

# QwikConnect

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## Mil-Aero Connector Reference Guide




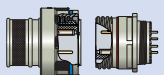

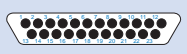
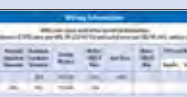



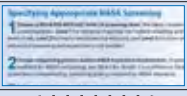
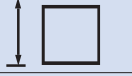



# Welcome Interconnect Professionals

High-performance MS type electrical connectors have been around since the late '30s. As military and aerospace electronics became more prevalent and sophisticated, so did the requirements for interconnection devices. Today, a broad range of circular and rectangular connector types—many specialized for land, sea, air and space applications—are used for the interconnection of electronic systems, sensors, power supplies and other equipment that depend on reliable performance and standards-body guarantees for performance and quality.

In this special update edition of *QwikConnect*—which we think you'll agree belongs in your permanent reference library—we are happy to provide you with some of the most essential information for use in identifying and specifying MS type connectors and accessories.

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# MS Connector Types—Circular

## Cable Plugs and In-line Receptacles

Environmental cable plugs and in-line receptacles are the ruggedized cable-mounted halves of I/O connector pairs. These “free hanging,” or cable connectors, are equipped with coupling rings or other mating technologies to effect reliable and repeatable interconnections. Coupling styles include various threaded configurations as well as bayonet, breech-lock, push-pull, lanyard release, and others. In-line receptacles facilitate daisy-chaining of cables.

## Box- and Panel-Mounted Receptacles

The other half of an I/O interconnect assembly is the box, flange, or wall-mounted receptacle. These connector halves are characterized by their flange or mounting style (typically jam-nut mount or square-flange with fasteners) and their front or rear mount position vis-a-vis the box or panel. Crimp contact versions as well as wired pigtailed versions are available, but the most common configuration utilizes PC tail terminations for direct attachment to a circuit board.

## Bulkhead Feed-Throughs

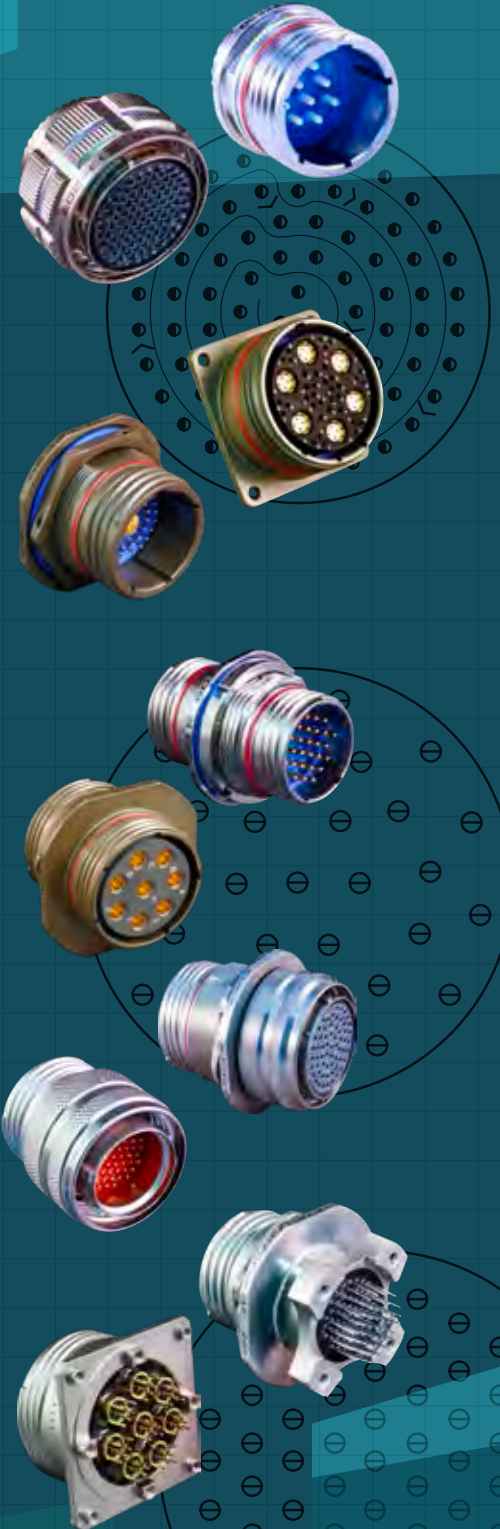
Bulkhead Feed-Throughs eliminate the need to permanently fix cable harnesses to panels—affording increased system flexibility, superior mechanical integrity, and greater serviceability. Popular hermetic and environmental bulkhead feed-through connectors include MIL-DTL-38999 Series I, II, III and IV configurations. Hermetic versions are ideally suited for high-pressure/low-leakage applications in air, sea and space environments, meeting a leak rate of  $1 \times 10^{-7}$  cm<sup>3</sup> per second. Environmental versions offer IP67 level sealing.

## Sav-Con® Connector Savers

Connector Savers protect connectors subject to repeated mating and unmating cycles, preventing costly repair or replacement of deliverable connectors and cables while preserving the quality and integrity of connector performance. Connector Savers take the abuse of repeated connection cycles instead of “black box” or other equipment-mounted connectors.

## PCB-Mount Connectors

Panel-mounted I/O connectors equipped with termination pins or tails for direct attachment to printed circuit boards allow electrical engineers to optimize electrical performance and save space in line replaceable modules (LRMs) and other electronic equipment enclosures. Various types of PCB terminations are available including compliant pin, through-hole, and surface mount.



## Fused Glass and Lightweight Encapsulant Hermetics

Hermetic connectors are a special class of Mil /Aero interconnect that incorporates glass-to-metal or other highly-engineered sealing technology. Hermetic connectors are specified for applications as divergent as submarines and orbiting satellites. They are deployed to resist moisture ingress in underground applications and to withstand pressure differentials in vacuum chambers, laboratory equipment and commercial and military aircraft. While glass-to-metal sealing has traditionally been the “gold standard” of hermetic sealing, new lightweight encapsulant sealing technology from Glenair, called CODE RED, delivers mission-critical hermetic sealing with better contact electrical performance and a significant reduction in weight.

## EMI/EMP Filtered Connectors

EMI/RFI filter connectors incorporate electronic circuitry (capacitors) to strip line signals of unwanted RF or HRF noise that could potentially impact electronic equipment or system performance. Filter connectors may also be equipped with transient voltage suppression diodes to clamp off a high-energy power surge, such as might occur from a lightning strike or EMP event, before the surge can damage sensitive electronic equipment. Typically supplied as receptacle configurations, filtering technology may also be incorporated in plugs, bulkhead feed-throughs, and Sav-Con® Connector Savers.

## Blind-Mate Connectors

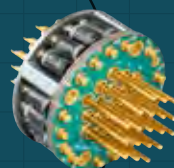
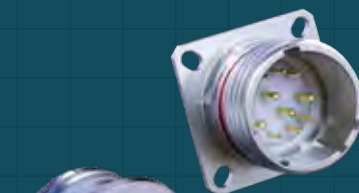
Various special applications for MS circular connectors, such as satellite payload docking and release, require the use of mating connectors without threaded couplings or some other style of fixed attachment. Blind-mate connectors typically use special keying, guide pin technology or other design features to ensure smooth mating and de-mating of connector interfaces that are obscured from view such as in rack-and-panel applications.

## Lanyard-Release Connectors

Designed for extreme reliability in harsh environments including aerospace and defense applications, lanyard-release connectors (such as the AS81703) provide jam-free, push-on, pull-off operation. Lanyard-release connectors are commonly used for droppable stores, umbilical connect, rocket launch, and other extreme vibration and shock applications where rugged and reliable de-mating is a must. Numerous configurations exist including umbilical receptacles, go-between buffers, and mounted plugs. Insert arrangements may include hybrid signal/power and RF contact technology.

## Special-Application Connectors

Any number of unique special-application connector designs, often derivatives of military standards but not exactly covered by the specifications, are common in the industry. Special high-voltage or high-current designs, deep sea pressure-resistant configurations, hazardous zone solutions, extreme temperature tolerant connectors, and so on, are employed to meet extraordinary electrical, mechanical, and environmental stress factors.



# Popular MS Connector Series

All the same functional types as were presented in the previous MS Circular spread are to be found in rectangular designs—including cable plugs and receptacles, connector savers, PCB-mount receptacles, hermetics, EMI/EMP filter connectors, blind mates and so on. So rather than repeat the same discussion for rectangular connectors, let's go ahead instead with a description of each of the military standard series for both rectangular and circular connectors, largely categorized by size and contact density.

## ARINC 404 (MIL-C-81659) and 600

The largest rectangular connector family, the ARINC 404 and 600, takes its name from Aeronautical Radio, Inc., an airline industry association active in specifying connectors for use in commercial aircraft. The modular ARINC connector family features aerospace-grade construction and is designed with seals against moisture for use in high-reliability applications. The original environmental resistant version, the ARINC 404 series, was geared for use by the commercial aircraft industry. The military produced its own version under specification MIL-C-81659. Later, the ARINC 600 series was developed—again for the commercial aircraft industry—as a significant upgrade to the ARINC 404. ARINC 600 offers low mating force contacts, and up to 800 size 22 contact positions in one connector. Larger power contacts are also supported as well as shielded contacts up to size #8.

## MIL-DTL-24308 D-Subminiature

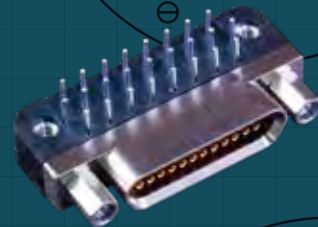
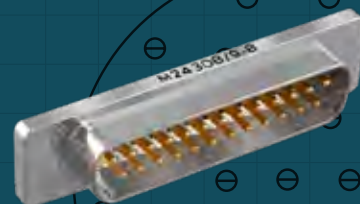
By far the most common of all rectangular connectors, the MIL-DTL-24308 D-Subminiature connector, with its distinctive D-shape mating interface, is well suited for its role as a general purpose power and signal interconnect—for example for the low and medium speed serial data communications required by flight computers. Adapted from military connectors first offered in the 1950s, D-subminiature pin and socket connectors are typically supplied with solder cup, crimp, or PC tail contacts. Special versions of the D-sub, for coaxial, high-voltage, and high-current contacts are available. High-performance environmental, space-grade, hermetic and filter class versions are used in airframe applications and elsewhere when standard-performance products will not serve.

## MIL-DTL-83513 Micro-D

The Micro-D is a high-density, precision machined rectangular with contacts set on .050" centers, typically supplied with fixed solder cup or PC tail contacts, or pre-wired with a pigtail or flex. This small form-factor rectangular connector is typically specified for missile, satellite, or other high vibration and shock mil-aero applications that require reduced size and weight, and mission-critical interconnect performance.

## MIL-DTL-32139 Nanominiature

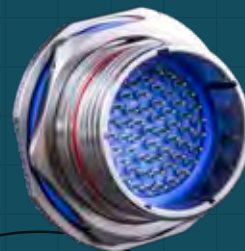
Nanominiature connectors, with their 1 AMP contacts set on .025" centers, are the smallest and lightest mil-spec rectangular in the business. These MIL-DTL-32139 qualified connectors for mission-critical board-to-wire applications offer superior mating and unmating performance and environmental resistance. TwistPin contact-equipped Nanominiature connectors are precision machined from aluminum, titanium or stainless steel. Designed to accommodate size #30 and #32 gauge wire, both rectangular and circular versions are available in prewired pigtail or printed circuit board configurations.





## MIL-DTL-38999 (Aerospace)

Environmental and hermetic class MIL-DTL-38999 Series connectors are the most widely used connectors within the mil-aero industry. Developed for fast vibration-proof mating, the Series III triple-start prevents galling and cross-threading, as well as low-resistance metal-to-metal coupling. Series IV offers the industry's most positive mating with a 90° quarter-turn breech-lock mate with visual, tactile and audible engagement confirmation. Series I and II (low-profile) bayonet-couplers round out this versatile, high-density connector family.



## MIL-DTL-81703 (Lanyard-Release)

Ideal for high-shock / high-vibration environments including military space and defense applications such as missile and payload deployment, the AS81703 provides jam-free, push-on, lanyard-activated pull-off operation. Glenair's AS81703 Series 3 type connector series is intermateable and intermountable with currently available AS81703 mil-spec and commercial connectors, and offers several enhancements to the standard design: an integrated band porch for shield termination, 360° saw teeth for rear-end accessory clocking, and a red full-mate indicator stripe.



## MIL-DTL-5015 (Threaded and Reverse-Bayonet)

The MIL-DTL-5015 is a medium-density circular series with a wide range of power and signal insert arrangements. Available in both threaded and reverse-bayonet coupling, the 5015 is specified in many rugged-duty applications including military ground vehicles and industrial applications. Considered more of a "legacy" connector series, the 5015 nevertheless is a popular choice for general-duty environmental applications with mixed power and signal requirements.



