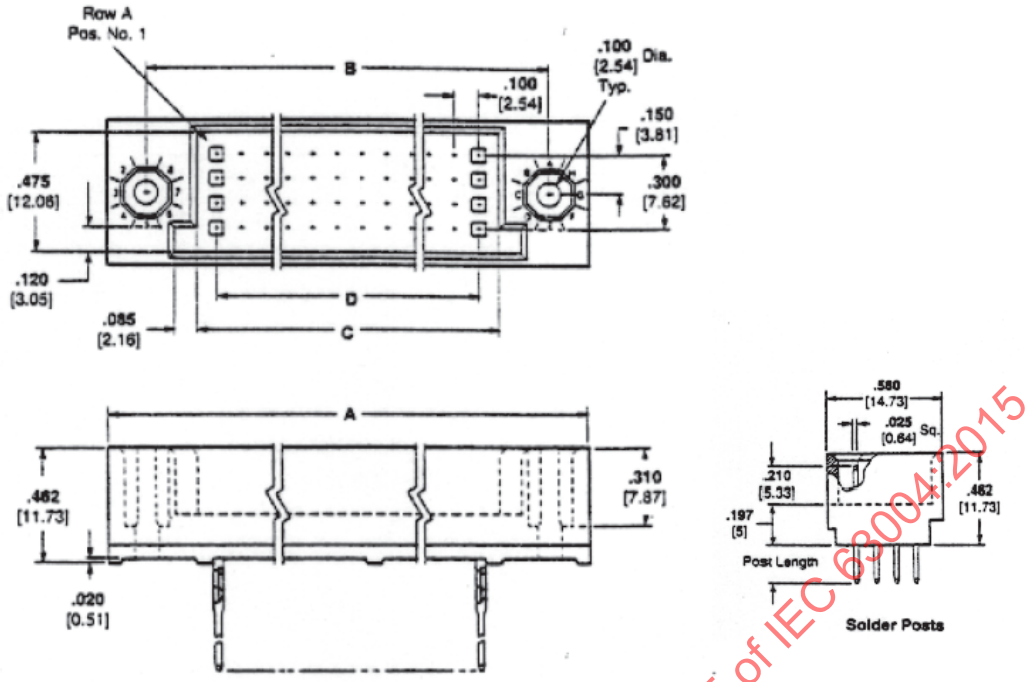
Figure 41—Square-post signal module receiver receptacle connector assembly dimensional specifications



NOTE 1—Dimensions shown are shown as inches with metric measurements in millimeters in parentheses.

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Figure 42—Square-post signal module fixture pin connector assembly dimensional specifications

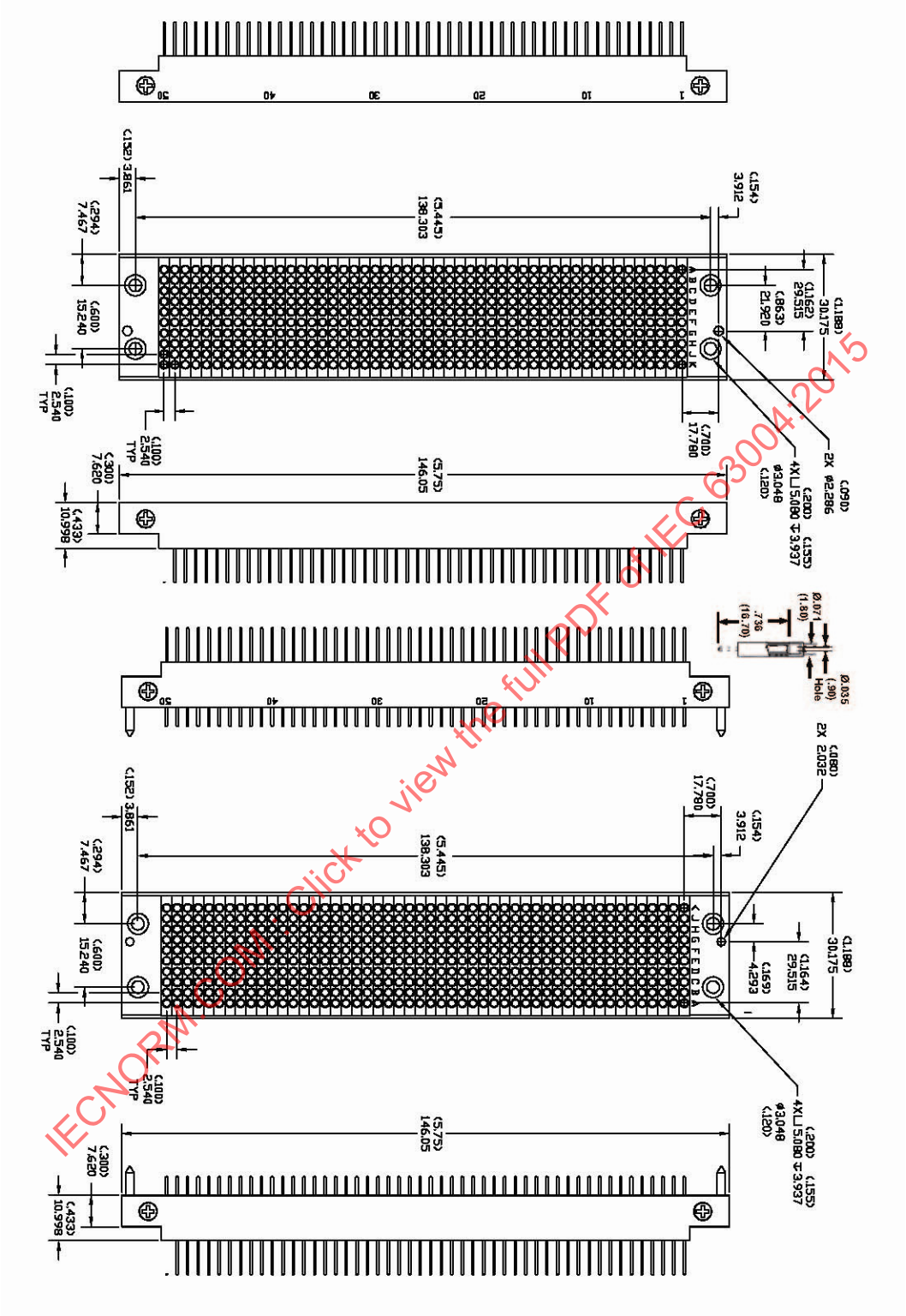


Figure 43—Circular-post signal module 500 pin connector assembly dimensional specifications

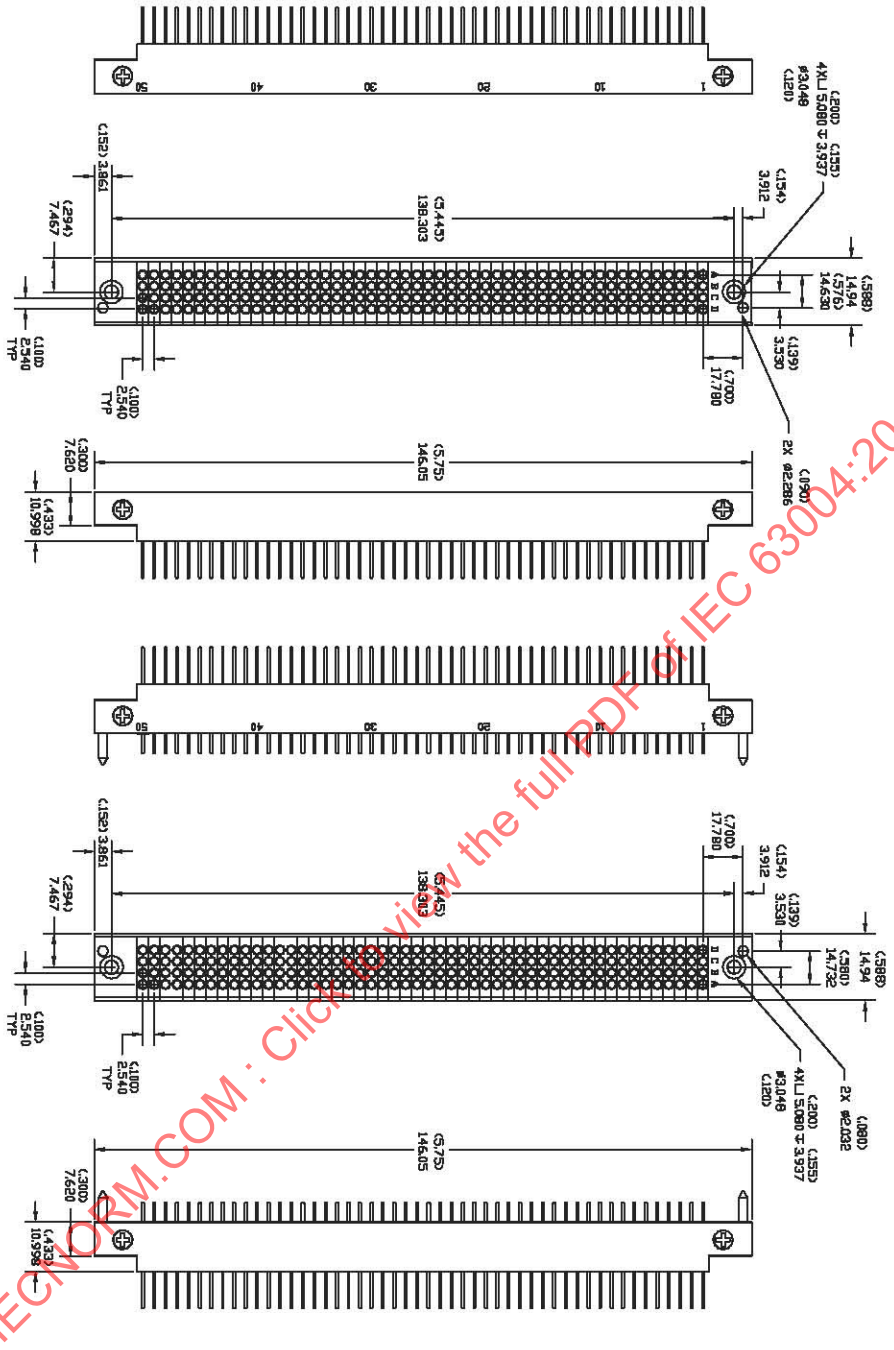


Figure 44—Circular-post signal module 200 pin connector assembly dimensional specifications

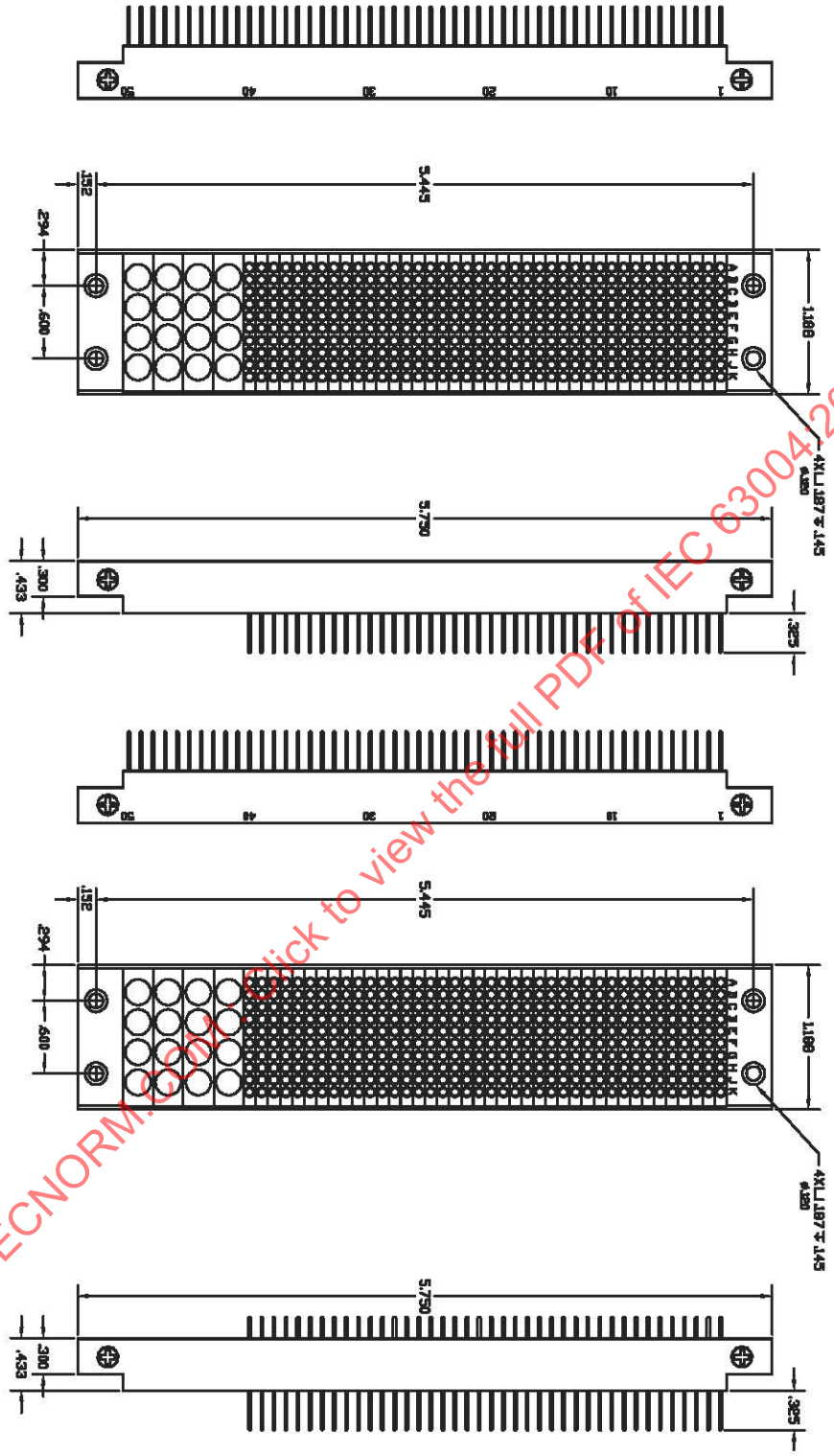


Figure 45—Mixed circular-post signal and size 18 (i.e., coax/power) module connector assembly dimensional specifications

7.2.1 Specification relationships

Rule 7.2.1: The individual connector-type style requirements shall be as specified within Clause 6 and in accordance with the applicable specification sheets listed in Clause 7 of this specification. In the event of any conflict between the requirements of this document and the specification sheets, the latter shall govern.

7.3 Design and construction requirements

7.3.1 General requirements

Rule 7.3.1: Each connector shall meet all applicable connector specifications described in Clause 6 and the related qualification requirements in Clause 4, unless otherwise specified hereafter.

7.3.2 Materials

Rule 7.3.2a: The identified reference materials, platings, and processes described in 4.2.2 shall be used to enable connectors manufactured to this document to mate to similar industry standard or government-specified connector systems with minimal problems related to electrochemical contamination of critical electrical or mechanical interfaces or generation of incompatible mechanical interface surface wear products.

Permission 7.3.2: The manufacturers of connectors supplied to this document may use alternate recognized industry standard materials, platings, and processes from those identified in 4.2.2 of this specification. However, use of alternate materials, platings, and processes shall be coordinated with the qualifying activity as part of the qualification process.

Rule 7.3.2b: Use of alternates to those referenced guidance items by the supplier shall not result in inferior short- or long-term performance or reliability of supplied connectors as compared with connectors manufactured using the referenced materials, platings, or processes. Short- or long-term failures or reliability problems due to use of these alternates shall be the responsibility of the supplier.

7.3.3 Dimensions

Rule 7.3.3: Dimensions shall be shown in metric and referenced to inches in parentheses.

7.3.4 Tolerances

Rule 7.3.4: Unless otherwise specified, tolerance is 0.13 mm (0.005 in) on decimals and ±2° on angles.

7.3.5 Related mating connector

Rule 7.3.5: Each connector described herein provides mating male (pin header), and female (receptacle) connector elements specified within this clause.