## MIL-DTL-83723 (General Duty)

The MIL-DTL-83723 Series III Type connector is suited for use on commercial, military, and aerospace interconnect systems that demand high-vibration resistance and reliability in a medium-density cylindrical connector. The MIL-DTL-83723 uses Mil-Standard AS39029 crimp contacts as well as solder cups and PC Tail terminations in sizes 12, 16, and 20 and is available in over 30 insert arrangements, from 2 to 61 contacts.



## MIL-DTL-26482 (Series I and II)

The MIL-DTL-26482 (Glenair Series IPT) bayonet-lock connector is suited for general and environmental applications that require a medium-density military type cylindrical connector. Also referenced by the VG qualification, VG95328, the 26482 bayonet coupling mechanism provides fast and easy mating, especially when the connector is situated in an awkward or hard-to-reach location. Series II versions (Glenair IPT SE) offer crimp contacts and improved dielectrics.



## MIL-DTL-28840 (Shipboard)

The standard connector and backshell series for shipboard use, MIL-DTL-28840 offers high-density insert arrangements and high-shock performance. The MIL-DTL-28840 features RFI/EMI shielding, scoop-proof shells and corrosion-resistant materials and finishes. Glenair's qualified product line is fully tooling and highly available.



# Glenair Signature Connector Series

Available military standard connector series satisfy the broad range of requirements for electrical wire interconnect systems. For application requirements that are not addressed by an MS series, or go beyond the capabilities of available series designs, Glenair has developed a wide range of smaller, lighter, and advanced-performance solutions.

## HiPer-D High-Performance M24308

The Glenair Series 28 HiPer-D® connector is intermateable and intermountable with standard M24308 type D-Subs, but meets the need for improved performance in rugged environments. Unlike standard M24308 connectors with stamped steel shells, the HiPer-D® is precision-machined from aluminum or stainless steel. Dielectric inserts are made with thermoset epoxy for improved chemical resistance and are capable of withstanding 200°C continuous operating temperature. Aerospace-grade fluorosilicone grommets and face seals provide watertight sealing. Integrated grounding fingers provide superior electromagnetic compatibility. The HiPer-D® is available in every standard and high-density M24308 layout as well as combo layouts integrating power and shielded contacts.

## Series 79 Ultraminiature Rectangular

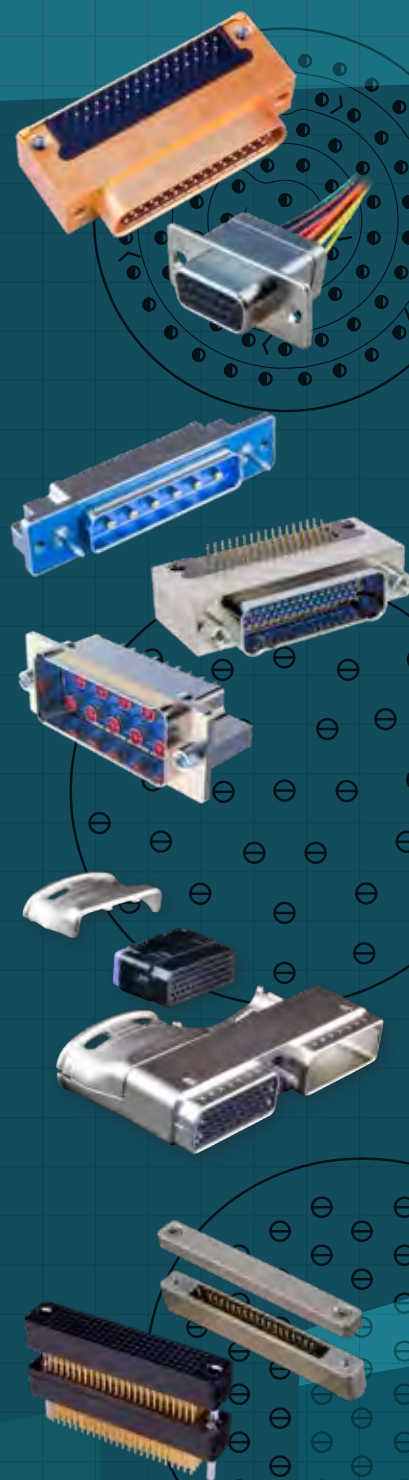
The Series 79 was developed for aerospace systems that require advanced levels of environmental protection, electromagnetic shielding and size/weight reduction. The Series 79 features crimp, rear-release size #23 contacts on .075" spacing, as well as size #12 and #16 power and coaxial crimp contacts in a range of hybrid layouts. Panel-mount connectors feature conductive sealing gaskets. Right-angle PCB connectors have an EMI shroud to prevent electromagnetic interference. Wire sealing grommets and interfacial seals protect circuits from moisture and contamination. Plugs are available with auxiliary EMI springs for superior EMC performance. Series 791 adds advanced shell design and polarization features for rack-and-panel applications, and Series 792 is specially designed to accommodate shielded Size #8 contacts for high-speed datalink applications.

## Series 20 Super-Twin™ Modular Composite

The Glenair series 20 Super-Twin™ lightweight modular connector is an innovative replacement for legacy cable and panel connectors that no longer meet changing performance specifications for ease of assembly, EMC, and size, weight and power optimization. Super-Twin™ can accommodate a broad range of contact sizes and types from #23 to #8 signal, Quadrax, power, and fiber. Modular inserts offer fast and flexible assembly and repair. Peripheral and grommet seals provide outstanding environmental protection. Keyed inserts and shells provide protection against mis-mating. Innovative clamshell and banding porch design brings modern connector capabilities to cable and panel applications.

## Board-Level Rectangulards: HD Stacker™ / AlphaLink™

The HD Stacker™ brings Glenair innovation to stacking board-to-board connectors: Ultra high-density .0625" Chevron Contact System provides 55% more contacts per connector size as compared to current industry solutions. Polarized connector bodies and polarized guide pins prevent accidental mismating. The solder-free press-fit compliant pin contacts are removable, repairable, and available in custom lengths. HD Stacker™ connectors may be ordered with pre-wired cable or flex jumper terminations. AlphaLink™ is an innovative high-performance PCB connector built on .050" spacing with spring-loaded board contacts and flex, wire, or solder cup terminations. AlphaLink may be ordered as a discrete connector or in turnkey jumper configurations paired with Glenair signature I/O connectors.





## Subsea: SeaKing™ and SuperG55™

SeaKing is an innovative new connector series that eliminates a broad range of mechanical design weaknesses found in many of today's high-pressure subsea connectors. From its double O-ring seals and retractable engaging nut, to its multi-keyed mating interface, the SeaKing represents a bold new approach to 10K psi open-face subsea power and signal connectivity. The SuperG55 family of dry-mate underwater connectors is a revolutionary new design of the popular industry-standard marine interconnect used in countless ROV, underwater camera, diver communications, lights, pan and tilts, and other subsea applications.



## PowerTrip™ Next-Generation Power Connector

Series 970 connectors fill the need for a military grade harsh environment power connector with improved mechanical, environmental and electrical performance. PowerTrip™ also delivers reduced size and weight compared to lower-density 5015 type power connectors. Featuring triple start mating threads, crimp rear-release contacts, upgraded finish choices and improved EMI protection, the PowerTrip™ connector is ideal for power distribution units, hybrid electric drives, motors, and other high current, high-reliability applications.



## SuperNine® Advanced Performance D38999

The Series 23 SuperNine® advanced performance connector series rolls up many of the technology advances Glenair has pioneered in our environmental, hermetic, and filter connectors into a comprehensive high-performance MIL-DTL-38999 Series III solution. SuperNine® combines advanced plating, sealing and other high-performance features including crimp-contact hermetics, integrated EMI shield banding porch, high-durability anti-vibration coupling and more.



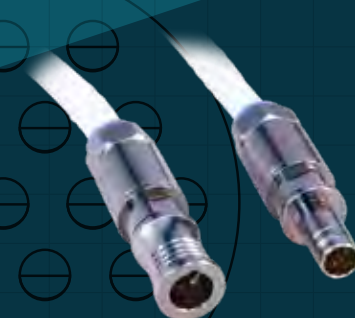
## Series 80 Mighty Mouse Connectors

Glenair has recognized a growing need in tactical military, aerospace and specialty industrial markets for a connector series that mimics the electrical and mechanical performance of popular mil-standard connectors, such as MIL-DTL-38999, but in a smaller and lighter package. The Series 80 Mighty Mouse Connector is perfectly suited for the wide range of power and signal applications that depend on reliable environmental and mechanical performance and electromagnetic compatibility as well as high-speed applications such as gigabit Ethernet. At just half the size and weight of D38999, the high-performance Mighty Mouse is now specified on hundreds of mission-critical interconnect applications worldwide and has become the de facto high-performance connector solution for many former users of D38999.



## SuperFly® Nanominiature Circular

Glenair Series 88 SuperFly® represents a perfect storm of high-performance contacts, shells, wires, termination and mating technologies. SuperFly® is the only connector series in existence that combines the weight saving and performance advantages of nanominiature, microminiature, and AS39029 type (size #23) contacts in a hybrid package for battlefield communications, high-speed datalink computing, and other high-performance applications. Available in factory-terminated cordsets, single-ended pigtailed, and PCB termination receptacles for complete flexibility in cable and box configurations.



# Introduction to Military Standard Cylindrical Connectors

The purpose of a connector is easy to describe: connectors bridge gaps between individual pieces of electronic equipment to make assembly, repair and upgrades easier. Instead of struggling with a gordian knot of soldered circuits and spliced wiring, connectors enable technicians to make interconnections with ease and convenience.

Connectors bridge the gap between individual wires to provide contact between two conductive elements of an electronic system. The connection they make enables electrical current (or light waves in the case of fiber optics) to flow from one conductor to the next. Edward's Publishing's indispensable Encyclopedia of Connectors defines the connector thus: *"An electromechanical device which permits two or more circuit elements to be electrically and mechanically separated and reconnected at will without disturbing any other elements of the circuit. A connector performs no circuit function and should have no effect on the electrical performance of the device to which it is attached. If the connectors of a device were eliminated and the corresponding wires joined together, the circuit would not be affected."*

When connectors are used to connect one set of wires to another, they are called wire-to-wire connectors. Wire-to-board connectors connect a wire to a Printed Circuit Board (PCB). And board-to-board connectors directly interconnect PCBs.



Connector testing is designed to simulate a lifetime of use over a short period of time. Environmental, mechanical and electrical tests are conducted to measure both the reliability of the connector and the system. The number-one criterion of reliability is a change in contact resistance.

Connectors facilitate fabrication and assembly of electronic products by enabling designers to treat each subassembly as a unique, modular unit. Interconnection can then be accomplished at the most convenient time and place in the production process. Connectors also facilitate equipment repair by allowing technicians to quickly and easily replace suspect components. Without opening black box cabinets and without introducing contaminants like solder and flux into the system, technicians can swap out suspect equipment and have a system back on line in a matter of minutes. Connectors also permit upgrades to electronic equipment without major disruptions to the overall system. Connectors give engineers the flexibility to integrate new products and components into existing systems simply by maintaining a consistent connector specification.

While there is great variety in the makeup and design of each type of connector, as a family they generally share a common set of design elements and component parts. In fact, in order to function as a separable interconnect device, a connector must house the following elements:

- **Contact Interface:** a mechanical means of joining the conductive contacts together under normal force
- **Contact Spring Members:** a means of generating the normal force required to maintain the electrical path between conductive contact elements
- **Contact Finish:** a means of protecting the contacts from corrosion, and for optimizing the lubricity and durability of the contact interface
- **Contact Housing:** a means of holding the contacts and spring members in place and maintaining their exact position and alignment. The contact housing also shields the contacts from the operating environment.

Connectors are selected with consideration to electrical, mechanical and environmental requirements. Electrical requirements include wire type and size, contact resistance, transfer impedance and current rating. Mechanical specifications, such as thermal shock, vibration and durability indicate how well a connector will perform under critical stress factors. Environmental requirements include moisture absorption, temperature resistance, corrosion and resistance to electromagnetic interference. Environmentally resistant connectors are required for interconnect systems which are



subjected to fluids in combination with vibration, shock, thermal extremes and corrosion.

While the same basic connector design may be used for both signal and/or power distribution, power connectors use contacts designed specifically for the unique requirements of power distribution. This is due to the relatively higher current/voltage requirements of power applications and the temperature rise experienced by power connectors. A disk drive in a personal computer, for example, uses both signal and power connectors. The power connector bridges the circuit that drives the unit. The signal connector carries the digital data. While the signal and power contacts may be combined into a single connector housing, each contact type is uniquely suited for its role in transmitting either signal or power electrical energy.