7.3.6 Locator pin markings

Rule 7.3.6: Location indicators shall be marked with permanent paint or etched markings on surface. Numbers indicating end cavities, letters indicating row nearest to polarizing feature, and markings every 10 positions stamped on this surface, in lettering orientation as shown in Figure 46.

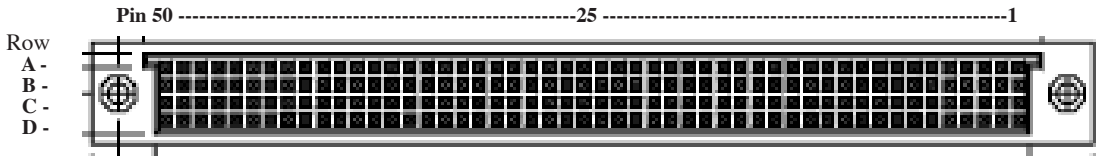


Figure 46—Front view receiver signal module connector 200 position markings

7.3.7 Chamfers

Rule 7.3.7: Chamfers shall be 0.015mm (0.38 in) minimum at a 45° angle (see Figure 44 and Figure 45).

7.3.8 Mating and unmating

Rule 7.3.8: The maximum mating force shall be 22.7 kg (50 lb). The maximum separation force is 20.4 kg (45 lb).

7.3.9 Contact retention

Rule 7.3.9: Contact retention shall be 1.36 kg (3 lb) at a minimum.

7.3.10 Compliant pin design

Rule 7.3.10: Compliant pins shall meet the requirements of MIL-STD-2166, Type III. For use with 2.362 mm (0.093 in) minimum thick printed wiring boards. Sequence of tests and number of samples shall be in accordance with MIL-STD-2166, Table III.

7.3.11 Wire-wrap post contact design

Rule 7.3.11: Wire-wrap post contacts shall be in accordance with MIL-STD-1130.

7.4 Electrical specifications

7.4.1 Current rating

Rule 7.4.1: Current rating of the pin shall be based upon amperes continuous per contact at ambient room temperature with no more than two adjacent contacts carrying this current without exceeding a 10 °C rise in temperature surrounding the contacts. See Table 8 for related wire gauge conditions/current rating.

7.4.2 Contact resistance

Rule 7.4.2: No individual contact pair shall have a resistance exceeding maximum level after testing, as described Table 9, for related wire gauge conditions/contact signal pin.

7.4.3 Contact dielectric withstanding voltage

Rule 7.4.3: Contact dielectric withstanding voltage shall be as follows:

— **At sea level:** 900 V rms

— **At 21 336 m (70 000 ft):** 200 V rms

— **Maximum leakage current:** 2 mA

Table 8—Signal contact current rating

Wire size, AWG Type E per MIL-W-16878	Max current continuous at room temperature (A)
20	5.0
22	3.0
24	2.0
26	1.5
28	1.0
30	0.75

Table 9—Signal contact resistance

Wire size, AWG Type E Per MIL-W-16878	Test current (mA)	Maximum contact resistance (m3/4)	Maximum voltage drop (mV)
20	100	9	9.0
22	100	15	15.0
24	100	20	20.0
26	100	24	25.0
28	100	40	40.0
30	100	50	50.0

7.5 Method of examination and test

7.5.1 Visual and mechanical examination

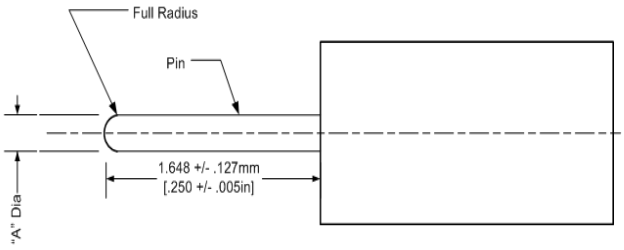
Rule 7.5.1: Examination shall be made to determine compliance with 4.5.

7.5.1.1 Interchangeability

Rule 7.5.1.1: Physical configuration and dimensional measurements shall meet the requirements of 4.6.2.1 and as specified in the related supplemental paragraphs.

7.5.2 Oversized signal pin exclusion

Rule 7.5.2: The applicable steel pin, shown in Figure 47, for the signal pin size contacts to be tested shall be applied to the sockets of the connector for a period of 10 s without the pin causing damage when entering the socket. A minimum of seven contacts shall be measured on each specimen.



"A" Dia. mm +.00254 -.00000	"A" Dia. Inches +.0001 -.0000	Applied Force kg	Applied Force Ounces	Contact Size
1.1811	0.0465	2.270 +0.014 -0.000	80.0 +0.5 -0.0	20
0.9144	0.0360	1.277 +0.014 -0.000	45.0 +0.5 -0.0	22
0.8382	0.0330	0.908 +0.014 -0.000	32.0 +0.5 -0.0	23
0.7747	0.0305	0.596 +0.014 -0.000	21.0 +0.5 -0.0	24
0.7366	0.0290	0.341 +0.014 -0.000	12.0 +0.5 -0.0	0.6mm

PIN; TOOL STEEL, HARDEN & DRAW TO ROCKWELL C50-55.
HANDLE: SHAPE OPTIONAL, SIZE TO BE DETERMINED BY SPECIFIED TOTAL WEIGHT

Figure 47—Signal socket test pin gauge

7.5.3 Contact engagement and separation forces

Rule 7.5.3: Sockets (contacts) shall be mounted in a suitable position or fixture (see Figure 48 and Figure 49) for applying gradually increasing loads for the engagement and separation of the test pin from the sockets (contacts). Maximum and minimum test pins shall be in accordance with MS3197. Insertion of test pins shall be to a minimum depth of 3.556 mm (0.140 in ± 0.020 in) when measured from the front of the socket contact. The test pin shall not bottom in the socket contact. This test shall be performed in the sequence as specified in Method 2014 of MIL-STD-1344A.

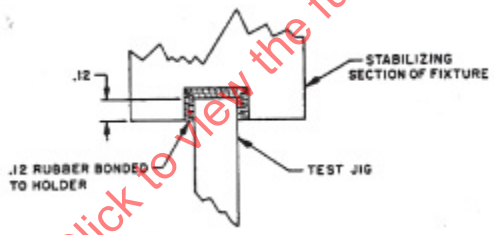


Figure 48—Stabilizing arrangement

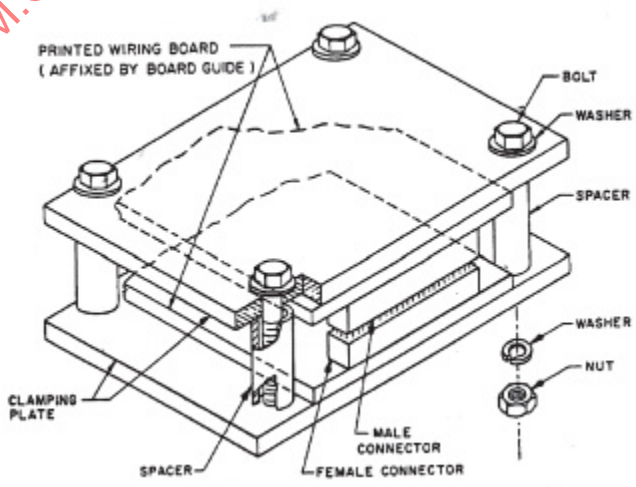


Figure 49—Bolts and standoffs

7.5.4 Mating and unmating

Rule 7.5.4: After three cycles of insertion and withdrawal, the force required to fully insert and withdraw a plug from the receptacle shall be measured. Each plug and receptacle so mated shall be considered as one test specimen where further testing of the plug or receptacle is indicated. The measuring equipment shall conform to the following.

a) **Rule 7.5.4a:** The axis of insertion of the pin contacts and mating receptacle contacts or hermaphroditic contacts as applicable shall coincide during insertion and withdrawal.

b) **Rule 7.5.4b:** The speed of insertion of the plug into the receptacle contacts shall not exceed 10 cycles per minute for constant speed machines, or the rate of loading shall not exceed 36.3 kg (80 lb) per minute for constant rate-of-force machines.

c) **Rule 7.5.4c:** Scale mechanisms shall have no dashpots or other damping devices.

d) **Rule 7.5.4.d:** Scales shall be calibrated in 0.057 kg (2 oz) steps or less, and shall be accurate to within 0.057 kg (2 oz).

NOTE—When mating and unmating tests are required by another test such as contact life, the preconditioning cycles are not required.

Table 10—Signal contact engagement and separation force test requirements

Signal contact		Tolerance
Signal pin standard diameter	0.635 mm (0.025 in)	±0.025 mm (0.00 1 in)
Maximum engagement force	113 g (4 oz)	±2.8 g (0.1 oz)
Maximum separation force	99 g (3.5 oz)	±2.8 g (0.1 oz)

7.5.5 Contact durability/cycle test

Rule 7.6.5a: To meet this document's requirements, each manufacturer shall subject the test specimen receiver and fixture connector to a *durability cycle test* in accordance with 4.6.2.7. A minimum durability cycle objective of 10 000 repetitions is required, unless otherwise defined in the respective connector/contact requirements (see Clause 7 through Clause 12).

Rule 7.6.5b: When tested in accordance with this document's requirements (see 4.6.2.6), connectors shall show no evidence of cracking or breaking, the contact resistance requirements (see 6.19) shall not be exceeded, and mating and unmating requirements (see 6.17) shall be met.

8. Power size 8 and 16 connector module(s)

8.1 Introduction

Clause 8 and the related Clause 6 of this document describe specifications for developing and integrating RFI power size 8 and 16 module connector, receptacle, and pin assembly, connector saver, contacts, and accessories for multiple module configurations including:

a) Mixed size 8 and 16 power module single slot with 45 positions of 23 A contacts in three rows and four positions of 45 A contacts with two on each end of the connector

b) Size 16 power module single slot with 59 positions of 23 A contacts in three rows

c) Size 16 power module dual slot with 152 positions of 23 A contacts in eight rows

d) Size 16 connector saver power module four-slot assembly with 307 positions of 23 A contacts in 17 rows

NOTE—All connectors support discrete wiring; single slot also supports printed wiring board (PCB) applications.

8.2 General specifications

Rule 8.2: The power module receptacle receiver and fixture pin connector assemblies described herein shall conform to the following subclauses and illustrations. The design specifications provided address connector/contact physical dimensions, vertical interconnect scheme implementations, electrical and environmental performance specifications, and applicable PCB layout requirements. The information presented in Clause 8 is not stand-alone and shall coexist with the information presented in Clause 6 and conform to the related requirements in Clause 4.

Figure 50 presents implementations of the power signal module connector pin and receptacle assembly under the specifications described herein. Figure 51 through Figure 56 reflect detailed dimensions required.

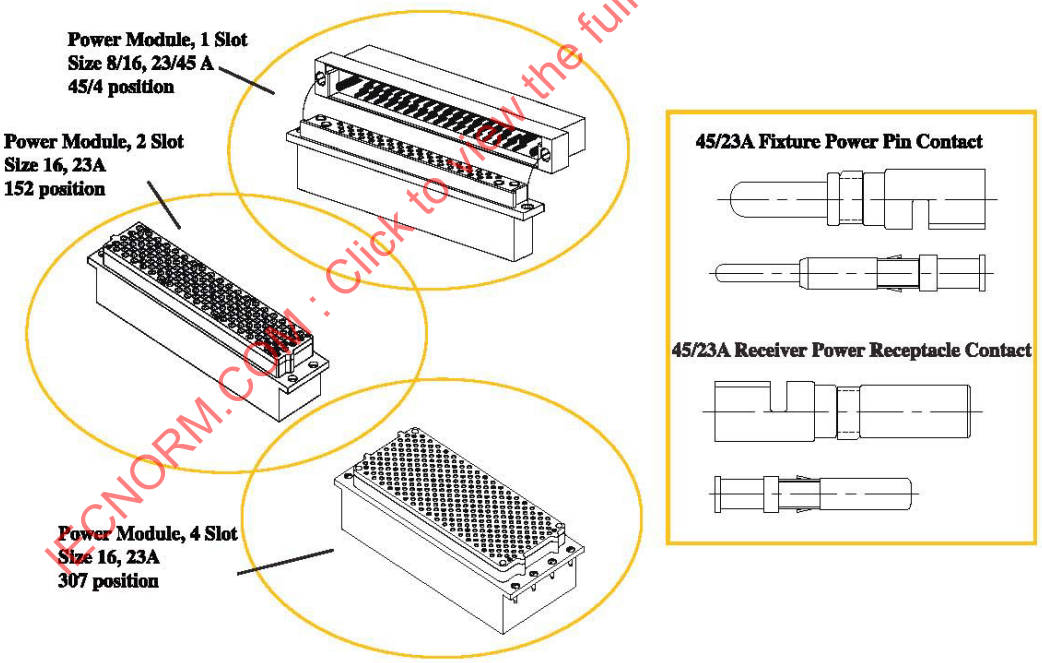


Figure 50—Power module receiver and fixture assembly

8.2.1 Specification relationships

Rule 8.2.1: The individual connector type style requirements shall be as specified within this standard and in accordance with the applicable specification sheets listed in this clause. In the event of any conflict between the requirements of this document and the specification sheets, the latter shall govern.

8.3 Design and construction requirements

8.3.1 General requirements

Rule 8.3.1: Each connector, as shown in Figure 51 through Figure 56, shall meet all applicable connector specifications described in Clause 6 and the related qualification requirements in Clause 4, unless otherwise specified hereafter.

8.3.2 Materials

Rule 8.3.2a: The identified reference materials, platings, and processes described in 4.2.2 shall be used to enable connectors manufactured to this document to mate to similar industry standard or government-specified connector systems with minimal problems related to electrochemical contamination of critical electrical or mechanical interfaces or generation of incompatible mechanical interface surface wear products.

Permission 8.3.2: The manufacturers of connectors supplied to this document may use alternate recognized industry standard materials, platings, and processes from those identified in 4.2.2 of this specification. However, use of alternate materials, platings, and processes shall be coordinated with the qualifying activity as part of the qualification process.

Rule 8.3.2b: Use of alternates to those referenced guidance items by the supplier shall not result in inferior short- or long-term performance or reliability of supplied connectors as compared with connectors manufactured using the referenced materials, platings, or processes. Short- or long-term failures or reliability problems due to use of these alternates shall be the responsibility of the supplier.

8.3.3 Dimensions

Rule 8.3.3: Dimensions shall be shown in metric and referenced to inches in parentheses.

8.3.4 Tolerances

Rule 8.3.4: Unless otherwise specified, tolerance is 0.13 mm (0.005 in) on decimals and ±2° on angles.

8.3.5 Related mating connector

Rule 8.3.5: Each connector described herein provides mating male (pin header), and female (receptacle) connector elements specified within this clause.