## The Military Standard Connector

The multi-contact electrical connector used in Air Force, Navy and other high-reliability applications is a critical subassembly within the wiring system. Military connectors find many diversified applications due to severe environments, mobility, and field repairability. The key attribute of such connectors is better reliability when compared to less expensive commercial connectors. The reliability of a system is essentially a measure of the failure rate of its components. Connectors can fail due to plug dependent mechanisms, wear mechanisms or corrosion mechanisms. Total system life, power on-hours (POH) and system on/off cycles (number of times that a product powers on and off) are important factors determining system reliability. Military standard connectors (and their commercial equivalents) are chosen for their performance and reliability even in the most severe interconnect applications.

The military standard connector is made up of two separate component assemblies known as the “plug and receptacle”

which intermate to connect wires with pin and socket contacts. Connector families are defined in this high-reliability world by the military detail specifications which spell out the exact

**Power connectors carry contacts from size 4/0 to #16**

**Miniature contacts from size #12 to #20**

**High-density contacts from size #20 to #22**

**Ultraminiature contacts size #23**

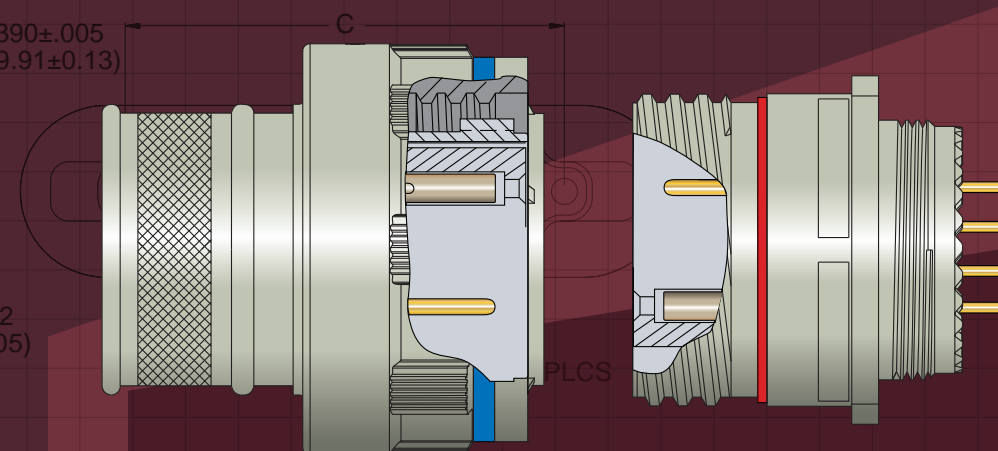
**Microminiature contacts size #24**

**Nanominiature contacts size #30**

requirements for every aspect of the connector’s design and performance. Connector families are distinguished by their coupling mechanisms, physical shape, contact types, environmental classes and termination methodologies.

Plug and receptacle connector pairs are available in various mounting configurations to accommodate different levels of interconnection and different application requirements. The most common configurations are in-line (wire-to-wire) applications, or various bulkhead, chassis and enclosure mountings. In general, connectors are available to accommodate any fixed mounting or in-line requirement.

Circular connectors are selected because of their compact, rugged design and their ability to effectively seal the connector from environmental hazards. Circular connectors may incorporate bayonet couplings, threaded couplings, ball detent couplings (push/pull), and/or breech lock couplings as their mechanism for locking the mated pairs together.



Circular connector coupling technology: the ubiquitous MIL-DTL-38999 Series III circular features one of the most popular connector coupling designs, the triple-start stub ACME thread. In addition to fast and reliable mating, this threaded coupling design has the advantage of a ratcheting anti-decoupling mechanism, receptacle striping indicating full mating, and metal-to-metal bottoming between the mating pairs for reduced electrical resistance.



Rectangular connectors are selected to maximize the number of contacts possible in a restricted space. However, rectangulars are not as easily sealed against fluid damage and other environmental hazards. Spring style rack/panel couplings as well as standard jackscrew fasteners are both common coupling styles in rectangular connectors.

Both circulars and rectangulars can accommodate multiple contact types including power or high-voltage contacts, signal contacts, coaxial and triaxial contacts, or fiber-optic termini. High reliability contacts are usually made from gold plated, copper alloy material. Large diameter power contacts and solder type contacts may be either gold or silver plated copper alloy.

Crimp style contacts are preferred for all aerospace and other high-reliability applications (except those requiring a hermetic seal) due to their relative ease of assembly and maintenance. Solder type contacts are usually selected when cost is the primary consideration and repairability secondary. Solder type contacts are also used in hermetic connectors.

Installation of both crimp and solder type contact connectors requires unobstructed working room behind the connector. Rear release crimp contacts require additional working room to install the extraction tool to remove the contact. Another important design feature of crimp type contact connectors is the connector insert wire sealing grommet. The grommet provides moisture sealing around each individual wire.

The shell of a military standard circular connector is a cylinder available in a range of mating thread diameters with increments of 1/16". The shell size is determined by multiplying the mating thread diameter in inches by 16. For example, a connector with a 1.5 inch diameter mating thread is designated as a shell size 24 (1.5 X 16 = 24). Standard shell sizes range from size 8 (½ inch mating thread) to size 40 (2 ½ inch thread size).

# Making Sense of Connector Part Numbers

Military standard connectors are organized under specification series numbers: SAE AS50151, MIL-DTL-38999 and so on. The specification series number identifies the master document which explains everything about the particular connector family. The actual part numbers of connector components are designed to call out the physical connector type and its dimensional attributes. For example, a SAE AS50151 receptacle connector designed to be mounted on a box would have a part number such as MS3402DS28-21PY. The number can be dissected as follows:

**The first 4 digits after the MS (Military Standard) designate the physical connector type, like so:**

- 3400 - Wall mounted receptacle
- 3401 - In line receptacle
- 3402 - Box mount receptacle
- 3404 - Jam nut receptacle
- 3406 - Straight plug
- 3408 - 90° plug
- 3409 - 45° plug
- 3412 - Box mount receptacle with rear threads

**The single character which follows indicates the connector service class:**

- D - High Shock
- K - Firewall
- L - High Temperature
- W - General Purpose

The next character, S in our example, indicates the shell material; in this case stainless steel. The next two characters, 28 in our example, identify the shell size. The following pair of numbers, 21 in our example, identifies the contact arrangement. If this pair of characters is followed by an "S," it indicates female-style (socket) contacts. If they are followed by a "P," it indicates male contacts (Pin). The final character, Y in our example, indicates the choice of polarization keying.

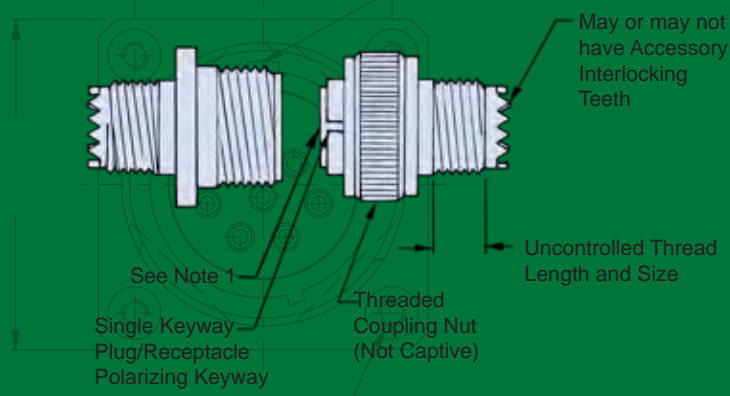
That's all there is to it. While there are many part number complexities and nuances throughout the various MS connector families, they all follow the same basic approach to part number development.

Example: D38999/26 Plug with Accessory Threads Part Number Development						
Sample Part Number	D38999/26	W	A	35	P	N
"D38999" indicates the connector series or family, in this case a MIL-DTL-38999 Series III.						
"/26" indicates the particular configuration of the connector, in this case a cable plug with accessory threads						
"W" indicates the Class of the connector (its environmental rating and material construction), in this case an environmental connector made from Aluminum with CAD/OD over Electroless Nickel overplating						
"A" indicates the shell size of the connector (in this series, a letter designator is used rather than a number.)						
"35" indicates the contact or insert arrangement (layout and size of contacts)						
"P" indicates the contact type, in this case a standard Pin contact						
"N" indicates the polarization (keying) of the mating interface						

## Design Elements: Military Standard Connector Series

The following pages recap standard circular military connector design features for some of the more common series. Application notes and illustrations describe key mechanical aspects of each series. Readers will note that many of the descriptions call out deficiencies in design, particularly for older connector series such as 5015 and 26482.

SAE AS50151 (MIL-DTL-5015)  
connectors, circular,  
MS3100 series (solder contact)  
Glenair designator code B  
(Glenair series: IT)



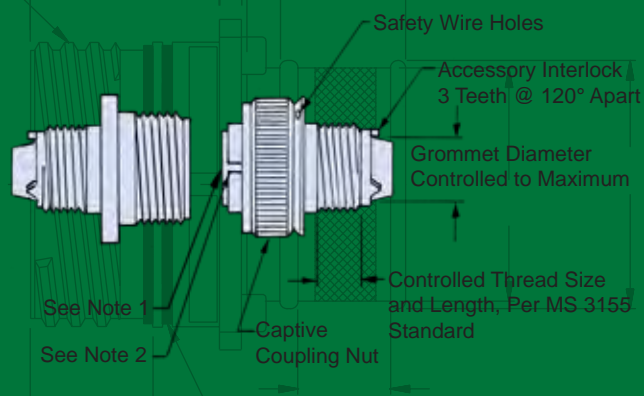
### Design Features:

- Threaded coupling design; eight connector configurations.
- Fifteen shell sizes—Range 8 thru 48 (.500" to 3.000" diameter).
- Wide variety of power and signal contact sizes (#4/0 to #20), standard density; 1 to 100 contacts.
- Conductive finish—Cadmium/Olive drab, 96-hour corrosion protection (standard).

### Application Notes:

1. Contacts may mate prior to connector shell mating.
2. Single keying may not always ensure shell polarizing.
3. Uncontrolled accessory interface.
4. Plug or receptacle may have pin or socket contacts.
5. Connector shell may strike pin contacts, thus power should always be on socket contacts.

SAE AS50151 connectors, circular  
MS3400 (front-release crimp contact) and  
MS3450 (rear-release crimp contact)  
Glenair designator code A



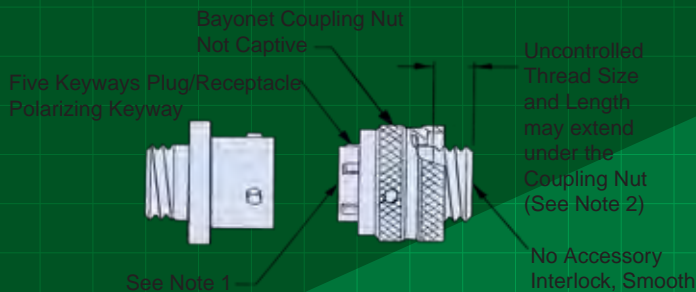
### Design Features:

- Threaded coupling design, captive; eight connector configurations.
- Fifteen shell sizes—Range 8 thru 48 (.500" to 3.000" diameter).
- Wide variety of contact sizes (#4/0 to #20), standard density; 1 to 100 contacts.
- Cadmium/Olive drab conductive finish, 500 hour salt spray; electroless-nickel options (standard).

### Application Notes:

1. Same interface features as MS3100 and MS3106; intermateable.
2. Single keying may not always ensure shell polarizing.

MIL-DTL-26482 connectors, circular  
MS3110 and MS3116 Series 1 (solder  
contact) Glenair designator code D  
(Glenair series: IPT)



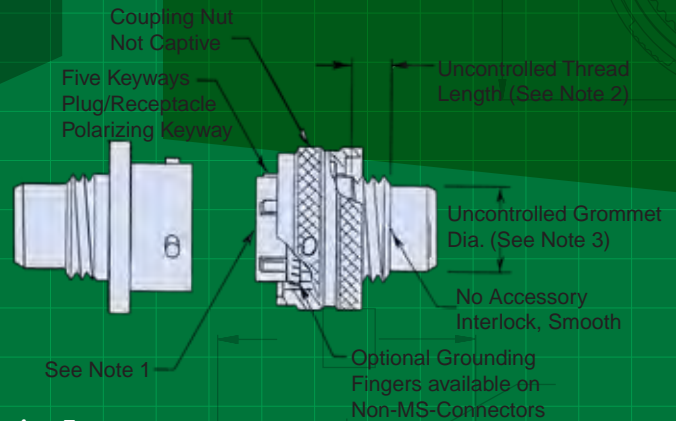
**Design Features:**

- Bayonet coupling, quick disconnect plug and receptacle
- Ten shell sizes—Range 6 through 24 (.3750" to 1.500" diameter).
- 3 to 61 standard density #12, #16, and #20 contacts.
- Conductive and non-conductive finishes; Cadmium/Olive drab and anodic.