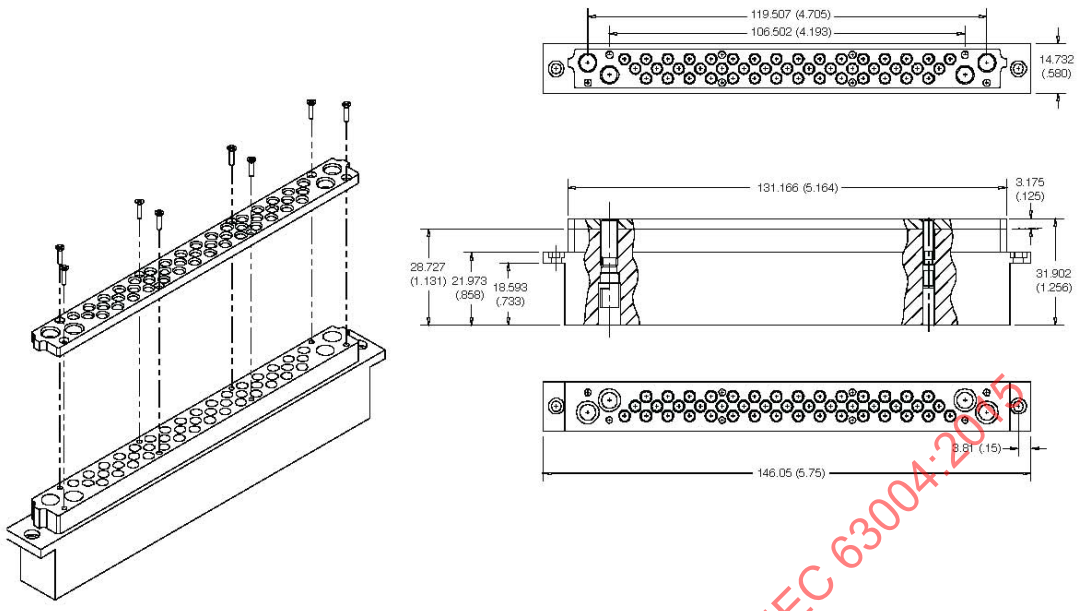


Figure 51—Mixed power module, 45-23 A/4-45 A position-rating, receiver housing physical layout

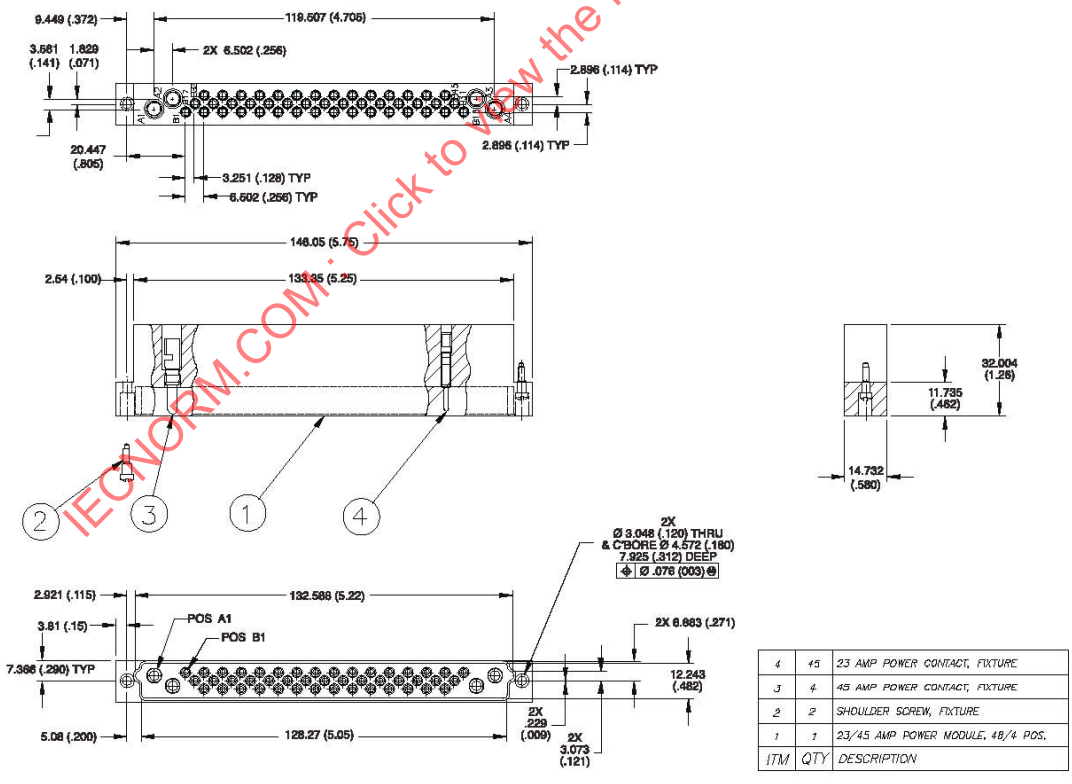


Figure 52—Mixed power module, 45-23 A/4-45 A position-rating, fixture housing physical layout

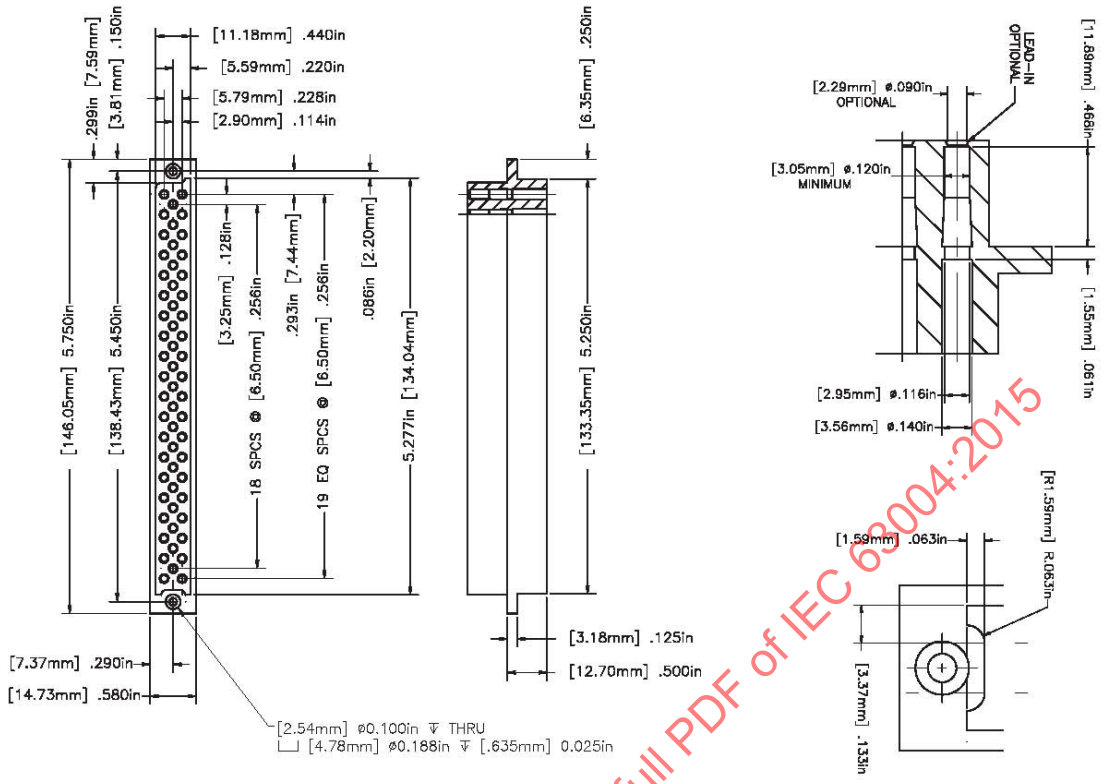


Figure 53—Power module, 59 position for 23 A contact, receiver housing physical layout

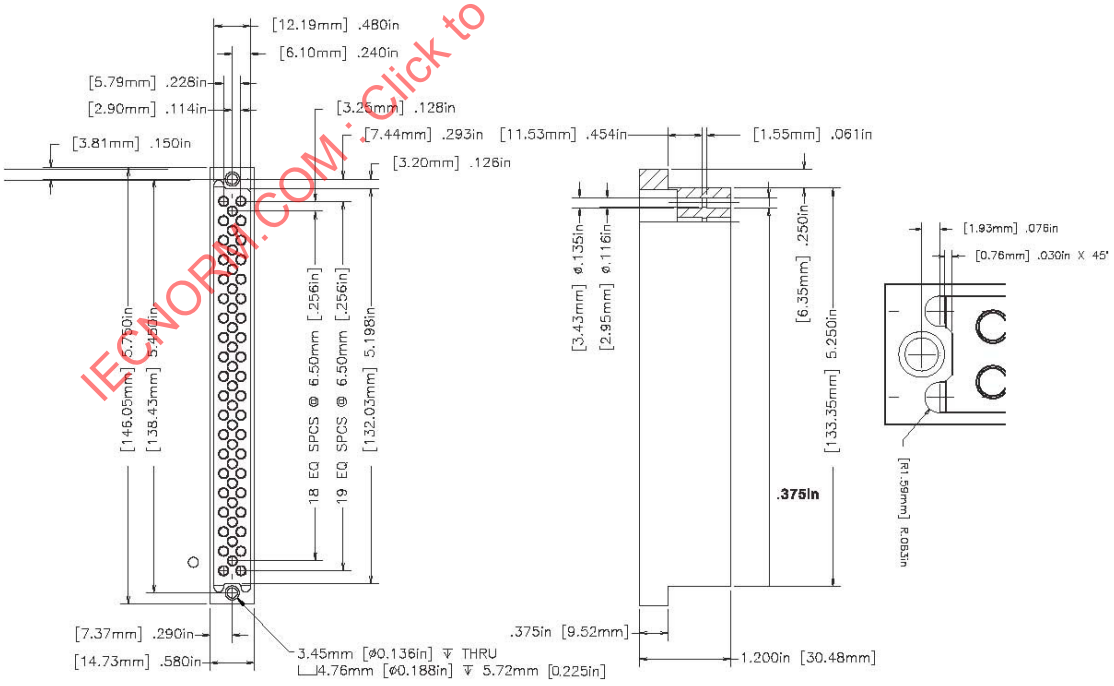


Figure 54—Power module, 59 position for 23 A contact, fixture housing physical layout

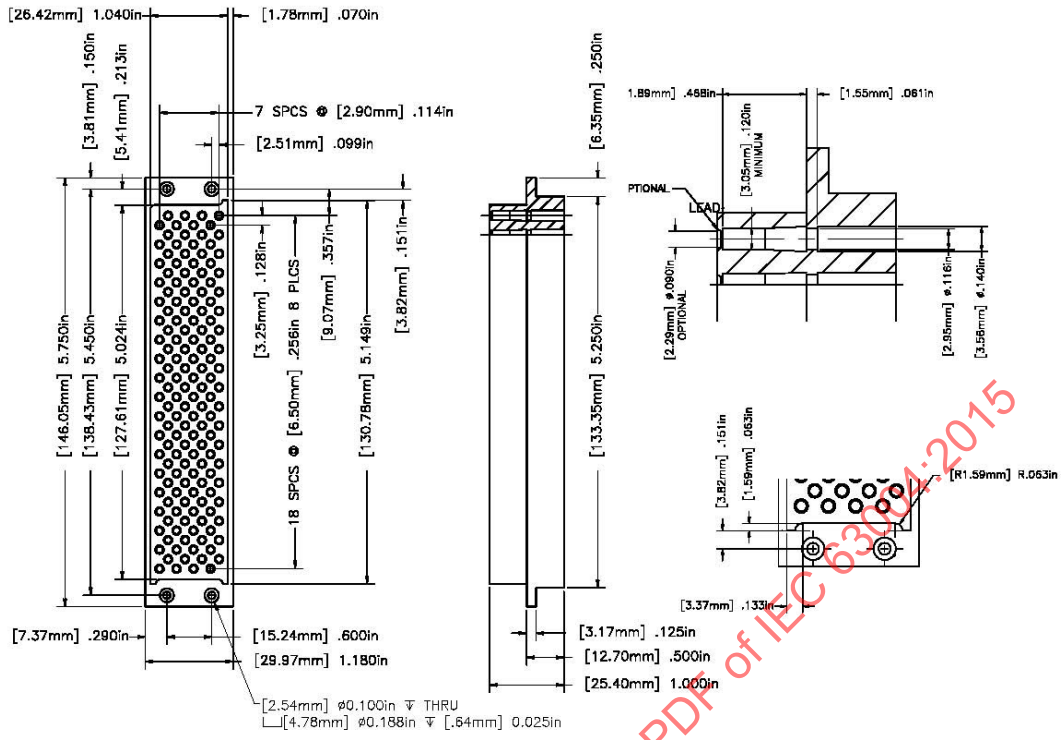


Figure 55—Power module, 2 slot, 152 position for 23 A contact, receiver housing physical layout

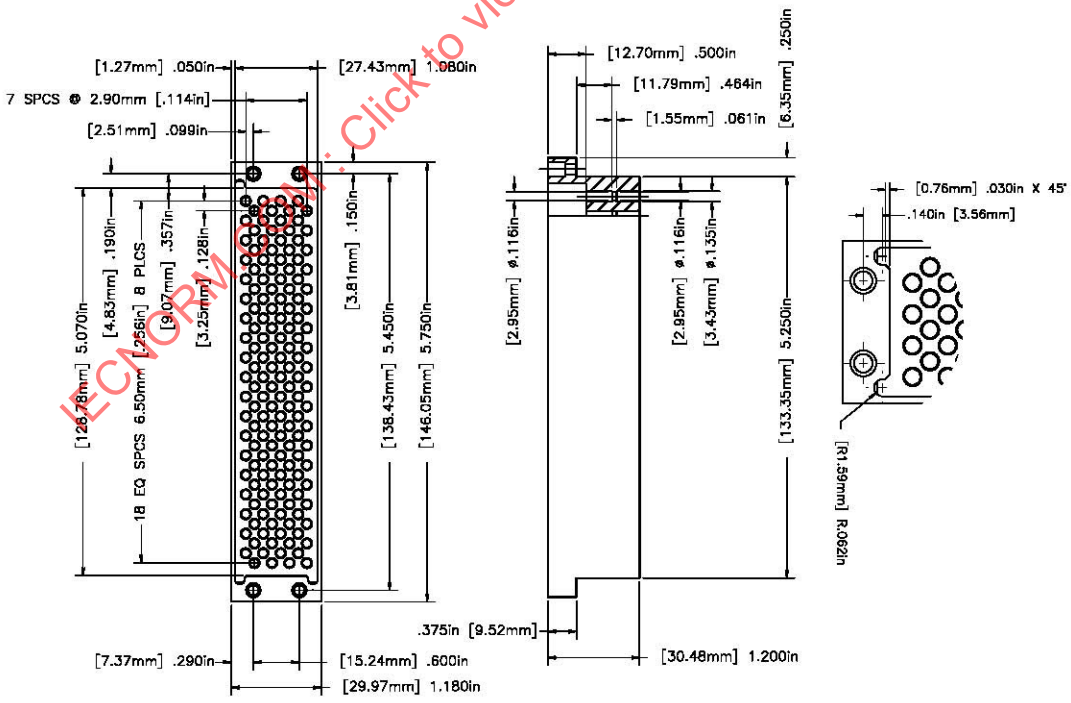


Figure 56—Power module, 2 slot, 152 position for 23 A contact, fixture housing physical layout

8.3.6 Locator pin markings

Rule 8.3.6: Location indicators shall be marked with permanent paint or etched markings on surface. Numbers indicating end cavities, letters indicating row nearest to polarizing feature, and markings at each position shall be stamped or permanently labeled on this surface.

8.3.7 Chamfers

Rule 8.3.7: Chamfers shall be 0.38 mm (0.015 in) minimum at a 45° angle (see Figure 51 through Figure 56).

8.3.8 Keying

Permission 8.3.8: Two keys, Part or Identifying Number (PIU) MS5530Z/31-04, and two 0.086-56 UNC-2A mounting screws may be applied.

8.3.9 Jackscrews

Permission 8.3.9: Use M55302/182-1 1, -12, -13, -14, -15, or -16. Jackscrews may be applied.

8.3.10 Contact retention

Rule 8.3.10: Contact retention shall be 4.5 kg (10 lb) at a minimum.

8.3.11 Connector part or identifying number

Rule 8.3.11: Suffix to any manufacturing part number shall include the respective connector Clause 8 specification. Example: 555302/RFI.8.3.

8.4 Electrical specifications for 23 A power contact

8.4.1 Current rating

Rule 8.4.1: Current rating of the pin, as described in Figure 57, shall be 23.0 A maximum per contact in free air, and 18.0 A continuous per contact with no more than six adjacent contacts carrying this current when applied to 14AWG stranded wire and not exceed a 10 °C temperature rise from ambient.

8.4.2 Contact resistance

Rule 8.4.2: No individual contact pair shall have a resistance exceeding 4 mΩ initial and 5 mΩ after testing.

8.4.3 Contact dielectric withstanding voltage

Rule 8.4.3: Contact dielectric withstanding voltage shall be as follows:

- **At sea level:** 900 V rms
- **At 21 336 m (70 000 ft):** 200 V rms
- **Maximum leakage current:** 2 mA

8.4.4 Mating and unmating

Rule 8.4.4: The maximum mating/unmating force in kilograms (pounds) shall be the number of contacts multiplied by 680 g (24 oz) for connector engagement force and 510 g (18 oz) for separation force.