**Notes:**

1. Contacts may mate prior to connector shell mating.
2. Plug may have less than three threads.

MIL-C-26482 Connectors, Circular,  
MS3120 and MS3126 Series 1 (front-  
release crimp contacts) Glenair designator  
code D (Glenair series IPT SE)



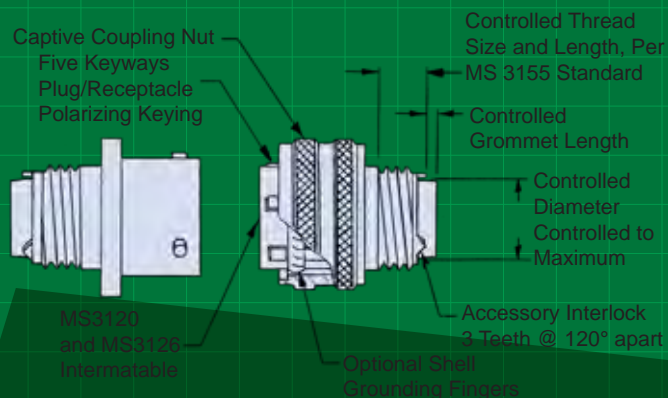
**Design Features:**

- Bayonet coupling, quick disconnect plug and receptacle.
- Eight shell sizes—Range 8 thru 24 (.500" to 1.500" dia.)
- 3 to 61 standard density #12, #16, #20, and #22 contacts.

**Application Notes:**

1. Contacts may mate prior to connector shell mating when grounding fingers not supplied.
2. Same limitations as MS3110/MS3116 solder connectors.
3. Uncontrolled wire seal grommet geometry; accessories properly mate.

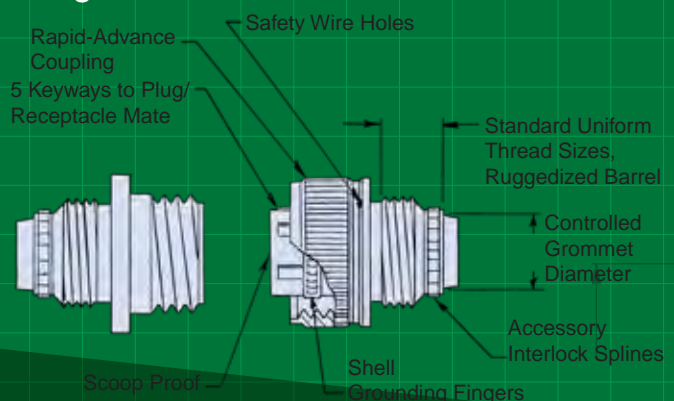
MIL-C-26482 Connectors, Circular,  
MS3470 Series 2 (rear-release crimp  
contacts) Glenair Designator Code A



**Design Features:**

- Bayonet coupling design, quick disconnect. Seven receptacle designs and two plug designs (including RFI shielded)
- Nine shell sizes—8 through 24 (.500" to 1.500" dia)
- 3 to 61 standard-density #12, #16, #20, and #22 contacts.

MIL-DTL-28840 Connectors, Circular  
(front-release crimp contacts) Glenair  
designator code G

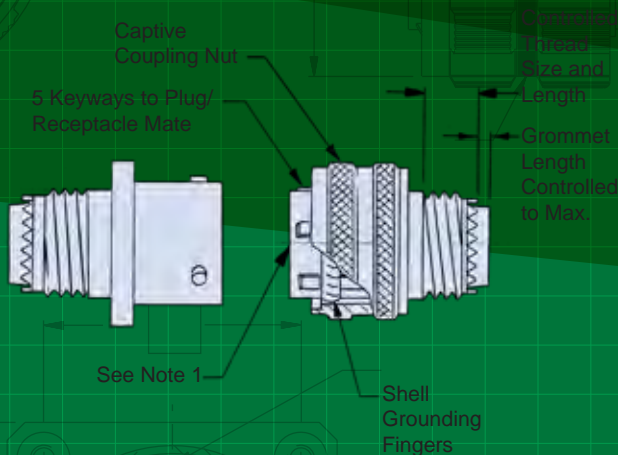


**Design Features:**

- Threaded coupling design, rapid advance, captive, scoop proof; five connector designs
- Nine shell sizes—Range 11 through 33 (.500 to 2.000 diameter).
- 7 to 155 #20 gauge high density contacts.



## MIL-DTL-38999 Connectors, Series I (rear-release crimp contacts) Glenair designator code F (Glenair series 231-105)



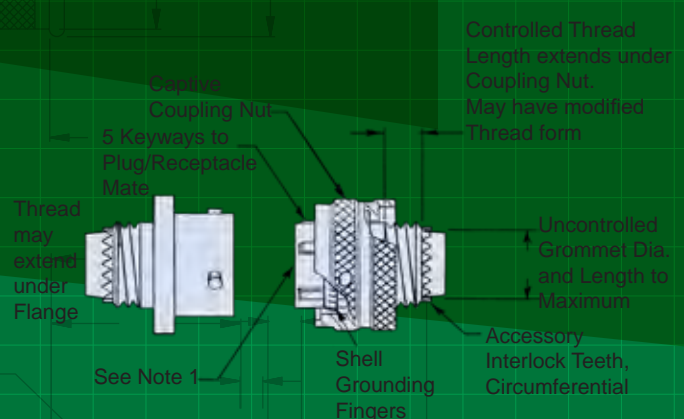
### Design Features:

- Bayonet coupling design, quick disconnect.
- Nine shell sizes—Range 8 through 24 (.500" to 1.500" diameter); twelve connector styles.
- #8, #10, #12, #16, #20, and #22 standard-density; #22 high-density arrangements; 3 to 128 contacts.
- Scoop-proof shell design to prevent shell-to-contact problem.
- Controlled accessory interface per MIL-DTL-38999, figure II.
- Cork-and-bottle primary insert interface seal and shell environmental seal, fuel-resistant silicone elastomers.
- Conductive and non-conductive finishes; electroless nickel, Cadmium/Olive drab 500 hour salt spray, and anodic.

### Notes:

1. Long scoop-proof barrel design to prevent shell striking contacts.
2. Serrated accessory interlocking tooth design may prevent reliable moisture seal or EMI bond to accessories.
3. Bayonet coupling may not perform under severe conditions with large diameter cable and backshell.

## MIL-DTL-38999 Connectors, Series II (rear-release crimp contacts) Glenair designator code F (Glenair series 232-105\*)



### Design Features:

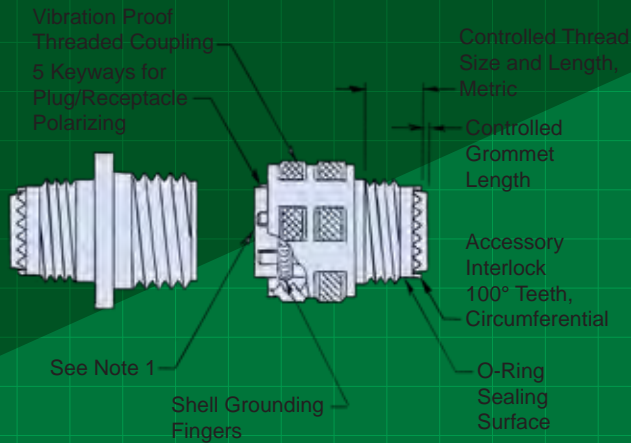
- Bayonet coupling design, quick disconnect, captive.
- Nine shell sizes—Range 8 through 24 (.500" to 1.500" diameter); Fifteen connector designs.
- #16, #20, and #22 contacts, standard density and #22 high-density arrangements; 3 to 128 contacts.
- Shell ground available on MS and commercial part numbers.
- Controlled accessory interface per MIL-DTL-38999 fig. II.
- Cork-and-bottle primary interface and shell environmental seals, fluid-resistant silicone elastomers.
- Conductive and non-conductive finishes; electroless nickel, Cadmium/Olive drab, 500-hour salt spray, and anodic.
- Short barrel construction for minimum envelope.

### Notes:

1. Very short barrel, shell may strike pin contacts.
2. Wire seal grommet controlled to maximum condition only, over compression will cause contact splaying.
3. Same limitations as D38999 Series I.

\* In development

MIL-DTL-38999 connectors, Series III  
circular, rear-release crimp contacts;  
Glenair code H (Mil-qualified and  
commercial versions available from Glenair)



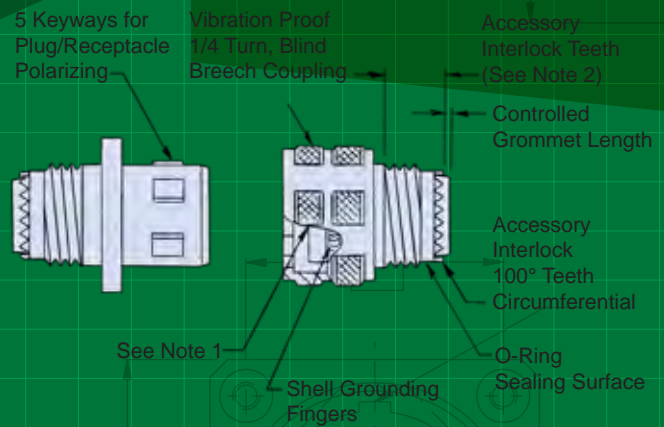
#### Design Features:

- Threaded coupling design, rapid advance, self-locking.
- Nine shell sizes—Range 9 through 25 (.500" to 1.500" diameter). Thirteen connector designs.
- #8, #10, #12, #16, #20, and #22 contacts, standard density and #22 high-density arrangements; 3 to 128 contacts.
- #16 fiber-optic insert arrangement.
- Scoop-proof shell design to prevent shell to contact problem.
- Controlled accessory interface with metric threads.
- Diaphragm contact seal interface and shell environmental seal, fluid resistant fluorosilicone elastomers.
- Conductive and non-conductive finishes; Cadmium/Olive drab 500 hour salt spray, electroless nickel, anodic and stainless steel.
- Conductive composite shell, cadmium/olive drab over electroless nickel, and electroless nickel, 2000 hour salt spray.

#### Notes:

1. Same accessory mating interface as MIL-DTL-38999 Series I, except metric threads.
2. 100 percent scoop proof, positive shell mating.

MIL-DTL-38999 connectors, Series IV  
circular, rear-release crimp contacts;  
Glenair code H (Mil-qualified and  
commercial versions available from Glenair)



#### Design Features:

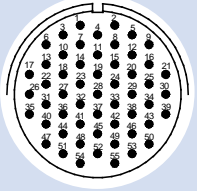
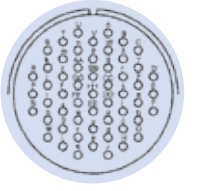
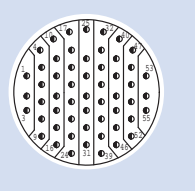
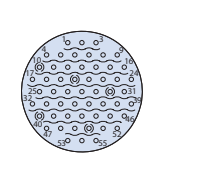
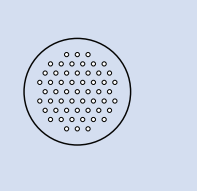
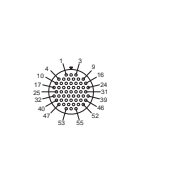
- Breech lock coupling design, rapid advance, self-locking.
- Eight shell sizes—Range 11 through 25 (.500" to 1.500" diameter).
- #12, #16, #20, and #22 contacts, standard density and #22 high density arrangements; 3 to 128 contacts.
- #16 fiber optic insert arrangements.
- Scoop-proof shell design to prevent shell-to-contact problems.
- Controlled accessory interface with metric threads.
- Ruggedized construction for shipboard service.
- Cork and bottle primary interface and shell environmental seals, fluid resistant fluorosilicone elastomers.
- Conductive and non-conductive finishes; Cadmium/Olive drab 500 hour salt spray, electroless nickel, anodic, and stainless steel.

#### Notes:


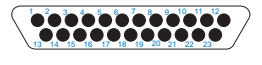
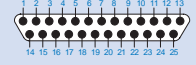
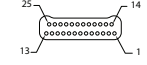
1. 100 percent scoop-proof, positive shell mating.
2. Same accessory interlock teeth as MIL-DTL-38999, Series III.
3. Same O-ring seal features as MIL-DTL-38999, Series III.