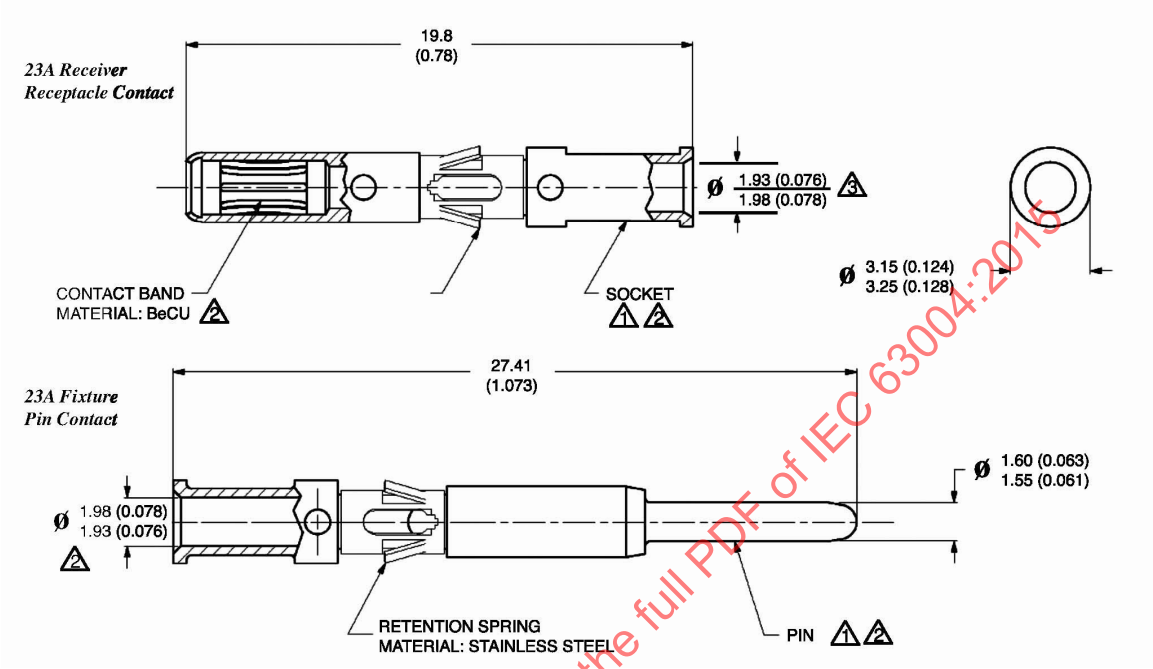


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Figure 57—Power receiver/fixture size 16, 23 A contact, physical layout

8.5 Electrical specifications for 45 A power contact

8.5.1 Current rating

Rule 8.5.1: Current rating of the pin, as described in Figure 58, shall be 45.0 A maximum per contact and 40 A continuous per contact at room ambient with no more than one adjacent contacts carrying this current, when applied to 8AWG stranded wire and not exceed a 10 °C temperature rise from ambient.

8.5.2 Contact resistance

Rule 8.5.2: No individual contact pair shall have a resistance exceeding 3 mΩ initially and 5 mΩ after testing.

8.5.3 Contact dielectric withstanding voltage

Rule 8.5.3: Contact dielectric withstanding voltage shall be as follows:

- **At sea level:** 900 V rms
- **At 21 336 m (70 000 ft):** 200 V rms
- **Maximum leakage current:** 2 mA

8.5.4 Mating and unmating

Rule 8.5.4: The maximum mating/unmating force in kilograms (pounds) shall be the number of contacts multiplied by 1361 g (36 oz) for connector engagement force and 1134 g (30 oz) for separation force.

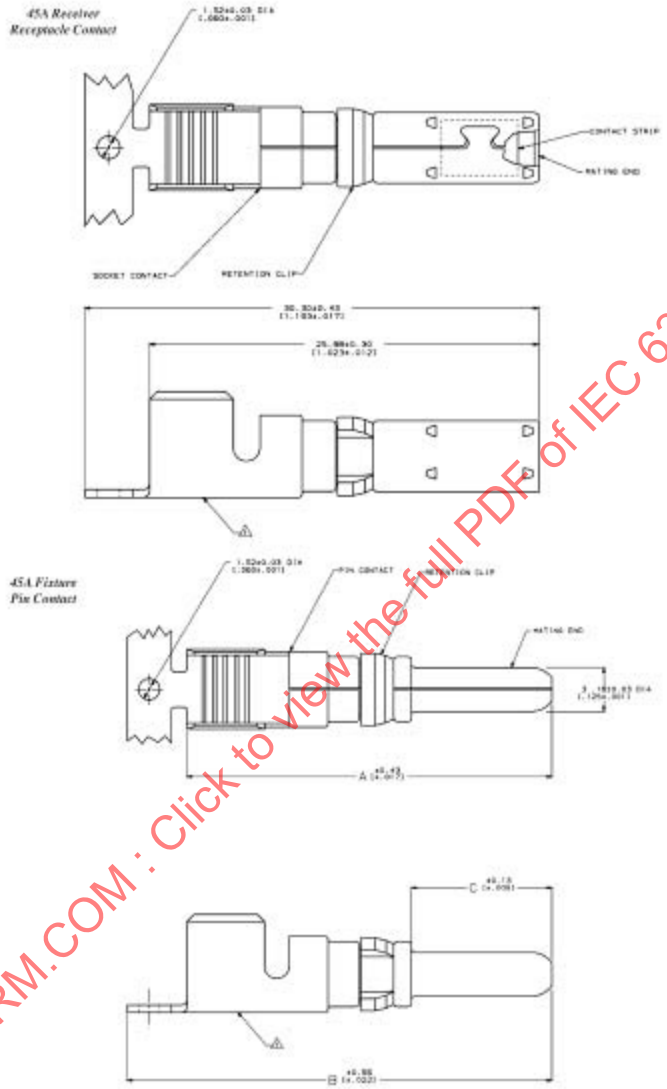

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Figure 58—Power receiver/fixture size 8, 45 A contact, physical layout

8.6 Method of examination and test

8.6.1 Visual and mechanical examination

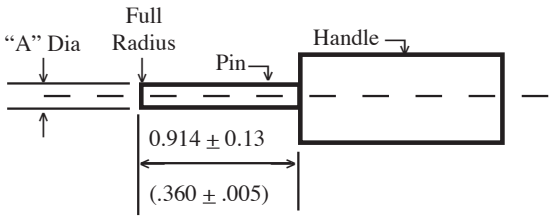
Rule 8.6.1: Examination shall be made to determine compliance with 4.5.

8.6.1.1 Interchangeability

Rule 8.6.1.1: Physical configuration and dimensional measurements shall meet the requirements of 4.6.2.1 and as specified in the related supplemental paragraphs.

8.6.2 Oversized signal pin exclusion

Rule 8.6.2: The applicable steel pin, shown in Figure 59, for the signal pin size contacts to be tested, shall be applied to the sockets of the connector for a period of 10 s without the pin causing damage when entering the socket. A minimum of seven contacts shall be measured on each specimen.



"A" DIA ±0.03 (.001)	Applied Force kg (lbs)	Contact Size
1.65 (.065)	0.907 (2.0)	16
3.25 (.128)	1.814 (4.0)	8

Pin; Tool Steel, Harden and Draw To Rockwell C50-55.
Handle; Shape Optional, Size To Be Determined by Specified Total Weight.

Figure 59—Signal socket test pin gauge

8.6.3 Contact engagement and separation forces

Rule 8.6.3: Sockets (contacts) shall be mounted in a suitable position or fixture for applying gradually increasing loads for the engagement and separation of the test pin from the sockets (contacts). Maximum and minimum test pins shall be in accordance with MS3 197. Insertion of test pins shall be to a minimum depth of 5.08 mm ± 0.508 mm (0.200 in ± 0.020 in) when measured from the front of the socket contact. The test pin shall not bottom in the socket contact. This test shall be performed in the sequence as specified in Method 2014 of MIL-STD-1344A.

8.6.4 Mating and unmating

Rule 8.6.4: After three cycles of insertion and withdrawal, the force required to fully insert and withdraw a plug from the receptacle shall be measured and conform to the requirements listed in Table 11. Each plug and receptacle so mated shall be considered as one test specimen where further testing of the plug or receptacle is indicated. The measuring equipment shall conform to the following rules:

a) **Rule 8.6.4a:** The axis of insertion of the pin contacts and mating receptacle contacts or hermaphroditic contacts as applicable shall coincide during insertion and withdrawal.

b) **Rule 8.6.4b:** The speed of insertion of the plug into the receptacle contacts shall not exceed 10 cycles per minute for constant speed machines, or the rate of loading shall not exceed 36.29 kg (80 lb) per minute for constant rate-of-force machines.

c) **Rule 8.6.4c:** Scale mechanisms shall have no dashpots or other damping devices.

d) **Rule 8.6.4d:** Scales shall be calibrated in 0.057 kg (2 oz) steps or less and shall be accurate to within 0.057 kg (2 oz).

Table 11—Power contact size, engagement, and separation force test requirements

Contact size	Pin maximum diameter mm (in)	Tolerance	Engagement max force (g/oz)	Separation max force (g/oz)
8	3.25 (0.128)	± 0.0762 (0.003)	1361 (36)	1134 (30)
16	1.65 (0.065)	±0.0254 (0.001)	680 (24)	113 (18)

NOTE—When mating and unmating tests are required by another test such as contact life, the preconditioning cycles are not required.

8.6.5 Contact durability/cycle test

Rule 8.6.5a: To meet IEEE 1505 requirements, each manufacturer shall subject the test specimen receiver and fixture connector to a *durability cycle test* in accordance with 4.6.2.7. A minimum durability cycle objective of 10 000 repetitions is required, unless otherwise defined in the respective connector/contact requirements (see Clause 7 through Clause 12).

Rule 8.6.5b: When tested in accordance with this document's requirements (see 4.6.2.6), connectors shall show no evidence of cracking or breaking, the contact resistance requirements (see 6.19) shall not be exceeded, and mating and unmating requirements (see 6.17) shall be met.

9. Coax size 16 connector module(s)

9.1 Introduction

Clause 9 and the related Clause 6 of this standard describe specifications for developing and integrating RFI coax size 16 module connector, receptacle and pin assembly, connector saver, contacts, and accessories for multiple module configurations including:

a) Size 16 coax module single slot with 59 positions of 5 GHz contacts in three rows

b) Size 16 coax module dual slot with 152 positions of 3 GHz or 5 GHz contacts in eight rows

NOTE—Size 16 connector saver coax module four-slot assembly with 307 positions of 3 GHz or 5 GHz contacts in 17 rows, which support discrete wiring and printed wiring board (PCB) applications.

9.2 General specifications

Rule 9.2: The *coax module receptacle receiver* and *fixture pin connector assemblies* described herein shall conform to the following subclauses and illustrations. These design specifications provided address connector/contact physical dimensions, vertical interconnect scheme implementations, electrical and environmental performance specifications, and applicable PCB layout requirements. The information presented in Clause 9 is not stand-alone and shall coexist with the information presented in Clause 6 and conform to this document's requirements in Clause 4.

Figure 60 presents implementations of the coax signal module connector pin and receptacle assembly under the specifications described herein. Figure 61 through Figure 64 reflect detailed dimensions required.

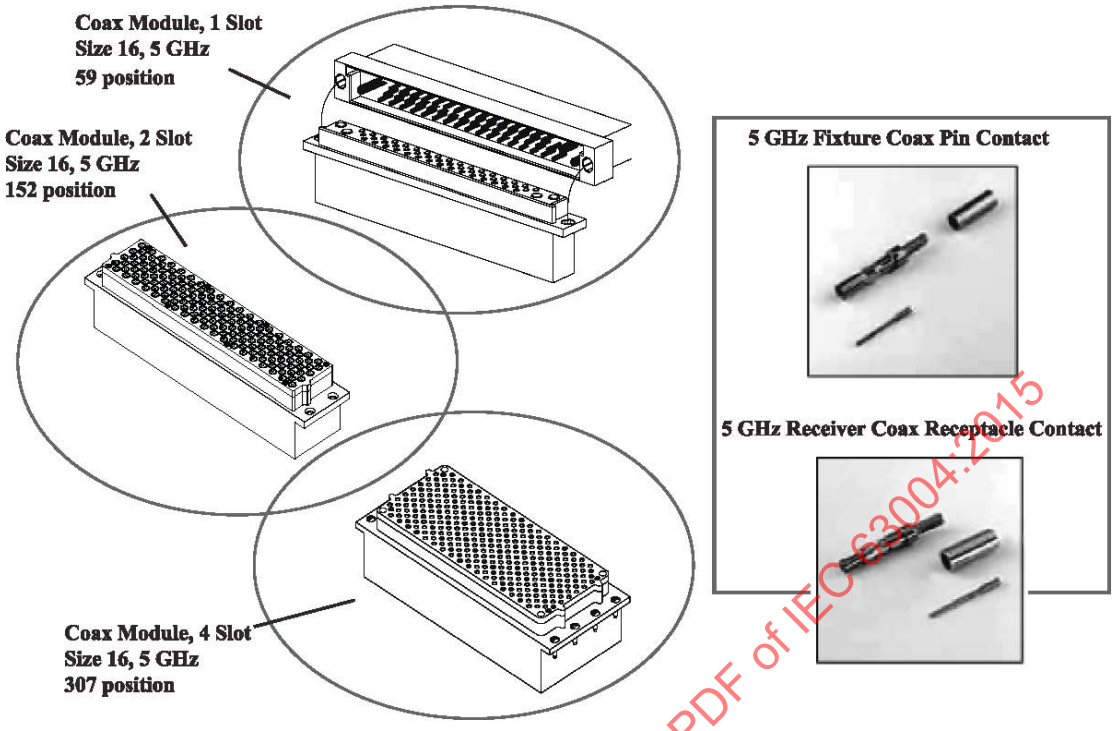


Figure 60—Coax module receiver and fixture assembly implementation

9.2.1 Specification relationships

Rule 9.2.1: The individual connector-type style requirements shall be as specified within this standard and in accordance with the applicable specification sheets, listed in Clause 9 of this specification. In the event of any conflict between the requirements of this document and the specification sheets, the latter shall govern.

9.3 Design and construction requirements

9.3.1 General requirements

Rule 9.3.1: Each connector module and related contact, as described in Figure 61 through Figure 64, shall meet all applicable connector specifications described in Clause 6, and requirements in Clause 4 unless otherwise specified hereafter.

9.3.2 Materials

Rule 9.3.2a: The identified reference materials, platings, and processes described in 4.2.2 shall be used to enable connectors manufactured to this document to mate to similar industry standard or government-specified connector systems with minimal problems related to electrochemical contamination of critical electrical or mechanical interfaces or generation of incompatible mechanical interface surface wear products.

Permission 9.3.2: The manufacturers of connectors supplied to this document may use alternate recognized industry standard materials, platings, and processes from those identified in 4.2.2 of this specification.

However, use of alternate materials, platings, and processes shall be coordinated with the qualifying activity as part of the qualification process.

Rule 9.3.2b: Use of alternates to those referenced guidance items by the supplier shall not result in inferior short- or long-term performance or reliability of supplied connectors as compared with connectors manufactured using the referenced materials, platings, or processes. Short- or long-term failures or reliability problems due to use of these alternates shall be the responsibility of the supplier.

9.3.3 Dimensions

Rule 9.3.3: Dimensions shall be in metric and referenced to inches where applicable.

9.3.4 Tolerances

Rule 9.3.4: Unless otherwise specified, tolerance is 0.13 mm (0.005 in) on decimals and ±2° on angles.

9.3.5 Related mating connector

Rule 9.3.5: Each connector described herein provides mating male (pin header), and female (receptacle) connector elements specified within this clause.

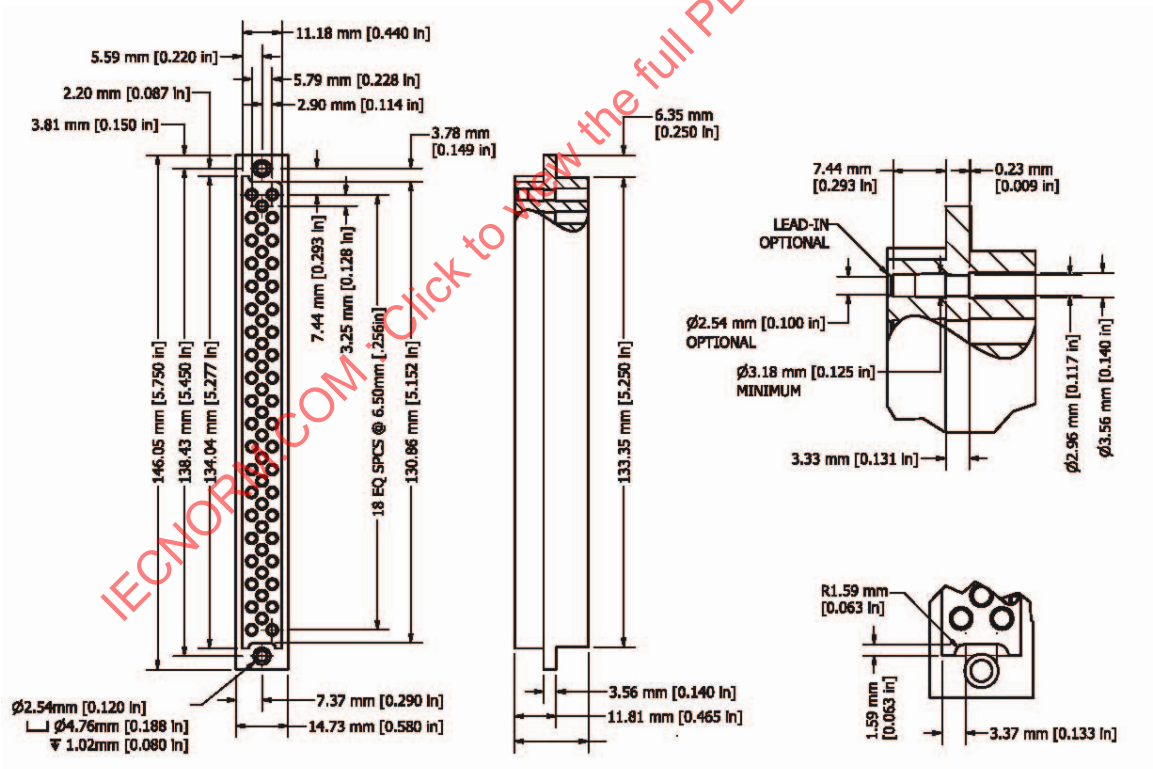


Figure 61—Coax module, 59 position for 5 GHz contact, receiver housing physical layout

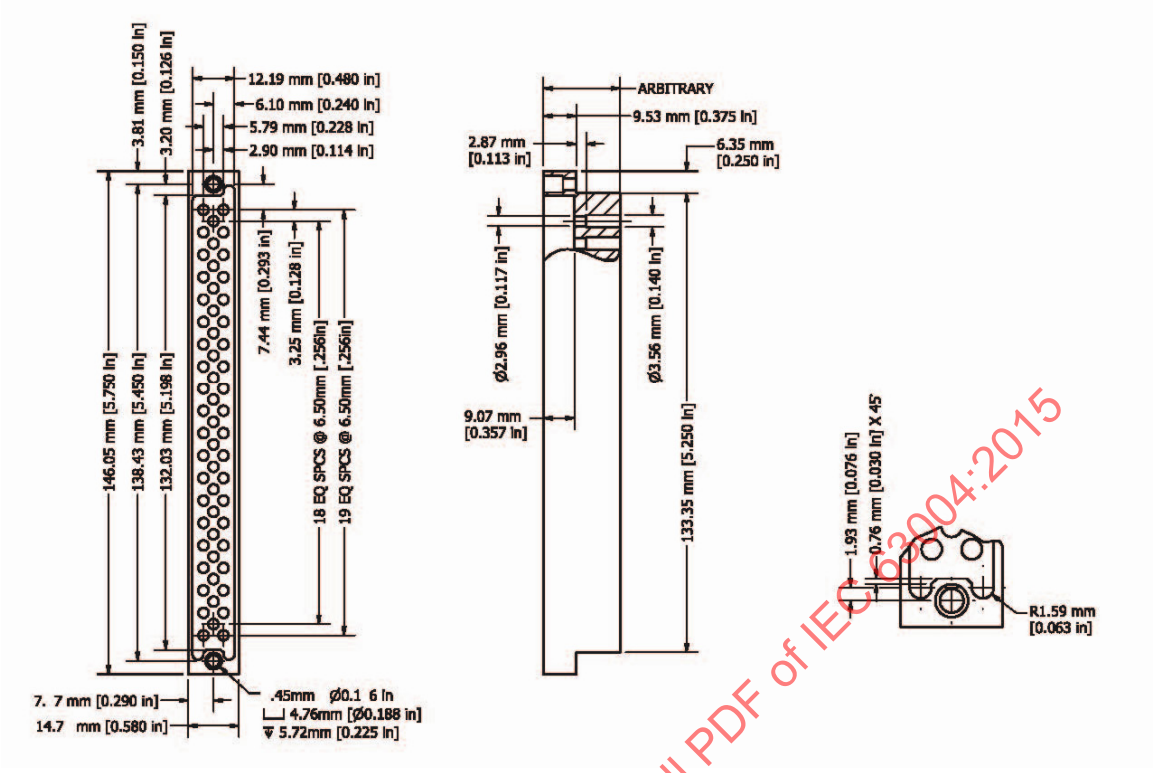


Figure 62—Coax module, 59 position for 5 GHz contact, fixture housing physical layout

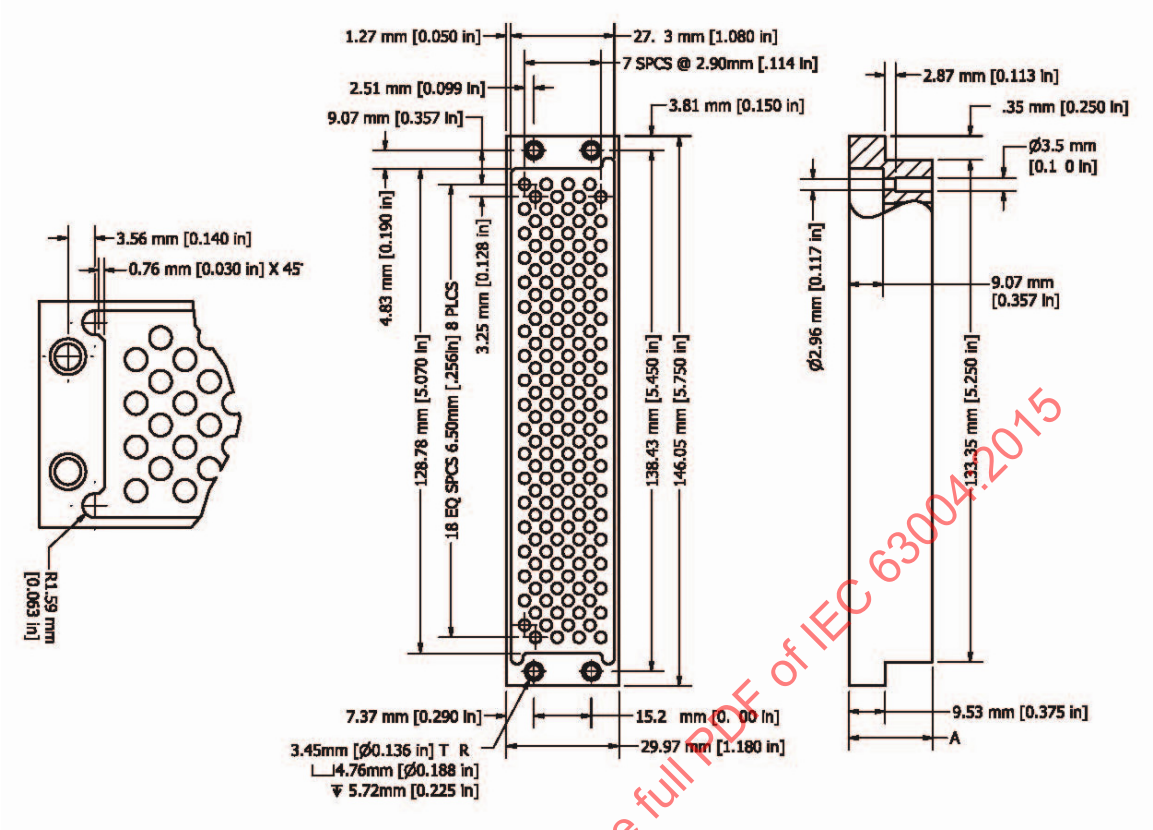


Figure 63—Coax module, 2 slot, 152 position for 5 GHz contact, fixture housing physical layout

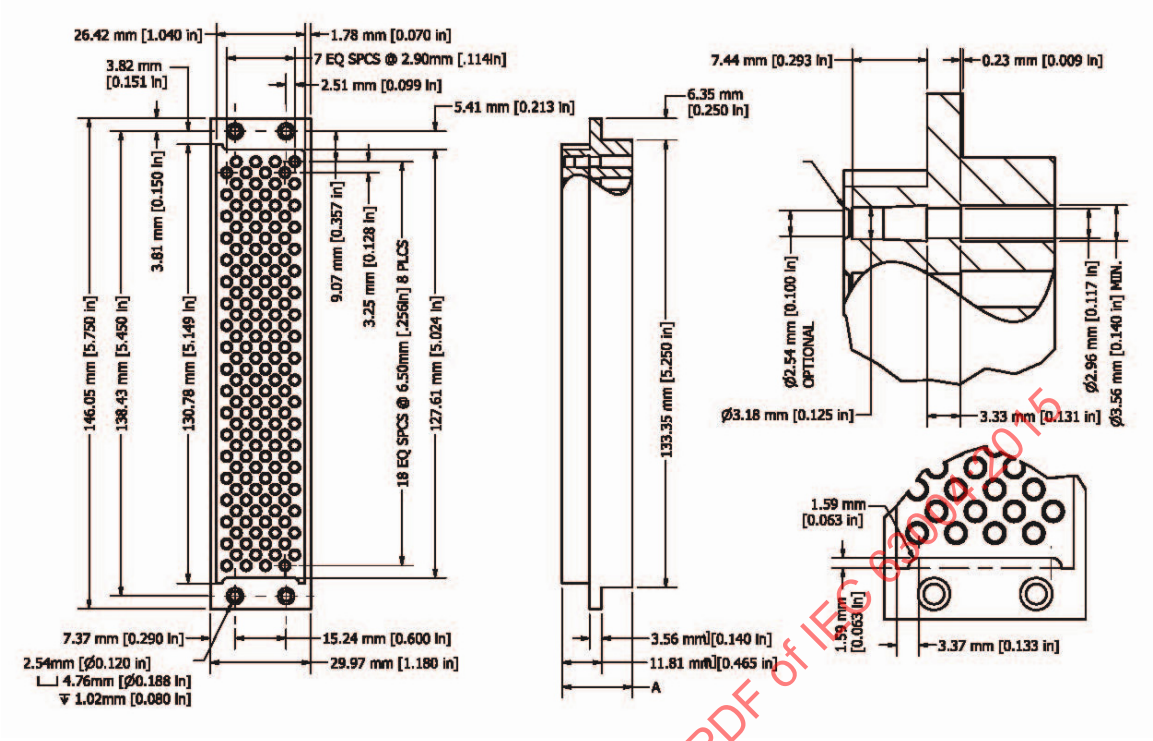


Figure 64—Coax module, 2 slot, 152 position for 5 GHz contact, receiver housing physical layout

9.3.6 Locator pin markings

Rule 9.3.6: Location indicators shall be marked with permanent paint or etched markings on surface. Numbers indicating end cavities, letters indicating row nearest to polarizing feature, and markings at each position shall be stamped or permanently labeled on this surface.

9.3.7 Chamfers

Rule 9.3.7: Chamfers shall be 0.38 mm (0.015 in) minimum at a 45° angle (see Figure 61 through Figure 64).

9.3.8 Keying

Permission 9.3.8: Two keys, Part or Identifying Number (PIU) MS5530Z/31-04, and two 0.086-56 UNC-2A mounting screws may be applied.

9.3.9 Jackscrews

Permission 9.3.9: Use M55302/182-1 1, -12, -13, -14, -15, or -16. Jackscrews may be applied.

9.3.10 Contact retention

Rule 9.3.10: Contact retention shall be 4.5 kg (10 lb) at a minimum.

9.3.11 Connector part or identifying number

Rule 9.3.11: Suffix to any manufacturing part number shall include the respective connector specification from Clause 7through Clause 12. Example: 555302/RFI.9.3.

9.4 Coax 5 GHz contact electrical specifications

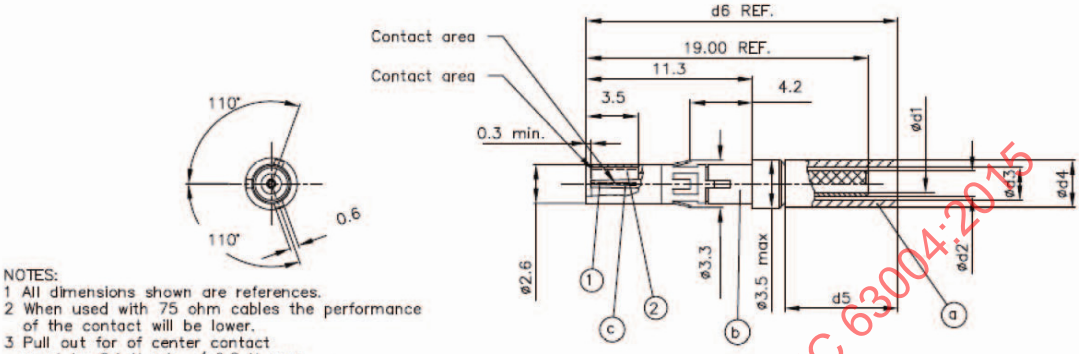
9.4.1 General

Rule 9.4.1: The coax 5 GHz size 16 contact shall meet the specifications described in Table 12 and physical dimensions illustrated in Figure 65 and Figure 66. Deviations from these definitions shall be noted by the vendor.

Table 12—Coax receiver/fixture size 16 contact specifications

Frequency range	DC to 5 GHz	
Bandwidth loss	<0.1 dB @ 2 GHz	
RF leakage (mated pair)	0.1 dB @ 2 GHz	
Crosstalk	>65 dB @ 100 MHz >60 dB @ 500 MHz >55 dB @ 1.3 GHz	
VSWR (mated pair)	<1.15:1 @ 2 GHz	
Characteristic impedance	50 Ω	
Insulation resistance	> 5000 MΩ	
Dielectric withstanding voltage	750 V	
Contact resistance	Initial	After environmental test
Center contact (mΩ)	3.5	4.2
Outer contact (mΩ)	0.45	0.6
Voltage rating	500 V	
Rise time degradation (corrected for board effects) at 300 ps	6 ps	
Difference in propagation delay between shortest and longest line	26 ps	
Near end crosstalk at 300 ps	0.2%	
Mechanical: Typical engagement force Typical disengagement force	680 g (24 oz) nominal 510 g (18 oz) nominal	
Temperature range	–25 °C to + 125 °C	
Material: Bodies Insulators Spring tabs	 Brass or bronze PTFE Beryllium copper	
Plating	Gold plated for contact zone	

CABLES	ød1	ød2	ød3	ød4	d5	d6	Remarks
RG 178B/U, RG196A/U TZC_50126	1.10	1.70	2.20	3.20	7.8	21.00	
RG188A/U, RG174A/U, RG316/U	1.70	2.50	2.90	3.60	9.0	22.20	
TZC_75106 (GORE CABLE) 75ohm	1.30	2.00	2.50	3.20	7.8	21.00	see note 2
RG 179 75ohm	1.70	2.50	2.90	3.60	9.0	22.20	see note 2
FILOTEX CABLE ALCATEL	1.30	2.00	2.50	3.20	7.8	21.00	see note 2



NOTES:
1 All dimensions shown are references.
2 When used with 75 ohm cables the performance of the contact will be lower.
3 Pull out for of center contact must be 0.1 N min. / 0.8 N max.
4 This product will be packed in a small plastic bag containing three lose parts, as follows.
a) Crimp Ferrule
b) Outer Contact
c) Inner Contact
5 Assemble product with tool HT430, use inserts EPL 193460 or EPL 193428.
6 THIS PRODUCT WITH "LF" SUFFIX MEETS EURPOEAN UNIONDIRECTIVES AND OTHER COUNTRY REGULATIONS AS DESCRIBED IN GS –22–008.
7 THE PRODUCT IS NOT INTENDEDTO BE EXPOSED TO A MANUFACTURING SOLDER PROCESS.