## Center-to-Center Contact Densities in Cylindrical and Rectangular Connectors

Center-to-Center Contact Distances: Circular Connectors						
Type	Connector Spec.	Ins. Arr. Spec.	Max Shell Size	Max # of Contacts	Contact Size	Center-to-Center
Standard	MIL-DTL-5015	MIL-STD-1651	48	85	16	0.241" (6.1 mm)
	MIL-DTL-22992	MIL-STD-1651	44	104	16	0.193" (4.9 mm)
	VG95234	MIL-STD-1651	26	52	16	0.203" (5.2 mm)
	MIL-DTL-28840	MIL-STD-1698	33	155	20	0.114" (2.9 mm)
Miniature	MIL-DTL-26482	MIL-STD-1669	24	61	20	0.135" (3.4 mm)
	MIL-DTL-26500	MIL-STD-1554	24	61	20	0.131" (3.3 mm)
	MIL-DTL-83723	MIL-STD-1554	24	61	20	0.131" (3.3 mm)
Subminiature	MIL-DTL-38999	MIL-STD-1560	25	128	22D	0.095" (2.4 mm)
	MIL-DTL-38999 HD	MIL-STD-1560	25	187	23	0.080" (2.0 mm)
Ultra-miniature	Series 80 Mighty Mouse	N/A	23	130	23	0.076" (1.9 mm)
Nanominiature	Series 89 Nano Circular	IAW MIL-DTL-32139	4	55	30/32	0.025" (0.6 mm)

Standard	Miniature	Subminiature	Subminiature HD	Ultraminiature	Nanominiature
					
MIL-DTL-5015 MIL-DTL-22992 VG95234 (ITS) MIL-DTL-28840	MIL-DTL-26482	MIL-DTL-38999	MIL-DTL-38999 High-Density	Series 80 Mighty Mouse	Series 89 Nano Circular
Arrangement shown: 24-A55 • 55 #20 Contacts	Arrangement shown: 22-55 • 55 #20 Contacts	Arrangement shown: E35 • 55 #22D Contacts	Arrangement shown: 15-23 • 55 #23 Contacts	Arrangement shown: 16-55 • 55 #23 Contacts	Arrangement shown: 4-55 • 55 1 Amp Contacts

Center-to-Center Contact Distances: Rectangular Connectors				
Type	Connector Spec.	Max # of Contacts	Contact Size	Center-to-Center
D-Sub	M24308	104	20/22	0.109" (2.8 mm)
Series 79	Series 790	102	23	0.076" (1.9mm)
Rectangular Micro	MIL-DTL-83513	100	24/26	0.050" (1.3 mm)
Rectangular Nano	MIL-DTL-32139	51	30/32	0.025" (0.6 mm)

D-Subminiature	Series 79	Micro-D	Nano-D
			
M24308	Series 79	MIL-DTL-83513	MIL-DTL-32139
Arrangement shown: 3S25 25 contacts on .109" spacing	Arrangement Shown: F-23 23 contacts on .076" spacing	Arrangement shown: 25 25 contacts on .050" spacing	Arrangement shown: 25 25 contacts on .025" spacing



# Wire Gauge Size and Composition Reference Table

Copper Wire Data						
Wire Size AWG	Stranding No. / AWG of Strands	Individual Strand Diameter in (mm)	Maximum Diameter in (mm)	Maximum Resistance (Ohms per 1000 ft. @ 20°C		
				Silver Coated	Nickel Coated	Tin Coated
32	1/32	0.0080 (0.20)	0.009 (0.23)	169	175	178
32	7/40	0.0031 (0.08)	0.011 (0.28)	173	185	189
30	1.30	0.0100 (0.25)	0.011 (0.28)	108	112	116
30	7/38	0.0040 (0.10)	0.013 (0.33)	100.7	110.7	114.1
28	1/28	0.0126 (0.32)	0.013 (0.33)	68.0	70.0	71.6
28	7/36	0.0050 (0.13)	0.016 (0.41)	63.8	43.8	45.3
26	1/26	0.0159 (0.40)	0.017 (0.43)	42.7	43.8	43.4
26	7/34	0.0063 (0.16)	0.020 (0.51)	40.5	43.1	43.4
26	19/38	0.0040 (0.10)	0.022 (0.56)	38.4	42.2	41.3
24	1/24	0.0201 (0.51)	0.022 (0.56)	26.8	27.4	27.8
24	7/32	0.0080 (0.20)	0.025 (0.64)	25.2	26.5	27.0
24	19/36	0.0050 (0.13)	0.027 (0.69)	24.3	25.9	26.2
22	1/2-2	0.0253 (0.64)	0.026 (0.66)	17.0	18.7	17.7
22	7/30	0.0100 (0.25)	0.031 (0.79)	15.9	16.6	17.1
22	19/34	0.0063 (0.16)	0.033 (0.84)	15.1	16.0	16.2
20	1/20	0.0320 (0.81)	0.033 (0.84)	10.5	10.7	10.9
20	7/28	0.0126 (0.32)	0.039 (0.99)	10.0	10.4	10.7
20	10/30	0.0100 (0.25)	0.040 (1.02)	11.3	11.8	12.1
20	19/32	0.0080 (0.20)	0.041 (1.04)	9.19	9.77	9.88
18	1/18	0.0403 (1.02)	0.041 (1.04)	6.60	6.70	6.90
18	7/26	0.0159 (0.40)	0.050 (1.27)	6.28	6.50	6.70
18	16/30	0.0100 (0.25)	0.051 (1.30)	6.30	6.60	6.80
18	19/30	0.0100 (0.25)	0.052 (1.32)	5.79	6.10	6.23
16	1/16	0.0508 (1.29)	0.052 (1.32)	4.20	4.35	4.36
16	19/29	0.0113 (0.29)	0.059 (1.50)	4.52	4.76	4.80
16	26/30	0.0100 (0.25)	0.062 (1.57)	4.31	4.55	4.69
14	1/14	0.0641 (1.63)	0.065 (1.65)	2.58	2.67	2.68
14	19/27	0.0142 (0.36)	0.073 (1.85)	2.88	3.00	3.06
14	41/30	0.0100 (0.25)	0.081 (2.06)	2.74	2.85	2.94
12	1/12	0.0808 (2.05)	0.082 (2.08)	1.62	1.68	1.69
12	19/25	0.0179 (0.45)	0.093 (2.36)	1.81	1.88	1.92
12	37/28	0.0126 (0.32)	0.091 (2.31)	1.90	1.98	2.02
12	65/30	0.0100 (0.25)	0.099 (2.51)	1.73	1.80	1.85
10	1.10	0.1019 (2.59)	0.103 (2.62)	1.02	1.05	1.06
10	37/26	0.0159 (0.40)	0.115 (2.92)	1.1	1.24	1.26
10	105/30	0.0100 (0.25)	0.130 (3.30)	1.07	1.11	1.15
8	133/29	0.0113 (0.29)	0.173 (4.39)	0.658	0.694	0.701

# Wire Bundle Diameter Calculator

## Calculating Wire Bundle Diameter

When calculating wire bundle diameters, note that the gauge of the wire describes only the diameter of the metal conductor, and not the overall diameter including insulation and/or braids. Refer to the appropriate wire specification for the actual diameter of the wire for use in the following calculations.

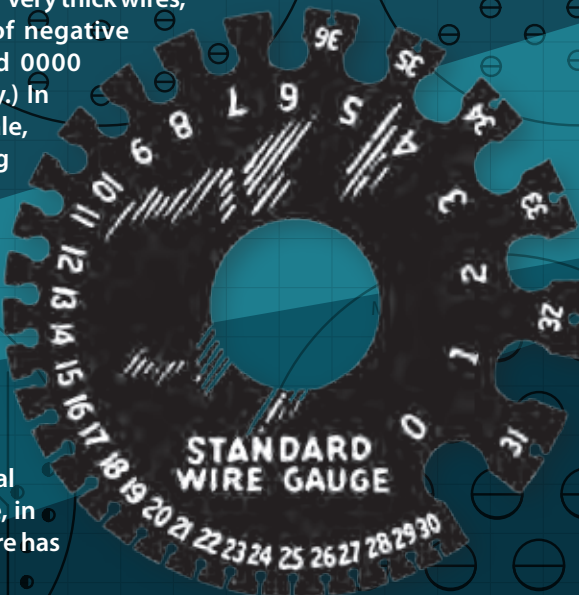
Steps	Calculations
(1a) Determine average wire diameter when all wires are the same diameter; or	Given 30 Wires @ .045 DIA <b>Avg. Wire DIA = .045</b>
(1b) Determine average wire diameter when wires are different diameters.	Given 15 Wires @ .045 and 15 Wires @ .135 $15 \times .045 = .68$ $15 \times .135 = \underline{2.03} + \frac{2.71}{30} = .090$ <b>Avg. Wire DIA</b>
(2) Multiply average wire diameter by factor from Table I below	(1a) $.045 \times 6.5 = .2925$ <b>Core Wire Bundle DIA</b> (1b) $.090 \times 6.5 = .585$ <b>Core Wire Bundle DIA</b>
(3) Add thickness of any shielding or jacketing to core wire bundle diameter (for example, add .025 for braided sleeving)	(1a) $.2925 + .025 = .3175$ <b>Wire Bundle Outside DIA</b> (1b) $.585 + .025 = .61$ <b>Wire Bundle Outside DIA</b>

Table I

No. of Wires	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	24	28	32
Factor	1.0	2.0	2.2	2.4	2.7	2.9	3.0	3.3	3.8	4.0	4.3	4.6	5.0	5.3	5.6	6.0	6.5	6.9
No. of Wires	36	40	45	50	55	60	65	70	75	80	90	100	125	150	175	200	250	300
Factor	7.4	7.7	8.1	8.5	8.9	9.3	9.7	10.1	10.5	10.9	11.6	12.2	13.7	15.0	16.1	17.2	19.3	21.0

## Understanding Wire Gauge [Ga]

A traditional unit measuring the diameter (or the cross-sectional area) of a wire. Various wire gauge scales have been used in the U.S. and Britain. In traditional scales, larger gauge numbers represent thinner wires. (For very thick wires, repeated zeros are used instead of negative numbers, so gauges 00, 000, and 0000 represent -1, -2, and -3, respectively.) In the American Wire Gauge (AWG) scale, 0000 gauge represents a wire having a diameter of 0.46 inch and 36 gauge represents a diameter of 0.005 inch (5 mils). Diameters for the other gauges are obtained by geometric interpolation, meaning that the ratio between successive diameters is a constant, except for necessary roundoff. Thus n gauge wire has a diameter of  $.005 \cdot 92^{((36-n)/39)}$  inch. The metric wire gauge number is equal to 10 times the diameter of the wire, in millimeters; thus a metric 8 gauge wire has diameter 0.8 millimeters.



# Scoop-Proof Contact Protection

The scoop-proof connector shell design solves problems associated with mating plugs and receptacles in less than ideal conditions, such as in the dark, from an awkward angle, or in the case of the illustrations below, in a blind-mate application. Scoop-proof connectors feature a long shell on the receptacle side which prevents mechanical damage of exposed pin contacts from the nose of the plug during mating. As Dick Holden explained it, "no matter how hard that swabbie tries, it is impossible to cock the mating plug so as to damage the pins or electrically short the contacts." This scoop-proof design feature, common to most aerospace-grade connectors such as D38999 Series III, works hand-in-hand with the interlocking keys and keyways machined into the connector mating interfaces such that even if connector halves are brought together offset or at an angle, the plug and receptacle can only ever mate in the correct orientation. The drawings below show a blind-mate connector pair (no coupling nut on the plug) that takes advantage of keying and scoop-proof design features to ensure reliable mating. The top picture shows the plug's initial engagement with the receptacle, guided home by the keys and keyways. The bottom illustration shows the utility of the scoop-proof receptacle shell in preventing pin damage.