Figure 65—Coax receiver size 16 contact, physical layout

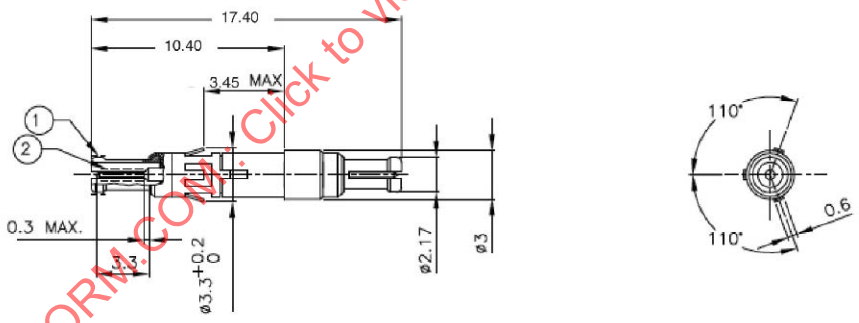


Figure 66—Coax receiver size 16 contact, physical layout

9.5 Coax 3 GHz contact electrical specifications

9.5.1 General

Rule 9.5.1: The coax 3 GHz size 16 contact shall meet the following specifications described in Table 13 and physical dimensions illustrated in Figure 67 and Figure 68. Deviations from these definitions shall be noted by the vendor.

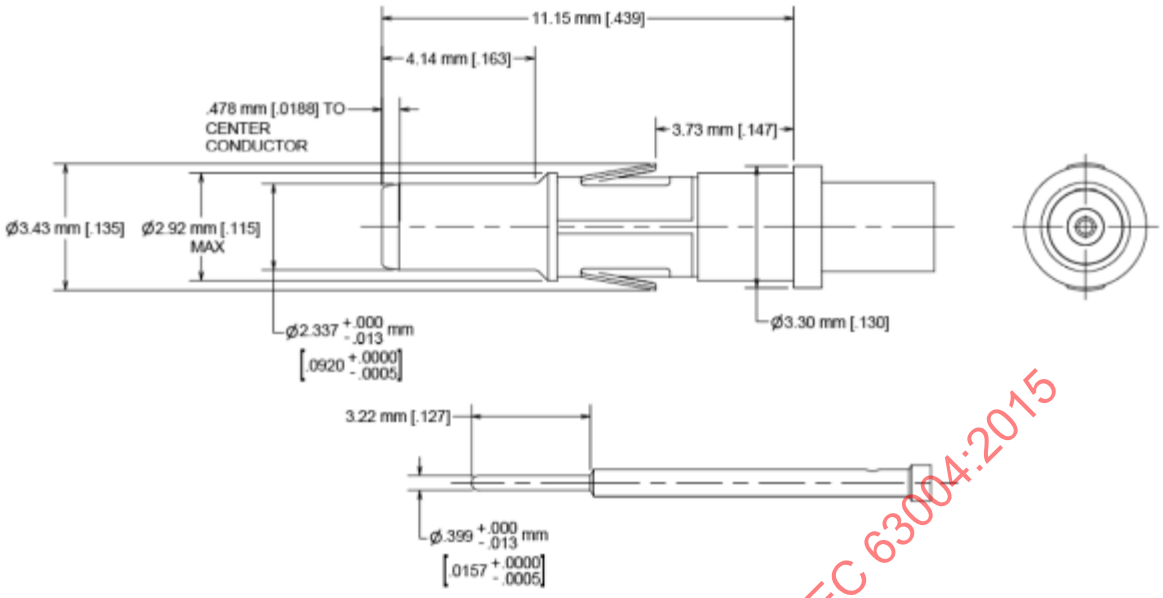


Figure 67—Coax fixture size 16 contact, physical layout

Table 13—Coax receiver/fixture size 16 contact, 3 GHz specifications

Frequency range	DC to 3 GHz
Bandwidth loss	<0.1 dB @ 2 GHz
RF leakage (mated pair)	0.1 dB @ 2 GHz
Crosstalk	>65 dB @ 100 MHz >60 dB @ 500 MHz >55 dB @ 1.3 GHz
Voltage standing wave ratio (VSWR) (mated pair)	<1.15:1 @ 2 GHz
Characteristic impedance	50 Ω
Insulation resistance	> 5000 MΩ
Dielectric withstanding voltage	750 V
Contact resistance Center contact (mΩ) Outer contact (mΩ)	Initial 3.5 0.45 After environmental test 4.2 0.6
Voltage rating	500 V
Rise time degradation (corrected for board effects) at 300 ps	6 ps
Difference in propagation delay between shortest and longest line	26 ps

Table 13—Coax receiver/fixture size 16 contact, 3 GHz specifications *(continued)*

Near end crosstalk at 300 ps	0.2%
Mechanical: Typical engagement force Typical disengagement force	 680 g (24 oz) nominal 567 g (20 oz) nominal
Temperature range	–25°C to +125°C
Material: Bodies Insulators spring tabs	 Brass or bronze PTFE Beryllium copper
Plating	Gold plated for contact zone

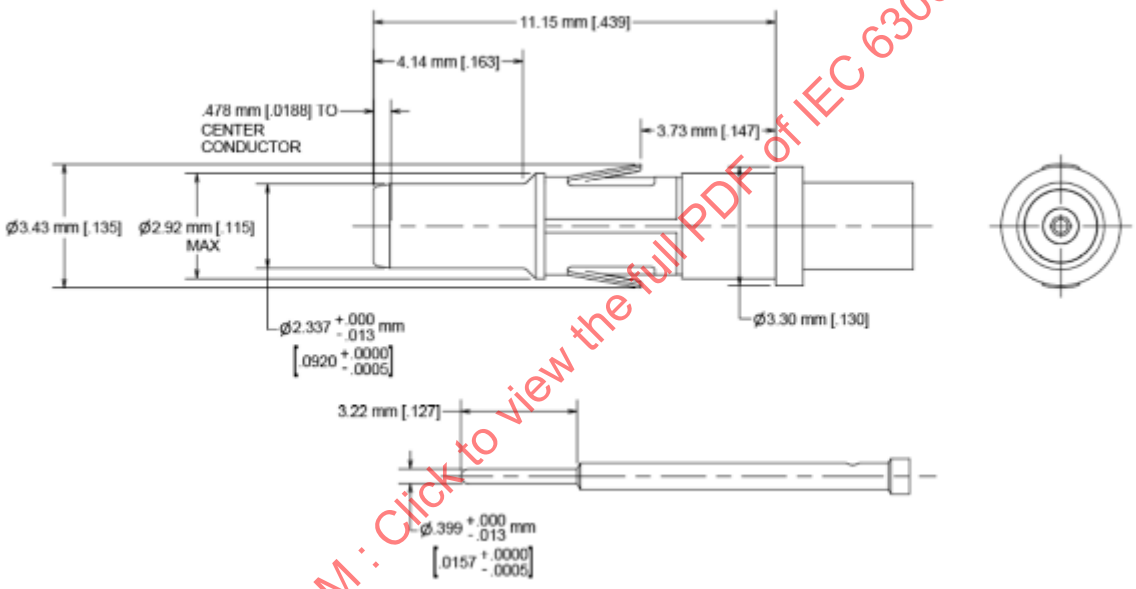


Figure 68—Coax fixture size 16 contact, physical layout

9.6 Method of examination and test

9.6.1 Visual and mechanical examination

Rule 9.6.1: Examination shall be made to determine compliance with 4.5 in this document.

9.6.1.1 Interchangeability

Rule 9.6.1.1: Physical configuration and dimensional measurements shall meet the requirements of 4.6.2.1 and as specified in the related specification supplemental paragraphs.

9.6.2 Contact pin size, engagement and separation force measurement

Rule 9.6.2: Sockets (contacts) shall be mounted in a suitable position or fixture for applying gradually increasing loads for the engagement and separation of the test pin from the sockets (contacts). Maximum

and minimum size test pins as specified in Table 14 shall be in accordance with MS3 197. Insertion of test pins shall be to a minimum depth of 2.54 ± 0.508 mm (0.100 ± 0.020 in) when measured from the front of the socket contact. The test pin shall not bottom in the socket contact. This test shall be performed in the sequence as specified in method 2014 of MIL-STD-1344A.

9.6.3 Mating and unmating

Rule 9.6.3: After three cycles of insertion and withdrawal, the force required to fully insert and withdraw a plug from the receptacle shall be measured and conform to the requirements listed in Table 14. Each plug and receptacle so mated shall be considered as one test specimen where further testing of the plug or receptacle is indicated. The measuring equipment shall conform to the following rules:

a) **Rule 9.6.3a:** The axis of insertion of the pin contacts and mating receptacle contacts or hermaphroditic contacts as applicable shall coincide during insertion and withdrawal.

b) **Rule 9.6.3b:** The speed of insertion of the plug into the receptacle contacts shall not exceed 10 cycles per minute for constant speed machines, or the rate of loading shall not exceed 36.3 kg (80 lb) per minute for constant-rate-of-force machines.

c) **Rule 9.6.3c:** Scale mechanisms shall have no dashpots or other damping devices.

d) **Rule 9.6.3d:** Scales shall be calibrated in 57 g (2 oz) steps or less and shall be accurate to within 57 g (2 oz).

NOTE—When mating and unmating tests are required by another test such as contact life, *the preconditioning cycles are not required.*

Table 14—Coax contact size, engagement, and separation force test requirements

Contact size	Pin diameter mm (in)	Tolerance (mm/in)	Engagement max force (g/oz)	Separation max force (g/oz)
16	1.65 (0.065)	+0.0254 (0.001)	680 (24)	510 (18)

9.6.4 Contact durability/cycle test

Rule 9.6.4a: To meet IEEE 1505 requirements, each manufacturer shall subject the test specimen receiver and fixture connector to a *durability cycle test* in accordance with 4.6.2.7. A minimum durability cycle objective of 10 000 repetitions is required, unless otherwise defined in the respective connector/contact requirements (see Clause 7 through Clause 12).

Rule 9.6.4b: When tested in accordance with this document's requirements (see 4.6.2.4), connectors shall show no evidence of cracking or breaking, the contact resistance requirements (see 6.19) shall not be exceeded, and mating and unmating requirements (see 6.17) shall be met.

10. Mixed power connector module, 28-10 A and 16-20 A positions

10.1 Introduction

Clause 10 and the related Clause 6 of this standard describe specifications for developing and integrating mixed power module connector, receptacle, and pin assembly; contacts and accessories with mixed

configuration of 28 positions, 10A contacts in three rows; and 16 positions, 20A contacts in two rows that support discrete wiring applications.

10.2 General specifications

Rule 10.2: The following subclauses and illustrations describe general specifications for the RFI mixed power module connector, receptacle, and pin assembly. The information presented in Clause 10 is not stand-alone and shall coexist with that presented in Clause 6 and conform to this document's requirements in Clause 4.

The design and physical layout of the RFI mixed power module connector, receptacle, and pin assembly are shown in Figure 69 and Figure 70. The design and physical layout of the RFI mixed power module contacts are shown in Figure 71 and Figure 72.

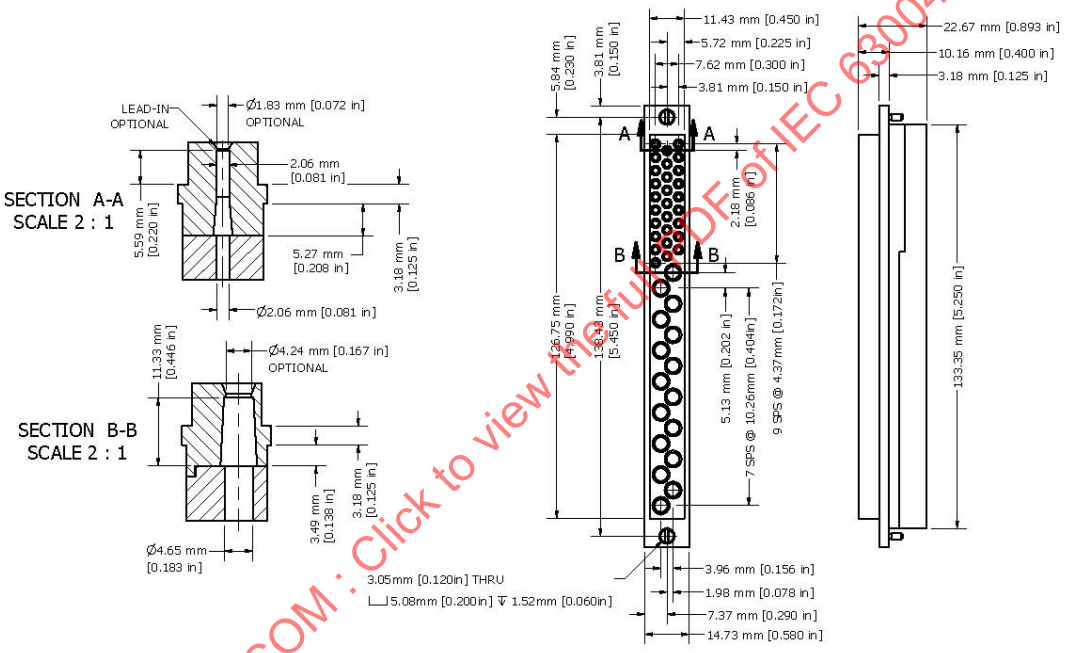


Figure 69—Mixed power module connector, 28-10 A/1 6-20 A position, receiver housing physical layout

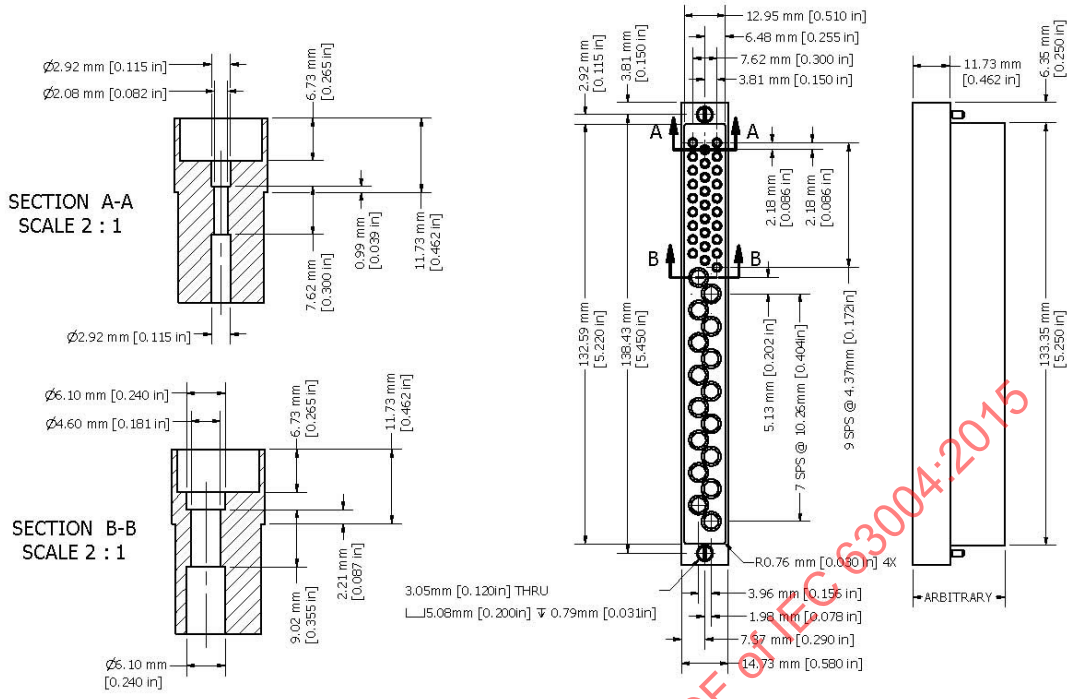


Figure 70—Mixed power module connector, 28-10 A/1 6-20 A position, fixture housing physical layout

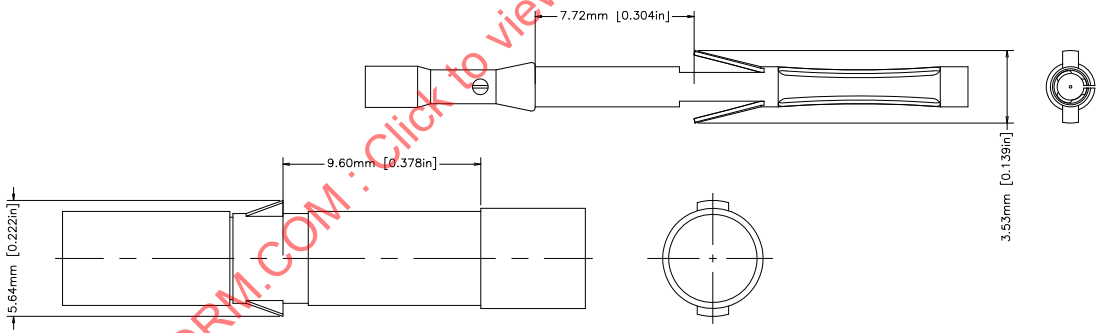


Figure 71—Mixed power module connector, 28-10 A/1 6-20 A position, receiver receptacle contact

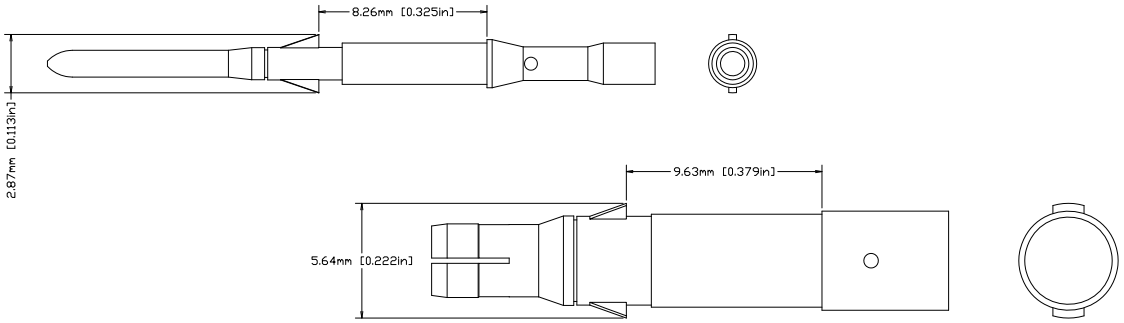


Figure 72—Mixed power module connector, 28-10 A/1 6-20 A position, fixture pin contact

10.3 Design and construction requirements

10.3.1 General requirements

Rule 10.3.1: Each connector shall meet all applicable connector specifications described in 6.6 and related qualifications, unless otherwise specified hereafter.

10.3.2 Materials

Rule 10.3.2a: The identified reference materials, platings, and processes described in 4.2.2 shall be used to enable connectors manufactured to this document to mate to similar industry standard or government-specified connector systems with minimal problems related to electrochemical contamination of critical electrical or mechanical interfaces or generation of incompatible mechanical interface surface wear products.

Permission 10.3.2: The manufacturers of connectors supplied to this document may use alternate recognized industry standard materials, platings, and processes from those identified in 4.2.2 of this specification. However, use of alternate materials, platings, and processes shall be coordinated with the qualifying activity as part of the qualification process.

Rule 10.3.2b: Use of alternates to those referenced guidance items by the supplier shall not result in inferior short- or long-term performance or reliability of supplied connectors as compared with connectors manufactured using the referenced materials, platings, or processes. Short- or long-term failures or reliability problems due to use of these alternates shall be the responsibility of the supplier.

10.3.3 Dimensions

Rule 10.3.3: Dimensions are shown in metric and referenced to inches in parentheses per Figure 68 through Figure 72.

10.3.4 Tolerances

Rule 10.3.4: Unless otherwise specified, tolerance is 0.13 mm (0.005 in) on decimals and ±2° on angles.

10.3.5 Related mating connector

Rule 10.3.5: These connectors shall mate as a mating set only with connector assemblies and contacts defined within this specific clause.

10.3.6 Locator pin markings

Rule 10.3.6: Location indicators shall be marked with permanent paint or etched markings on the surface. Numbers indicating end cavities, letters indicating row nearest to polarizing feature, and markings at each position shall be stamped or permanently labeled on this surface.

10.3.7 Chamfers

Rule 10.3.7: Chamfers shall be 0.38 mm (.015 in) minimum at a 45° angle (see Figure 68 through Figure 72).

10.3.8 Keying

Permission 10.3.8: Two keys, Part or Identifying Number (PIU) MS5530Z/31-04, and two 0.086-56 UNC-2A mounting screws may be applied.

10.3.9 Mating and unmating

Rule 10.3.9: The maximum mating/unmating force shall be the number of contacts multiplied by the following:

a) For 10 A contact, the engagement force of 680 g (24 oz), and the separation force of 510 g (18 oz)

b) For 20 A contact, the engagement force of 1361 g (36 oz), and the separation force of 1134 g (30 oz)

10.3.10 Contact retention

Rule 10.3.10: Contact retention shall be 4.5 kg (10 lb) at a minimum.

10.3.11 Wire-wrap post and contact design

Rule 10.3.11 Wire-wrap post and contacts shall be in accordance with MIL-STD-1130.

10.3.12 Connector part or identifying number

Rule 10.3.12: Suffix to any manufacturing part number shall include the respective connector Clause 10 specification. Example: 555302/RFI 10.3.

10.4 Electrical specifications

10.4.1 Current rating 10/20 A contact

Rule 10.4.1: Current rating of the contacts shall be at a maximum of 10.0 A and 20.0 A, respectively, per contact and 2.25 A and 10.0 A continuous per contact at room ambient with no more than two adjacent contacts carrying this current without exceeding a 10 °C rise in temperature surrounding the contacts.

10.4.2 Contact resistance

Rule 10.4.2: No individual contact pair shall have a resistance exceeding 8 mΩ initially and 10 mΩ after testing.

10.4.3 Contact dielectric withstanding voltage

Rule 10.4.3: Contact dielectric withstanding voltage shall be as follows:

- **At sea level:** 900 V rms
- **At 21 336 m (70 000 ft):** 200 V rms
- **Maximum leakage current:** 2 mA

10.4.4 Contact durability/cycle test

Rule 10.4.4a: To meet IEEE 1505 requirements, each manufacturer shall subject the test specimen receiver and fixture connector to a durability cycle test in accordance with 4.6.2.7. A minimum durability cycle objective of 10 000 repetitions is required, unless otherwise defined in the respective connector/contact requirements (see Clause 7 through Clause 12).

Rule 10.4.4b: When tested in accordance with this document's requirements (see 4.6.2.6), connectors shall show no evidence of cracking or breaking, the contact resistance requirements (see 6.19) shall not be exceeded, and mating and unmating requirements (see 6.17) shall be met.

11. Universal size 8 connector D-Sub compatible module, 24 position

11.1 Introduction

Clause 11 and the related Clause 6 in this standard describe specifications for developing and integrating universal size 8 D-Sub compatible module connector, receptacle and pin assembly, contacts and accessories with 24 positions, in two staggered rows that support mixed coaxial, power, pneumatic, or fiber discrete wiring applications.

11.2 General specifications

The following subclauses and illustrations describe general specifications for the universal size 8 D-Sub compatible module connector, receptacle, and pin assembly.

Rule 11.2: The information presented in Clause 11 is not stand-alone and shall coexist with that presented in Clause 6 and conform to this document's requirements in Clause 4.

The design and physical layout of the universal size 8 D-Sub compatible module connector, receptacle, and pin assembly are shown in Figure 73 and Figure 74.

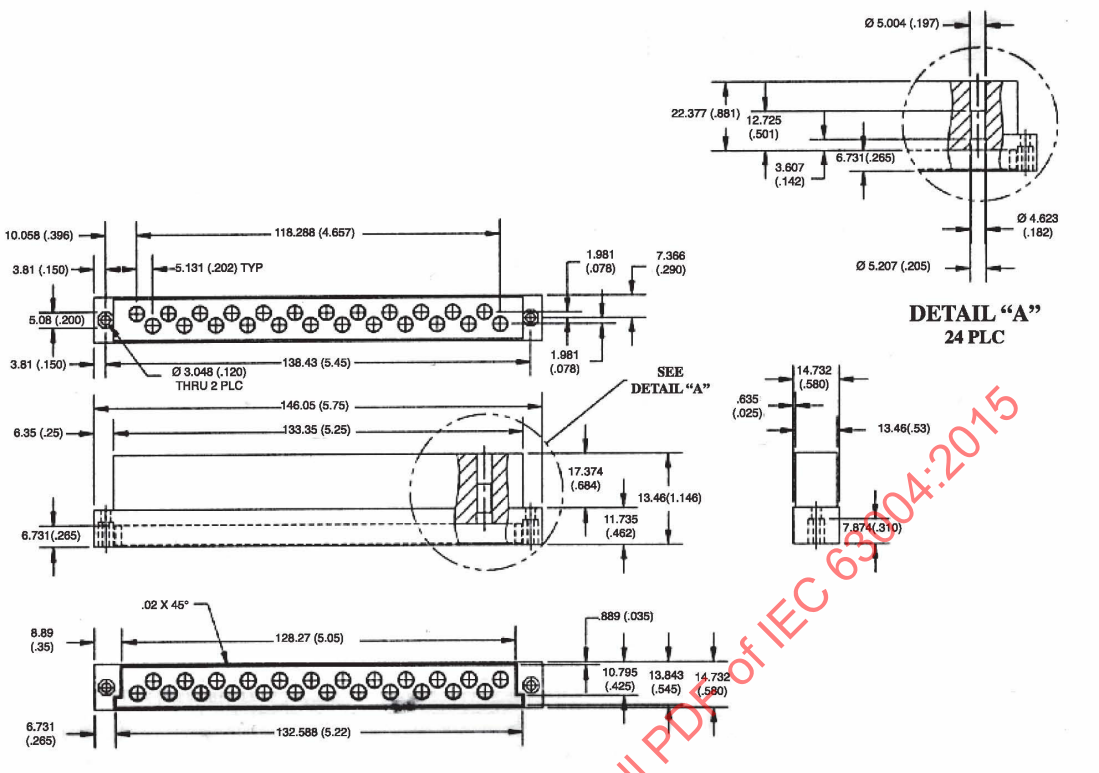


Figure 73—Universal size 8 D-Sub compatible module connector, 24 position, receiver housing physical layout

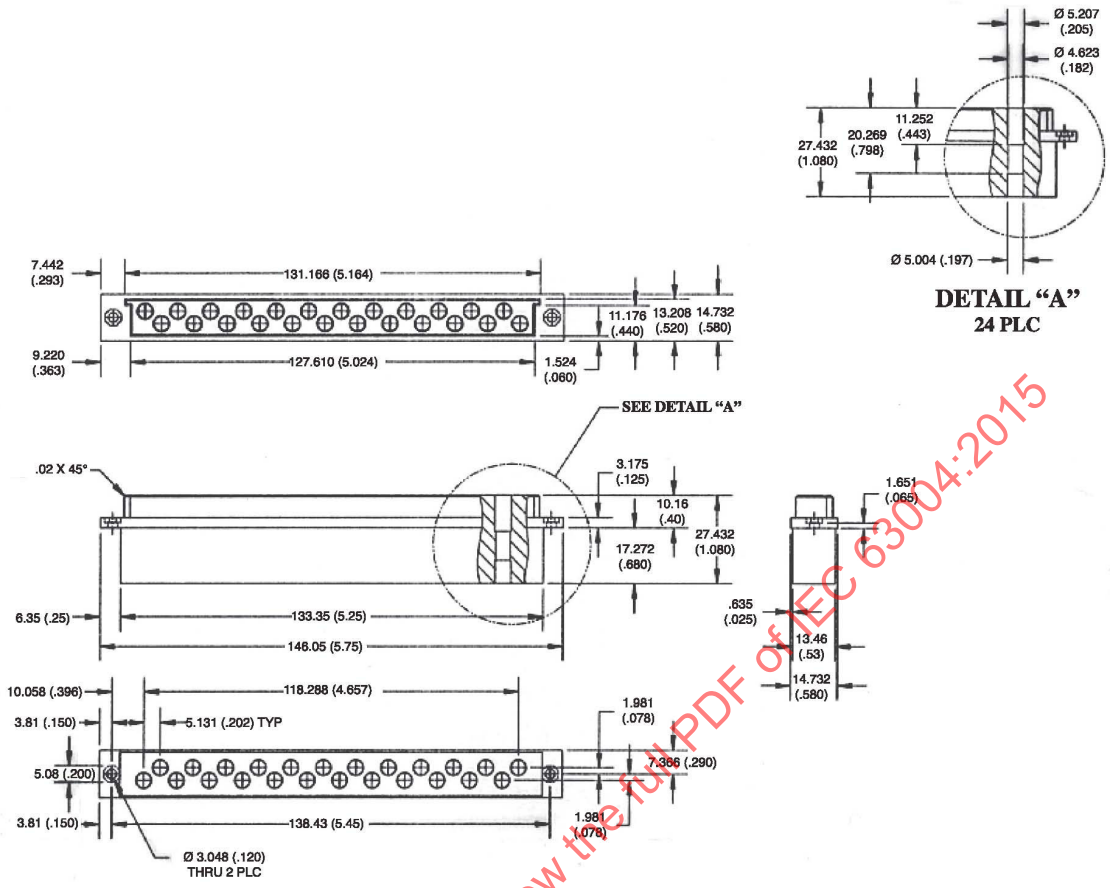


Figure 74—Universal size 8 D-Sub compatible module connector, 24 position, fixture housing physical layout

11.3 Design and construction requirements

11.3.1 General requirements

Rule 11.3.1: Each connector shall meet all applicable connector specifications described in 6.6, Figure 73, Figure 74, and related qualifications, unless otherwise specified hereafter.

11.3.2 Materials

Rule 11.3.2a: The identified reference materials, platings, and processes described in 4.2.2 shall be used to enable connectors manufactured to this document to mate to similar industry standard or government-specified connector systems with minimal problems related to electrochemical contamination of critical electrical or mechanical interfaces or generation of incompatible mechanical interface surface wear products.

Permission 11.3.2: The manufacturers of connectors supplied to this document may use alternate recognized industry standard materials, platings, and processes from those identified in 4.2.2 of this specification. However, use of alternate materials, platings, and processes shall be coordinated with the qualifying activity as part of the qualification process.

Rule 11.3.2b: Use of alternates to those referenced guidance items by the supplier shall not result in inferior short- or long-term performance or reliability of supplied connectors as compared with connectors manufactured using the referenced materials, platings, or processes. Short- or long-term failures or reliability problems due to use of these alternates shall be the responsibility of the supplier.

11.3.3 Dimensions

Rule 11.3.3: Dimensions shall be in inches and referenced to metric per Figure 73 and Figure 74, and in accordance with applicable MIL-C-24308C.