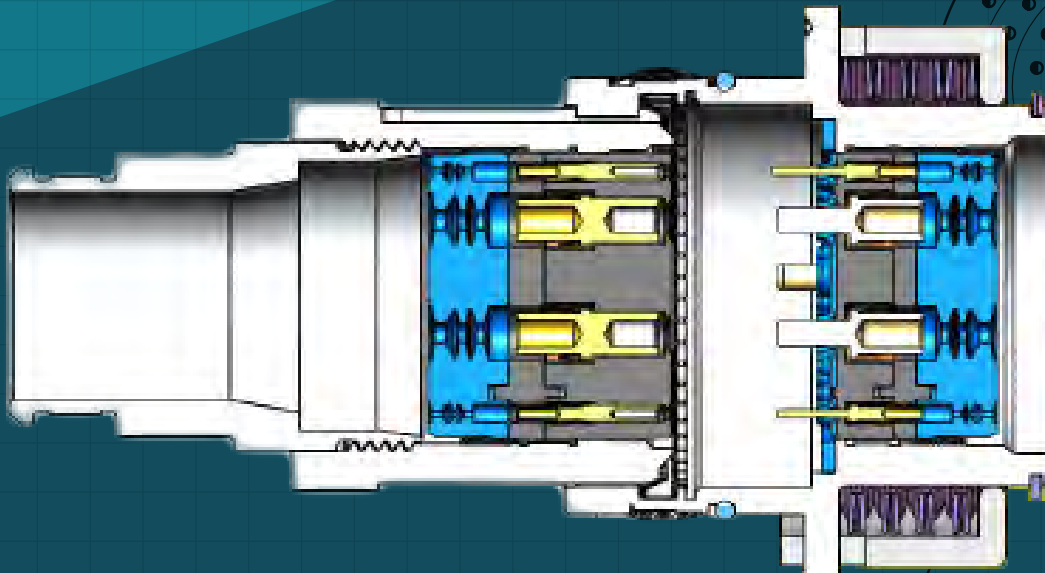


Figure 1: Key and keyway engagement ensures polarized mating and axial alignment

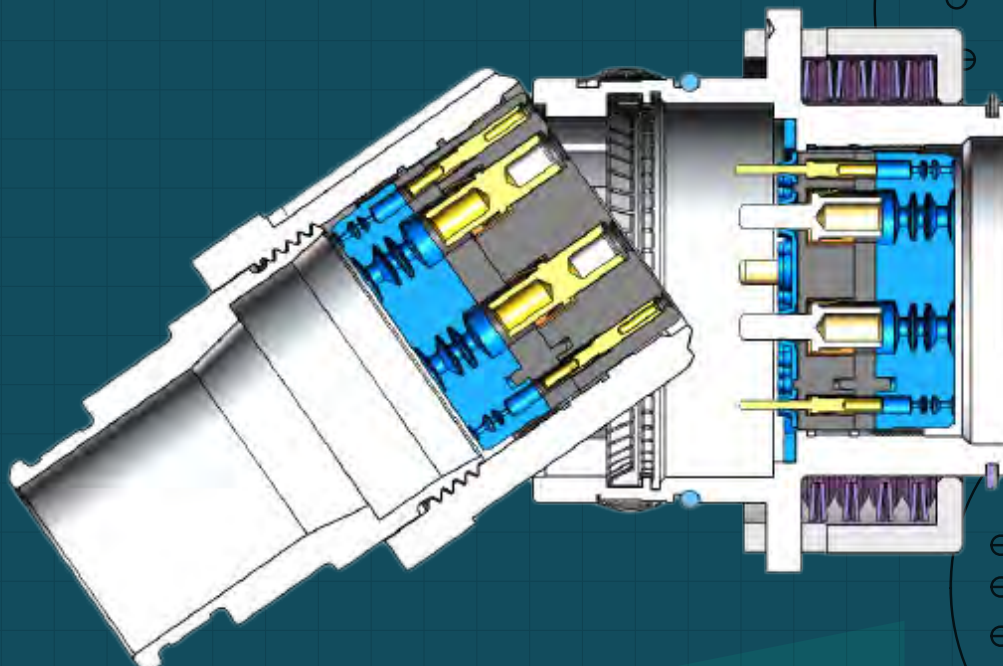


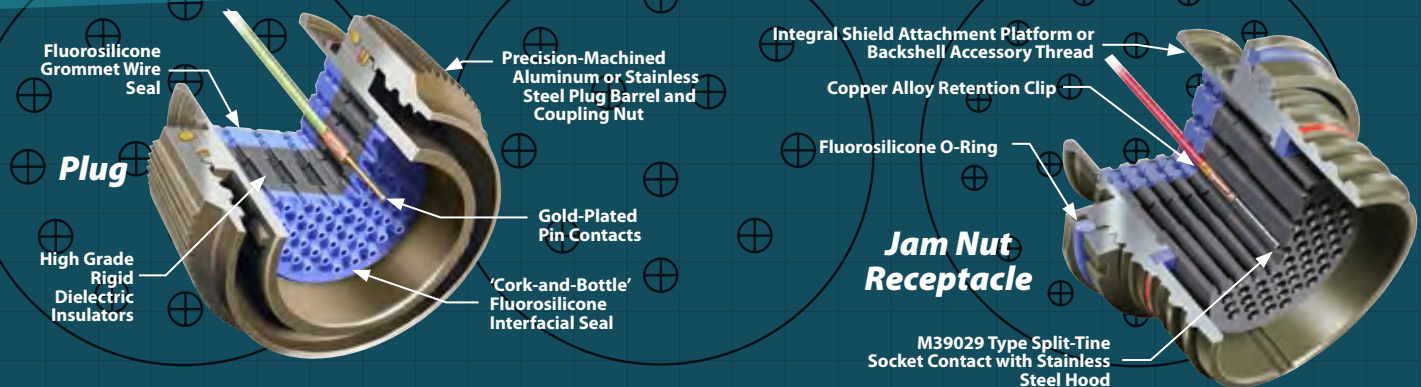
Figure 2: Scoop-proof design feature prevents badly-angled plug nose from striking the pin contacts



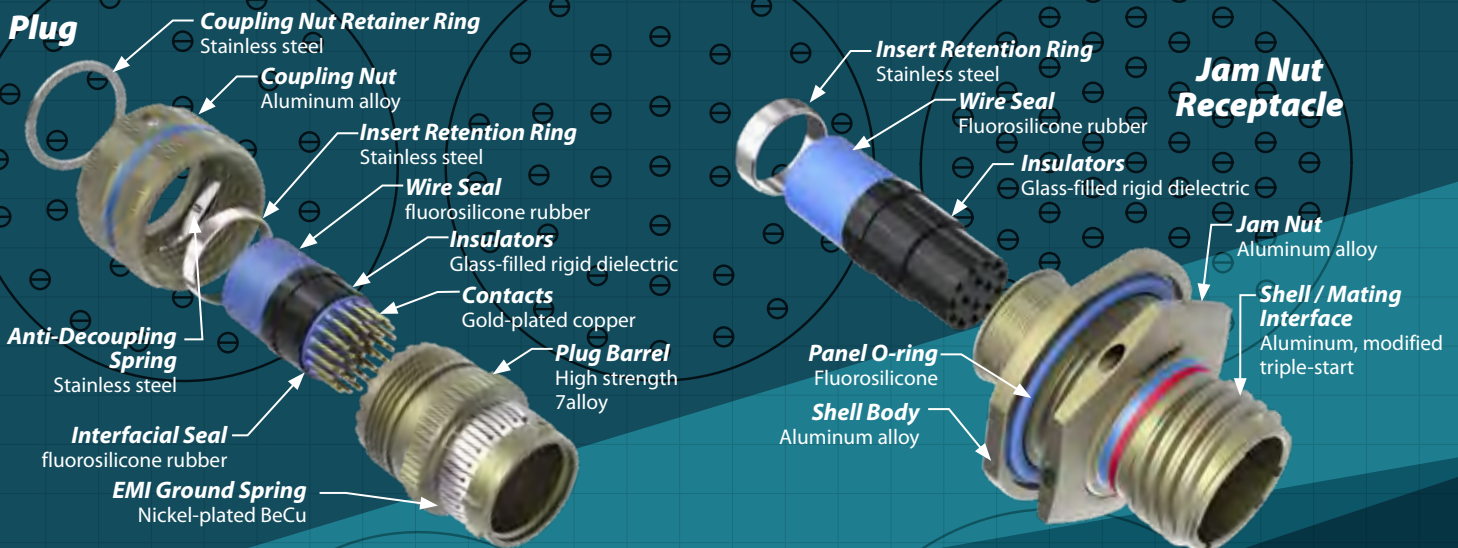
## Anatomy of a Crimp-Contact Circular Connector

All modern-day crimp-contact connectors share the same basic anatomy (component parts and construction). Exploded views shown here are Glenair Series 80 Mighty Mouse connectors.

### CROSS-SECTIONAL VIEW



### EXPLODED VIEW



# Outgassing Properties and Requirements

## Space-grade interconnect manufacturing and test capability

### Outgassing and Inspection Modification Codes

#### Outgassing

Space flight equipment requires low-outgassing components in order to prevent degradation to optics and other sensitive instruments. High-performance circular and rectangular connectors contain non-metallic materials such as rubber, plastic, adhesives and potting compounds which can give off condensable materials when subjected to a vacuum or high heat. Unless the connector is specially processed, the amount of condensable material outgassed can exceed allowable limits. The space industry has adopted a standardized test procedure, ASTM E595, to evaluate outgassing properties. The MIL-DTL-38999 specification Class G also details specific outgassing values. In Glenair's 186T process, connectors and connector materials are heated to 175° C at a vacuum of  $5 \times 10^{-6}$  Torr for 48 hours. Items under test are then weighed to calculate the Total Mass Loss (TML), which may not exceed 1.0% of the total initial mass. A collector plate is used to determine the Collected Volatile Condensable Material (CVCM), which may not exceed 0.1% of the total original specimen mass. Glenair is able to offer outgas processing which assures all materials comply with their respective standards.

#### Note on Connector Material and Finish Options

Some types of metals are prohibited for space flight. "Pure Tin, Cadmium, Zinc shall not be used as a final finish on EEE part (NASA EEE-INST-002 Instructions for EEE Parts Selection, Screening, Qualification, and Derating). NASA recommends electroless nickel or gold finish on connector shells and gold finish for contacts.

### Specifying Appropriate NASA Screening

**1** Choose a NASA EEE-INST-002 Table 2A screening level. This table contains three screening levels: **Level 1** for missions requiring the highest reliability and lowest level of risk, **Level 2** for low to moderate risk missions, and **Level 3** missions where enhanced screening and inspection is not invoked.

**2** Choose outgassing process and/or NASA inspection requirements. 7 options are available for NASA outgassing, see Table I for details. Cross reference Table II for inspections completed by screening level as required by NASA standards.

**3** Select the modification code from the table and add it to the part number. Example for a SuperNine Blind-Mate Plug, 253-016-00ME25-35PNMS-**429C**.

**Table I: Outgassing per NASA Screening Levels and D38999, Class G**

Screening Level	No Outgas Processing	48 Hour Oven Bake 175° C 100%	Thermal Vacuum* Outgassing 24 Hour 125° C 100%	Thermal Vacuum* Outgassing 48 Hour 175° C 100%	Mod Code
<b>D38999, Class G</b> (no screening)				●	<b>186T</b>
<b>3</b>			●		<b>429L</b>
<b>2</b>	●		●		<b>429</b>
		●			<b>429A</b>
					<b>429K</b>
<b>1</b>	●		●		<b>429B</b>
		●			<b>429C</b>
					<b>429J</b>

\*Thermal vacuum of  $10^{-6}$  Torr.

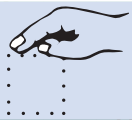



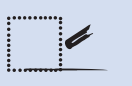



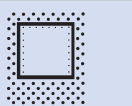

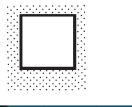



**Table II: NASA EEE-INST-02, Table 2A Screening Levels**

Inspection	Level 1	Level 2	Level 3
Visual	100%	100%	100%
Mechanical	2	2	
Dielectric Withstanding Voltage	2	2	
Insulation Resistance	2	2	
Contact Engagement & Separation Force	2		
Hermeticity (Sealed Receptacles Only)	100%	100%	100%
Coupling Force	2		

Note: required inspection quantity shown. Zero acceptance of failures allowed for all quantities inspected. Inspection is not performed/required for MIL-DTL-38999, Class G

# International Standards IP Protection Classification

International Protection Marking IEC standard 60529, or IP Code, classifies and rates the degree of ingress protection provided against foreign objects, dust, and water by mechanical casings and electrical enclosures.

First Numeral: Solid Particle Protection			Second Numeral: Liquid Ingress Protection		
IP	Effective Against	Description	IP	Effective Against	Description
0	—	No Protection	0	—	No Protection
1	 objects >50 mm	Protected against objects over 50 mm in diameter (large areas of the body such as the back of hand)	1	 Dripping water	Protected against vertically falling drops of water, (e.g. condensation or rainfall), test equivalent to 1mm rainfall/minute
2	 >12.5 mm	Protected against solid objects over 12.5 mm in diameter (contact with fingers)	2	 Dripping water when tilted at 15°	Protected against vertically dripping of water, enclosure tilted 15°. Four positions tested, equivalent to 3mm water/minute
3	 >2.5 mm	Protected against solid objects (e.g. tools, wires) over 2.5 mm in diameter	3	 Spraying water	Protected against sprays up to , 60° from vertical. Tested 1 minute/sq. m for 5 minutes.
4	 >1mm	Protected against objects over 1 mm in diameter (e.g. most wires, slider screws)	4	 Splashing water	Water splashing from any direction has no harmful effect. 10-minute test, plus 5 minute test with shield removed.
5	 Dust protected	Protected against dust (limited ingress, no harmful deposit)	5	 Water jets	Low pressure jets of water from all directions have no harmful effect.. 15 minute test, 1 min./sq. m
6	 Dust tight	Totally protected against dust. A vacuum must be applied, test up to 8 hours based on air flow.	6	 Powerful water jets	Protected against strong jets of water from any direction, 100 l / min. for at least 3 min.
			7	 Immersion up to 1m	Protection against ingress of water in harmful quantity, 1m, 30 min.
			8	 Immersion, continuous, 1m+	Duration and depth by agreement with manufacturer, generally 3m

Example IP Rating		
If the 1st IP number is...	and the 2nd IP number is...	Then the IP rating is
6	7	IP 67
Dust tight	Immersion up to 1m	Totally protected against dust; protected against damage from water ingress up to 1m for 30 minutes.

Levels of Sealing				
Connector Type	Seal Rating	Sealing Method	Typical Shell Material	Contact Material
Dust Tight	IP 65	Elastomer and/or epoxy	Aluminum or Plastic	BeCu/Brass/others
Environmental	IP 66	Elastomer and/or epoxy	Aluminum or Plastic	BeCu/Brass/others
Environmental	IP 67	Elastomer and/or epoxy	Aluminum or Plastic	BeCu/Brass/others
Environmental	IP 68	Elastomer and/or epoxy	Aluminum or Plastic	BeCu/Brass/others
Semi-Hermetic (-491 Mod Code)	1 X 10 <sup>-4</sup> Epoxy Special	Aluminum	Special	
Hermetic	1 X 10 <sup>-4</sup>	Glass (soft) to Metal	Aluminum	BeCu/other
Hermetic	1 X 10 <sup>-6</sup>	Glass to Metal	Cold Rolled Steel or Titanium	Alloy 52 or Kovar
Hermetic	1 X 10 <sup>-7</sup>	CODE RED Encapsulant	Aluminum	Gold-plated Copper
Hermetic	1 X 10 <sup>-8</sup>	Glass to Metal	Stainless Steel or Kovar	Alloy 52 or Kovar
Hermetic	1 X 10 <sup>-10</sup>	Glass to Metal	Inconel or Stainless Steel	Inconel or Stainless Steel

Hermetic leak rate = CC He/Sec



# Common Modifications to Standard MS Type Connectors

	Integrated Band and Boot Porch		Modular Insert Architecture for High-Speed		Space-Grade Plating and Outgas Processing
	Solder or Weld-Mount Flange Modifications		Unique Coupling Nut Castellations and Coatings		Pure Gas Tube and Pitot Tube Contact Integration
	Splined Accessory Attachment		High Density Contact Arrangements		Blind Mate / QDC Coupling
	TBH's Panel Thickness Modifications		Interface and Sealing Modifications for High-Voltage		High-Temperature Shells and Inserts
	Alternative Plating and Material Options (e.g. Composite)		Guide Pin Incorporation for Axial Alignment		Non-Standard MS Couplings such as Push-Pulls
	Back Potting for Advanced Environmental Sealing		Auxiliary Ground Spring Integration		Flange Modifications
	PC Tail Length and Diameter Modifications		Anti-mismating and Polarization Keys / Lobes		Bulkhead Penetrators
	Integrated Flex Circuit Terminations		Gender Changers and Other Unique Connector Savers		Anti-Demate Locking Collars
	Hybrid Power / Signal Contact Layouts		Integrated EMI Filtering and EMP Diodes		Anti-Vibration and Shock PCB Standoffs
	High-Speed Datalink and RF Contact Layouts		RJ45 and USB 3.0 Field Connector Modifications		O-Ring Equipped Panel and Box Mount Designs

# Military Standard Circular Connector Index

The following is a listing of circular connectors defined by US Military Specifications, cross-referenced to the applicable active or inactive part number series. The symbols in the Connector Designator column are an essential element in Glenair's backshell part number developments.

PART NO.	CONN. DESIGN.	SPECIFICATION	SERIES	DESCRIPTION
MS3100	B	SAE AS50151	MS3100	Receptacle Wall Mount (Solder). Superseded by SAE-AS31001
MS3101	B	SAE AS50151	MS3100	Plug (Solder). Superseded by SAE-AS31011
MS3102	**	SAE AS50151	MS3100	Receptacle Box Mount (Solder). Superseded by SAE-AS31021
MS3103	**	SAE AS50151	MS3100	Receptacle Potting (Solder). Superseded by SAE-AS31031
MS3105	**	SAE AS50151	MS3100	Dummy Receptacle. Superseded by SAE-AS31051
MS3106	B	SAE AS50151	MS3100	Plug Straight (Solder). Superseded by SAE-AS31061
MS3107	B	SAE AS50151	MS3100	Plug Quick Disconnect (Solder). Superseded by SAE-AS31070
MS3108	B	SAE AS50151	MS3100	Plug 90° (Solder). Superseded by SAE-AS31081
MS3110	D-729	MIL-DTL-26482	1	Receptacle Wall Mount
MS3111	D	MIL-DTL-26482	1	Plug Cable Connecting
MS3112	**	MIL-DTL-26482	1	Receptacle Box Mount
MS3113	**	MIL-DTL-26482	1	Receptacle Solder Mount
MS3114	D-717	MIL-DTL-26482	1	Receptacle Jam Nut
MS3115	**	MIL-DTL-26482	1-2	Dummy Receptacle
MS3116	D	MIL-DTL-26482	1	Plug Straight
MS3119	**	MIL-DTL-26482	1	Receptacle Thru-Bulkhead
MS3120	D	MIL-DTL-26482	1	Receptacle Wall Mount (Crimp)
MS3121	D	MIL-DTL-26482	1	Plug Straight (Crimp)
MS3122	**	MIL-DTL-26482	1	Receptacle Box Mount (Crimp)
MS3124	D-717	MIL-DTL-26482	1	Receptacle Rear Mount Jam Nut (Crimp)
MS3126	D	MIL-DTL-26482	1	Plug Straight (Crimp)
MS3127	**	MIL-DTL-26482	1	Receptacle Box Mount (Crimp)
MS3128	D	MIL-DTL-26482	1	Receptacle Wall Mount (Crimp)
MS3130	*	SAE AS81703	1	Receptacle Push Pull Wall Mount Flange
MS3132	X-706	SAE AS81703	1	Receptacle Push Pull Box Mount
MS3134	X-706	SAE AS81703	1	Receptacle Push Pull Jam Nut
MS3135	**	SAE AS81703	1	Dummy Receptacle
MS3137	X-706	SAE AS81703	1	Plug Straight Push Pull
MS3138	X-706	SAE AS81703	1	Plug Lanyard Push Pull
MS3139	**	SAE AS81703	1	Receptacle Thru-Bulkhead (Wall Mount)
MS3140	X-706B	SAE AS81703	2	Receptacle Push Pull Wall Mount
MS3142	**	SAE AS50151	MS3100	Receptacle Hermetic Box Mount (Solder)
MS3143	**	SAE AS50151	MS3100	Receptacle Hermetic Solder Mount
MS3144	X-706B	SAE AS81703	2	Receptacle Push Pull Jam Nut
MS3145	**	SAE AS81703	3	Receptacle Hermetic Push Pull Box Mount
MS3146	**	SAE AS81703	3	Receptacle Push Pull Hermetic Solder Mount
MS3147	X-706B	SAE AS81703	2	Plug Push Pull (Crimp)
MS3148	X-706B	SAE AS81703	2	Plug Push Pull Lanyard (Crimp)
MS3149	**	SAE AS81703	3	Receptacle Push Pull Hermetic (Single-Hole Mount)
MS3400	A	SAE AS50151	MS3400	Receptacle Wall Mount (Crimp)

\* Consult Factory

\*\* Connector does not accommodate rear accessories

\*\*\*Inactive for new design

# Military Standard Circular Connector Index

PART NO.	CONN. DESIGN.	SPECIFICATION	SERIES	DESCRIPTION
MS3401	A	SAE AS50151	MS3400	Receptacle Cable Connecting (Crimp)
MS3402	**	SAE AS50151	MS3400	Receptacle, Box Mount (Crimp)
MS3404	A	SAE AS50151	MS3400	Receptacle Jam Nut (Crimp)
MS3406	A	SAE AS50151	MS3400	Plug (Crimp)
MS3408	A	SAE AS50151	MS3400	Plug 90° (Crimp)
MS3409	A	SAE AS50151	MS3400	Plug 45° (Crimp)
MS3412	A	SAE AS50151	MS3400	Receptacle Wall Mount (Crimp)
MS3424	A	SAE AS81703	3	Receptacle Push Pull Wall Mount
MS3440	**	MIL-DTL-26482	2	Receptacle Narrow Flange Mount (was M83723/9/10)
MS3442	**	MIL-DTL-26482	2	Receptacle Wide Flange Mount
MS3443	**	MIL-DTL-26482	2	Receptacle Solder Flange Mount
MS3445	*	SAE AS81703	2	Plug Push Pull Rack & Panel Mount
MS3446	A	SAE AS81703	3	Plug Push Pull Rack & Panel Mount
MS3449	**	MIL-DTL-26482	2	Receptacle Push Pull Single Hole Mount
MS3450	A	SAE AS50151	MS3450	Receptacle Wall Mount (was M83723/19/20) (Crimp)
MS3451	A	SAE AS50151	MS3450	Receptacle Cable Connecting (was M83723/17/18) (Crimp)
MS3452	**	SAE AS50151	MS3450	Receptacle Box Mount (was M83723/21/22) (Crimp)
MS3454	A	SAE AS50151	MS3450	Receptacle Jam Nut (Crimp)
MS3456	A	SAE AS50151	MS3450	Plug Straight (was M83723/23/24) (Crimp)
MS3459	A	SAE AS50151	MS3450	Plug Straight Self Locking (was M83723/52/53)
MS3463	**	SAE AS81703	3	Receptacle Push Pull (Hermetic)
MS3464	A	SAE AS81703	3	Receptacle Push Pull Jam Nut
MS3466	**	SAE AS81703	3	Receptacle Push Pull Hermetic (Box Mount)
MS3467	A	SAE AS81703	3	Plug Push Pull
MS3468	A	SAE AS81703	3	Plug Push Pull Lanyard
MS3469	**	SAE AS81703	3	Receptacle Push Pull Hermetic Jam Nut
MS3470	A	MIL-DTL-26482	2	Receptacle Narrow Flange Mount (was M83723/1/2)
MS3471	A	MIL-DTL-26482	2	Receptacle Cable Connecting (was M83723/7/8)
MS3472	A	MIL-DTL-26482	2	Receptacle Wide Flange Mount (was M83723/3/4)
MS3473	**	MIL-DTL-26482	2	Receptacle Solder Mount Hermetic
MS3474	A	MIL-DTL-26482	2	Receptacle Rear Mount Jam Nut (was M83723/5/6)
MS3475	A	MIL-DTL-26482	2	Plug RFI Shielded (was M83723/42/43)
MS3476	A	MIL-DTL-26482	2	Plug Straight (was M83723/13/14)
MS3477	**	MIL-DTL-26482	2	Receptacle Hermetic Box Mount
MS3479	**	MIL-DTL-26482	2	Receptacle Hermetic Rear Mount Jam Nut
MS17343	C	MIL-DTL-22992	R	Receptacle Wall Mount
MS17344	C	MIL-DTL-22992	R	Plug Straight
MS17345	C	MIL-DTL-22992	R	Plug Cable Connecting (Female)
MS17346	C	MIL-DTL-22992	R	Receptacle Box Mount
MS17347	C	MIL-DTL-22992	R	Receptacle Jam Nut
MS17348	**	MIL-DTL-22992	R	Receptacle Jam Nut Box Mount
MS18062	**	MIL-DTL-22992	R	Dummy Receptacle
MS20026	*	MIL-DTL-27599	I	Receptacle Wall Mount Solder***
MS20027	*	MIL-DTL-27599	I	Receptacle Line***
MS20028	*	MIL-DTL-27599	I	Plug Straight***
MS20029	**	MIL-DTL-27599	I	Receptacle Jam Nut Mount***
MS20030	*	MIL-DTL-27599		Receptacle Box Mount Hermetic