11.3.4 Tolerances

Rule 11.3.4: Unless otherwise specified, tolerance shall be 0.13 mm (0.005 in) on decimals and ±2° on angles.

11.3.5 Related mating connector

Rule 11.3.5: These connectors shall mate as a mating set only with connector assemblies and contacts defined within this specific standard.

11.3.6 Locator pin markings

Rule 11.3.6: Location indicators shall be marked with permanent paint or etched markings on the surface. Numbers indicating end cavities, letters indicating row nearest to polarizing feature, and markings at each position shall be stamped or permanently labeled on this surface.

11.3.7 Chamfers

Rule 11.3.7: Chamfers shall be 0.38 mm (0.015 in) minimum at a 45° angle (see Figure 73 and Figure 74).

11.3.8 Keying

Permission 11.3.8: Two keys, Part or Identifying Number (PIU) MS5530Z/31-04, and two 0.086-56 UNC-2A mounting screws may be applied.

11.3.9 Contact retention

Rule 11.3.9: Contact retention shall be 4.54 kg (10 lb) at a minimum.

11.3.10 Connector part or identifying number

Rule 11.3.10: Suffix to any manufacturing part number shall include the respective connector Clause 11 specification. Example: 555302/RFI 11.3.

11.3.11 Electrical specifications

11.3.11.1 Contact resistance

Rule 11.3.11.1a: No individual coax contact shall have a resistance exceeding 5 mΩ for center contact and 3 mΩ for outer contact, and 8 mΩ and 10 mΩ after testing.

Rule 11.3.11.1b: No individual power contact shall have a resistance exceeding 3 mΩ for contact; and 8 mΩ after testing.

11.3.11.2 Contact dielectric withstanding voltage

Rule 11.3.11.2: Contact dielectric withstanding voltage shall be as shown in the following table.

	At sea level	At 21 336 m (70 000 ft)	Maximum leakage current
RG-402/U cable [3.58 mm (0.141 in) O.D.]	500 V rms at 60 Hz	125 V rms at 60 Hz	2 mA
RG-405/U cable [2.18 mm (0.086 in) O.D.]	335 V rms at 60 Hz	85 V rms at 60 Hz	2 mA

11.3.11.3 Coax contact impedance/insulation resistance

Rule 11.3.11.3: Coax contact shall maintain a 50 ~ nominal impedance and insulation resistance of 5000 ~ minimum.

11.3.11.4 Coax contact frequency bandwidth/standing wave ratio (SWR)

Rule 11.3.11.4: Coax contact shall provide a 0 GHz to 40.0 GHz frequency bandwidth and voltage SWR from 20.0 GHz for straight connector using semi-rigid or RG-402/U or FLL cable or FLL cable: 1.15 GHz +0.02F GHz on RG-316 cable and straight connector: 1.15 GHz +0.01F GHz on 3.58 mm (0.141 in) diameter semi-rigid cable.

11.3.12 Environmental

Rule 11.3.12: Contact shall meet the following environmental requirements:

- **Operating Temperature:** –55 °C to +125 °C
- **Vibration:** MIL-STD-202G, Method 204, Test Condition D
- **Shock:** MIL-STD-202, Method 213, Test Condition I
- **Corrosion resistance:** MIL-STD-202G, Method 101, Condition B

11.3.13 Visual and mechanical examination

Rule 11.3.13: Examination shall be made to determine compliance with this document's requirements in 4.5.

11.3.14 Interchangeability

Rule 11.3.14: Physical configuration and dimensional measurements shall meet the requirements of 4.6.2.1 and those specified in the related specification requirements.

11.3.15 Contact pin size, engagement, and separation force measurement

Rule 11.3.15: Sockets (contacts) shall be mounted in a suitable position or fixture for applying gradually increasing loads for the engagement and separation of the certified test pin from the sockets (contacts). Maximum and minimum size test pins as specified in Table 15 shall be in accordance with MS3 197.

Insertion of test pins shall be to a minimum depth of 2.54 mm (0.100 in) ± 0.5 mm (0.020 in) when measured from the front of the socket contact. The test pin shall not bottom in the socket contact. This test shall be performed in the sequence as specified in Method 2014 of MIL-STD-1344A.

Table 15—Coax contact size, engagement, and separation force test requirements

Contact size	Pin diameter	Pin tolerance	Engagement max force	Separation max force
8	5.72 mm (0.225 in)	±0.076 mm (0.003 in)	1.36 kg (3.0 lb)	1.13 kg (2.5 lb)

11.3.16 Mating and unmating

Rule 11.3.16: After three cycles of insertion and withdrawal, the force required to fully insert and withdraw a plug from the receptacle shall be measured and conform to the requirements listed in Table 15. Each plug and receptacle so mated shall be considered as one test specimen where further testing of the plug or receptacle is indicated. The measuring equipment shall conform to the following rules:

a) **Rule 11.3.16a:** The axis of insertion of the pin contacts and mating receptacle contacts or hermaphroditic contacts as applicable shall coincide during insertion and withdrawal.

b) **Rule 11.3.16b:** The speed of insertion of the plug into the receptacle contacts shall not exceed 10 cycles per minute for constant-speed machines, or the rate of loading shall not exceed 36.3 kg (80 lb) per minute for constant-rate-of-force machines.

c) **Rule 11.3.16c:** Scale mechanisms shall have no dashpots or other damping devices.

d) **Rule 11.3.16d:** Scales shall be calibrated in 57 g (2 oz) steps or less, and shall be accurate to within 57 g (2 oz).

NOTE—When mating and unmating tests are required by another test such as contact life, the preconditioning cycles are not required.

11.3.17 Contact durability/cycle test

Rule 11.3.17a: To meet IEEE 1505 requirements, each manufacturer shall subject the test specimen receiver and fixture connector to a durability cycle test in accordance with 4.6.2.7. A minimum durability cycle objective of 10 000 repetitions is required, unless otherwise defined in the respective connector/contact requirements (see Clause 7 through Clause 12).

Rule 11.3.17b: When tested in accordance with this document's requirements (see 4.6.2.6), connectors shall show no evidence of cracking or breaking, the contact resistance requirements (see 6.19) shall not be exceeded, and mating and unmating requirements (see 6.17) shall be met.

11.4 Coax 40 GHz, size 8, D-Sub compatible, contact

The coax size 8, D-Sub compatible contact may be integrated into the DIN cavity of the universal modules provides a 40 GHz capability to meet a wide range of RF requirements. Using a blind-mate, spring-loaded design, the mating contacts can be consistently mated and maintained a constant interconnect under varying stroke conditions.

11.5 Power 45-A, size 8, D-Sub compatible contact

The coax size 8, D-Sub compatible contact as referenced in 8.5 may be integrated into the DIN cavity of the universal modules provides a 45 A capability to meet high performance power requirements. All applicable references related to 8.5 power contacts shall be adhered to within the Clause 11 requirements.

11.6 Pneumatic, size 8, D-Sub compatible, contact

The pneumatic size 8, D-Sub compatible contact integrated into the DIN cavity of the universal modules provides 10 cfm at 50 psi capability to meet a wide range of pneumatic requirements. Using a blind-mate, double-grommet design, the mating contacts can be consistently mated and have a constant interconnect under varying stroke conditions.

11.7 Fiber-optic, size 8, D-Sub compatible, contact specifications

The fiber-optic size 8, D-Sub compatible contact integrated into the DIN cavity of the universal modules is a MU (single mode) (multi-mode) design, employing 2 mm, 900 µm fiber type capability to meet a wide range of fiber-optic requirements. Using a blind-mate, spring-loaded design, the mating contacts can be consistently mated and have a constant interconnect under varying stroke conditions.

12. High-speed signal module

12.1 Introduction

Clause 12 and Clause 6 of this document describe specifications for developing and integrating RFI high-speed signal module receptacle and pin connector assembly, connector saver receiver module, contacts, and accessories. Each module houses two connector plugs, with each plug having 6 rows by 25 pins for a 150-pin configuration, for a total of 300 contact positions per connector module, supporting discrete wire or two-wire coaxial wiring, in vertical mount, or right-angle printed wiring board (PWB) scheme.

12.2 General specifications

Rule 12.2: The high-speed signal module receptacle receiver and fixture plug connector assembly shall conform to the following subclauses and illustrations. These design specifications provided address connector/contact physical dimensions, vertical interconnect scheme implementations, electrical and environmental performance specifications, and applicable PCB layout requirements. The information presented in Clause 12 is not stand-alone and shall coexist with the information presented in Clause 6, and conform to the related qualification requirements in Clause 4.

Figure 75 presents implementations of the high-speed signal module connector plug and receptacle assembly under the specifications described herein. Figure 76, Figure 77, and Figure 78 reflect detailed dimensions required.

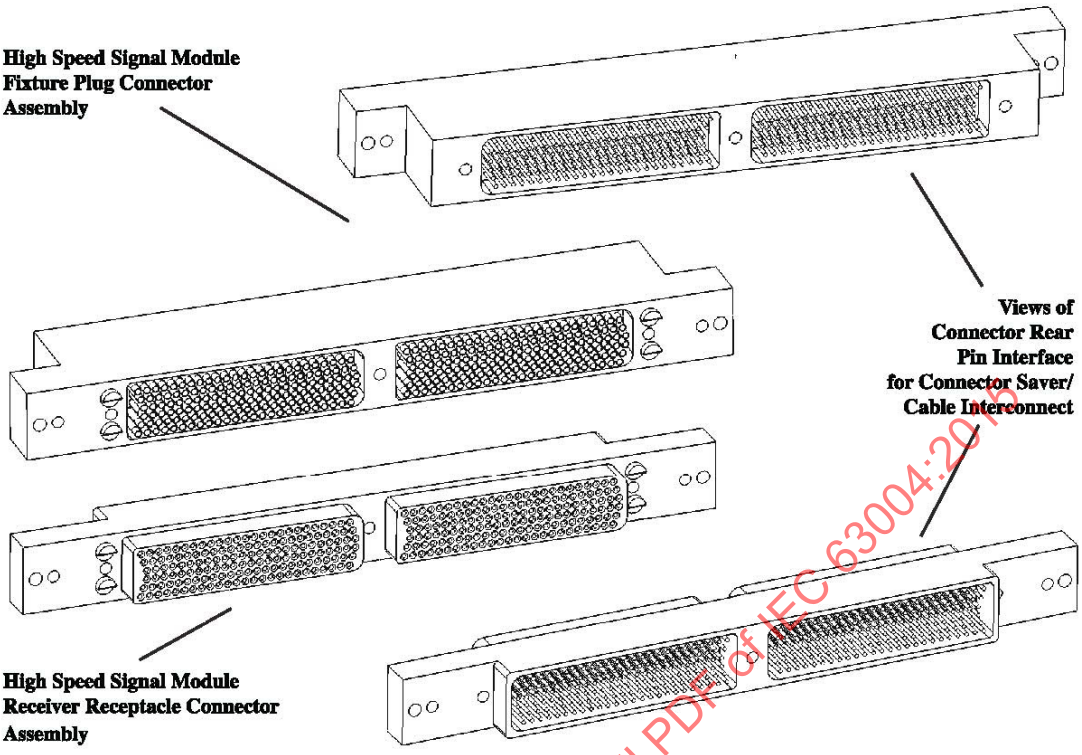


Figure 75—High-speed signal module connector pin and receptacle assembly implementation

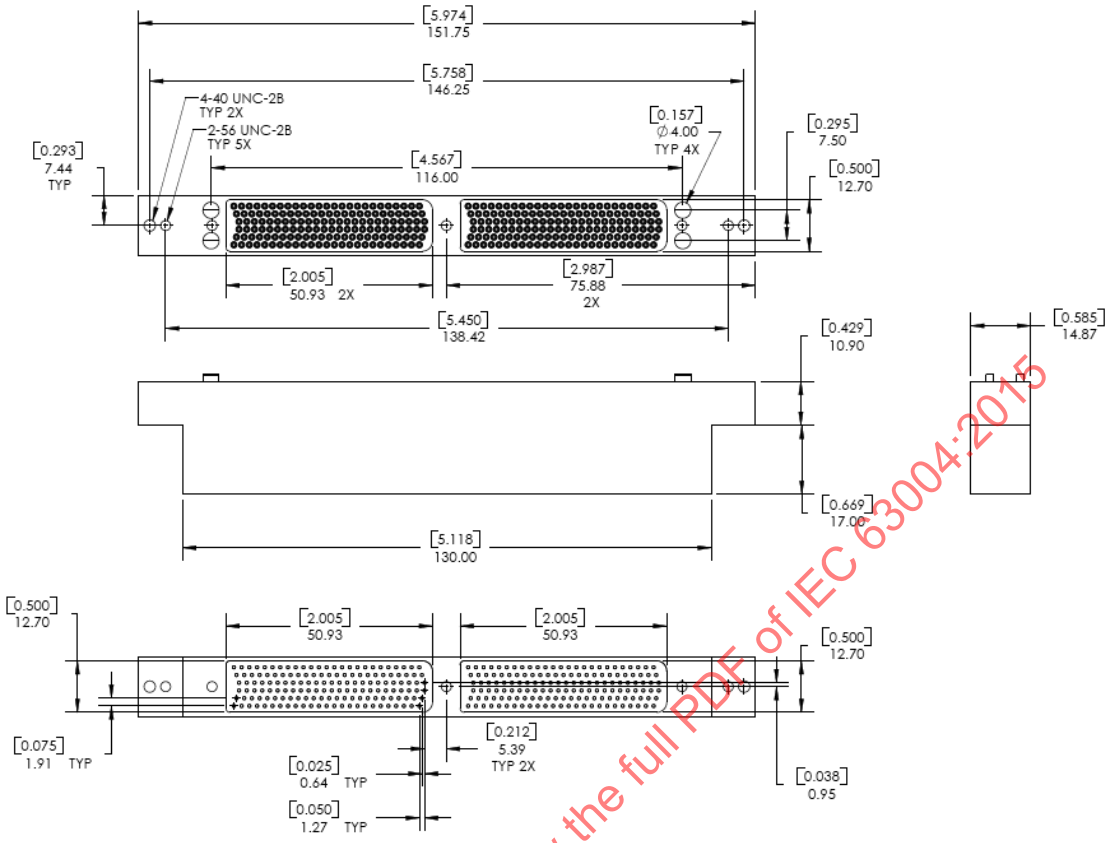


Figure 76—High-speed signal module receiver receptacle connector assembly dimensional specifications

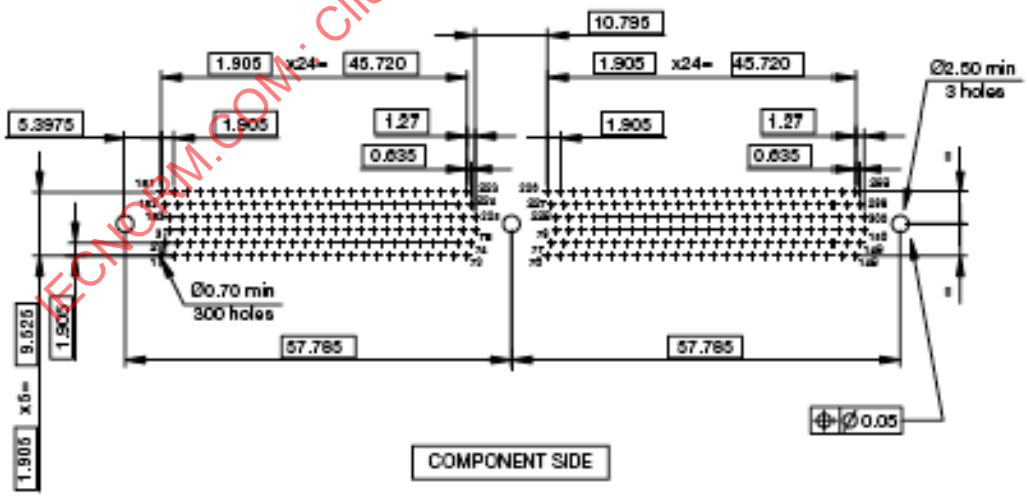


Figure 77—High-speed signal module receiver receptacle connector assembly PCB pin tail layout dimensional specifications