\* Consult Factory

\*\* Connector does not accommodate rear accessories

\*\*\* Inactive for new design TYP 2 PL



PART NO.	CONN. DESIGN.	SPECIFICATION	SERIES	DESCRIPTION
MS20031	**	MIL-DTL-27599		Receptacle Jam Nut Hermetic***
MS20032	**	MIL-DTL-27599		Receptacle Solder Mount Hermetic***
MS20034	*	MIL-DTL-27599		Receptacle Wall Mount***
MS20035	*	MIL-DTL-27599		Receptacle Box Mount***
MS24264	E	MIL-DTL-26500	F G & R	Receptacle Flange Mount*** Use MIL-DTL-83723
MS24265	E	MIL-DTL-26500	F G & R	Receptacle Single Hole Mount*** Use MIL-DTL-83723
MS24266	E	MIL-DTL-26500	F G & R	Plug Straight*** Use MIL-DTL-83723
MS25183	**	SAE AS50151	MS3100	Plug Potting Seal (Solder)
MS27034	**	MIL-DTL-26500		Receptacle Hermetic Solder Mount
MS27334	*	MIL-DTL-27599		Receptacle Wall Mount ***
MS27335	**	MIL-DTL-27599		Receptacle Box Mount ***
MS27336	*	MIL-DTL-27599		Plug Straight ***
MS27337	*	MIL-DTL-27599		Receptacle Jam Nut ***
MS27338	*	MIL-DTL-27599		Receptacle Wall Mount Hermetic
MS27339	**	MIL-DTL-27599		Receptacle Box Mount Hermetic
MS27340	**	MIL-DTL-27599		Receptacle Jam Nut Mount Hermetic
MS27341	**	MIL-DTL-27599		Receptacle Solder Mount Hermetic
MS27466	F	MIL-DTL-38999	I	Receptacle Wall Mount
MS27467	F	MIL-DTL-38999	I	Plug Straight
MS27468	F	MIL-DTL-38999	I	Receptacle Jam Nut
MS27469	**	MIL-DTL-38999	I	Receptacle Wall Mount Hermetic
MS27470	**	MIL-DTL-38999	I	Receptacle Jam Nut Hermetic
MS27471	**	MIL-DTL-38999	I	Receptacle Solder Mount Hermetic
MS27472	F	MIL-DTL-38999	II	Receptacle Wall Mount
MS27473	F	MIL-DTL-38999	II	Plug Straight
MS27474	F	MIL-DTL-38999	II	Receptacle Jam Nut
MS27475	F	MIL-DTL-38999	II	Receptacle Wall Mount
MS27476	**	MIL-DTL-38999	II	Receptacle Box Mount Hermetic
MS27477	**	MIL-DTL-38999	II	Receptacle Jam Nut Hermetic
MS27478	**	MIL-DTL-38999	II	Receptacle Solder Mount Hermetic
MS27479	F	MIL-DTL-38999	II	Inactive Use MS27472
MS27480	F	MIL-DTL-38999	II	Inactive Use MS27473
MS27481	F	MIL-DTL-38999	II	Inactive Use MS27474
MS27482	F	MIL-DTL-38999	II	Inactive Use MS27475
MS27483	**	MIL-DTL-38999	II	Inactive Use MS27474
MS27484P	**	MIL-DTL-38999	II	Plug Straight
MS27484T	F	MIL-DTL-38999	II	Plug Straight
MS27496	**	MIL-DTL-38999	I	Receptacle Box Mount
MS27497	F	MIL-DTL-38999	II	Receptacle Back Panel Wall Mount
MS27498	F	MIL-DTL-38999	I	Plug 90° (MS27467)
MS27499	**	MIL-DTL-38999	II	Receptacle Box Mount
MS27500	F	MIL-DTL-38999	II	Inactive See MS27473
MS27503	**	MIL-DTL-38999	II	Inactive See MS27478
MS27504	**	MIL-DTL-38999	II	Inactive See MS27499
MS27505	**	MIL-DTL-38999	I	Receptacle Back Panel Box Mount
MS27508	**	MIL-DTL-38999	II	Receptacle Back Panel Box Mount
MS27513	**	MIL-DTL-38999	II	Receptacle Box Mount

\* Consult Factory

\*\* Connector does not accommodate rear accessories

\*\*\*Inactive for new design

# Military Standard Circular Connector Index

PART NO.	CONN. DESIGN.	SPECIFICATION	SERIES	DESCRIPTION
MS27515	F	MIL-DTL-38999	I	Inactive Use MS27656
MS27613	E-710	MIL-DTL-26500		Receptacle Panel Mount ***Use MIL-DTL-83723
MS27614	E-710	MIL-DTL-26500		Receptacle D-Hole Mount ***Use MIL-DTL-83723
MS27615	E-710	MIL-DTL-26500		Plug Straight ***Use MIL-DTL-83723
MS27652	F	MIL-DTL-38999	I	Inactive Use MS27466
MS27653	F	MIL-DTL-38999	I	Inactive Use MS27467
MS27654	F	MIL-DTL-38999	I	Inactive Use MS27656
MS27656	F	MIL-DTL-38999	I	Receptacle Back Panel Wall Mount (MS27499)
MS27661	F-752	MIL-DTL-38999	I	Plug Lanyard Release
MS27662	**	MIL-DTL-38999	I	Receptacle Thru-Bulkhead
MS27664	**	MIL-DTL-38999	II	Receptacle Back-Panel Wall Mount
MS27665	F	MIL-DTL-38999	I	Plug Rack & Panel Mount
MS27667	**	MIL-DTL-38999	II	Receptacle Thru-Bulkhead
MS90555	*	MIL-DTL-22992	L	Receptacle Wall Mount
MS90556	*	MIL-DTL-22992	L	Plug Straight
MS90557	*	MIL-DTL-22992	L	Plug Cable Connecting
MS90558	*	MIL-DTL-22992	L	Receptacle w/Coupling Ring Wall Mount
M28840/10	G	MIL-DTL-28840		Receptacle Wall Mount
M28840/11	G	MIL-DTL-28840		Receptacle Cable Connecting
M28840/12	**	MIL-DTL-28840		Receptacle Box Mount
M28840/14	G	MIL-DTL-28840		Receptacle Jam Nut
M28840/16	G	MIL-DTL-28840		Plug Straight
D38999/20	H	MIL-DTL-38999	III	Receptacle Wall Mount
D38999/21	**	MIL-DTL-38999	III	Receptacle Hermetic (Box Mount)
D38999/23	**	MIL-DTL-38999	III	Receptacle Hermetic Jam Nut
D38999/24	H	MIL-DTL-38999	III	Receptacle Jam Nut
D38999/25	**	MIL-DTL-38999	III	Receptacle Hermetic Solder Mount
D38999/26	H	MIL-DTL-38999	III	Plug Straight
D38999/27	**	MIL-DTL-38999	III	Receptacle Hermetic Weld Mount
D38999/29	H-701	MIL-DTL-38999	III	Plug Lanyard Release
D38999/30	H-701	MIL-DTL-38999	III	Plug Lanyard Release
D38999/31	H	MIL-DTL-38999	III	Plug Lanyard Release
D38999/36	H	MIL-DTL-38999	III	Plug Lanyard Release
D38999/40	H	MIL-DTL-38999	IV	Receptacle Wall Mount
D38999/41	**	MIL-DTL-38999	IV	Box Mount Receptacle Hermetic
D38999/42	**	MIL-DTL-38999	IV	Receptacle Box Mount
D38999/43	H	MIL-DTL-38999	IV	Jam Nut Mount Hermetic Receptacle
D38999/44	H-715	MIL-DTL-38999	IV	Receptacle Jam Nut
D38999/45	**	MIL-DTL-38999	IV	Solder Mount Hermetic Receptacle
D38999/46	H	MIL-DTL-38999	IV	Plug Straight EMI
D38999/47	H	MIL-DTL-38999	IV	Plug Straight
D38999/49	H	MIL-DTL-38999	IV	In Line Cable Receptacle
D38999/60	H	MIL-DTL-38999	III	Tight Tolerance Fiber Optic Plug
D38999/61	H	MIL-DTL-38999	III	Tight Tolerance Wall Mount Fiber Optic Receptacle
M81511/1	J	SAE AS81511	2	Receptacle Flange Mount
M81511/2	**	SAE AS81511	2	Receptacle Solder Flange
M81511/3	J	SAE AS81511	2	Receptacle Jam Nut

\* Consult Factory

\*\* Connector does not accommodate rear accessories

\*\*\*Inactive for new design TYP 2 PL

PART NO.	CONN. DESIGN.	SPECIFICATION	SERIES	DESCRIPTION
M81511/4	**	SAE AS81511	2	Receptacle Jam Nut ***
M81511/5	J	SAE AS81511	2	Plug Cable Connecting ***
M81511/6	J	SAE AS81511	2	Plug ***
M81511/21	J	SAE AS81511	1	Receptacle Flange Mount ***
M81511/22	**	SAE AS81511	1	Receptacle Solder Flange Mount ***
M81511/23	J	SAE AS81511	1	Receptacle Jam Nut ***
M81511/24	**	SAE AS81511	1	Receptacle Jam Nut ***
M81511/25	J	SAE AS81511	1	Receptacle Cable Connecting ***
M81511/26	J	SAE AS81511	1	Plug ***
M81511/27	**	SAE AS81511	1	Receptacle Thru-Bulkhead Jam Nut ***
M81511/28	**	SAE AS81511	2	Receptacle Thru-Bulkhead Single Hole Mount ***
M81511/31	J	SAE AS81511	2	Receptacle Flange Mount ***
M81511/32	J	SAE AS81511	2	Receptacle Jam Nut Mount ***
M81511/33	J	SAE AS81511	2	Receptacle, Cable Connecting ***
M81511/34	J	SAE AS81511	2	Plug ***
M81511/35	J	SAE AS81511	1	Receptacle Flange Mount ***
M81511/36	J	SAE AS81511	1	Receptacle Jam Nut ***
M81511/37	J	SAE AS81511	1	Receptacle Cable Connecting ***
M81511/38	J	SAE AS81511	1	Plug ***
M81511/41	J	SAE AS81511	3	Receptacle Flange Mount ***
M81511/42	**	SAE AS81511	3	Receptacle Solder Flange Mount ***
M81511/44	**	SAE AS81511	3	Receptacle Jam Nut ***
M81511/45	J	SAE AS81511	3	Receptacle Cable Connecting ***
M81511/46	J	SAE AS81511	3	Plug ***
M81511/47	**	SAE AS81511	3	Receptacle Solder Flange Mount ***
M81511/48	**	SAE AS81511	3	Receptacle Jam Nut ***
M81511/49	J	SAE AS81511	3	Receptacle Jam Nut ***
M81511/50	**	SAE AS81511	4	Receptacle Jam Nut ***
M81511/51	J	SAE AS81511	4	Receptacle Flange Mount ***
M81511/52	**	SAE AS81511	4	Receptacle Solder Flange Mount ***
M81511/53	J	SAE AS81511	4	Receptacle Jam Nut ***
M81511/54	**	SAE AS81511	4	Receptacle Jam Nut ***
M81511/55	J	SAE AS81511	4	Receptacle Cable Connecting ***
M81511/56	J	SAE AS81511	4	Plug ***
M81511/57	**	SAE AS81511	4	Receptacle Solder Flange Mount ***
M81582/1	*	SAE AS81582		Receptacle Jam Nut Mount ***
M81582/2	*	SAE AS81582		Plug Lanyard Release ***
M83723/1	A	MIL-DTL-83723	I	Superseded by MS3470
M83723/2	A	MIL-DTL-83723	I	Superseded by MS3470
M83723/3	A	MIL-DTL-83723	I	Superseded by MS3472
M83723/4	A	MIL-DTL-83723	I	Superseded by MS3472
M83723/5	A	MIL-DTL-83723	I	Superseded by MS3474
M83723/6	A	MIL-DTL-83723	I	Superseded by MS3474
M83723/7	A	MIL-DTL-83723	I	Superseded by MS3471
M83723/8	A	MIL-DTL-83723	I	Superseded by MS3471
M83723/9	**	MIL-DTL-83723	I	Superseded by MS3440
M83723/10	**	MIL-DTL-83723	I	Superseded by MS3442

\* Consult Factory

\*\* Connector does not accommodate rear accessories

\*\*\*Inactive for new design



# Military Standard Circular Connector Index

PART NO.	CONN. DESIGN.	SPECIFICATION	SERIES	DESCRIPTION
M83723/11	**	MIL-DTL-83723	I	Superseded by MS3443
M83723/12	**	MIL-DTL-83723	I	Superseded by MS3443
M83723/13	A	MIL-DTL-83723	I	Superseded by MS3476
M83723/14	A	MIL-DTL-83723	I	Superseded by MS3476
M83723/17	K	MIL-DTL-83723	II	Superseded by MS3451 ***
M83723/18	K	MIL-DTL-83723	II	Superseded by MS3451 ***
M83723/19	K	MIL-DTL-83723	II	Superseded by MS3450 ***
M83723/20	K	MIL-DTL-83723	II	Superseded by MS3450 ***
M83723/21	**	MIL-DTL-83723	II	Superseded by MS3452 ***
M83723/22	**	MIL-DTL-83723	II	Superseded by MS3452 ***
M83723/23	K	MIL-DTL-83723	II	Superseded by MS3456 ***
M83723/24	K	MIL-DTL-83723	II	Superseded by MS3456 ***
M83723/25	**	MIL-DTL-83723	II	Superseded by MS3142 ***
M83723/26	**	MIL-DTL-83723	II	Superseded by MS3143 ***
M83723/36	A	MIL-DTL-83723	I	Inactive For New Design
M83723/37	A	MIL-DTL-83723	I	Inactive For New Design
M83723/38	A	MIL-DTL-83723	I	Inactive For New Design
M83723/39	A	MIL-DTL-83723	I	Inactive For New Design
M83723/40	A	MIL-DTL-83723	I	Inactive For New Design
M83723/41	A	MIL-DTL-83723	I	Inactive For New Design
M83723/42	A	MIL-DTL-83723	I	Superseded by MS3475
M83723/43	A	MIL-DTL-83723	I	Superseded by MS3475
M83723/45	**	MIL-DTL-83723	I	Superseded by MS3115
M83723/48	A	MIL-DTL-83723	I	Inactive For New Design
M83723/49	A	MIL-DTL-83723	I	Inactive For New Design
M83723/52	K	MIL-DTL-83723	II	Superseded by MS3459
M83723/53	K	MIL-DTL-83723	II	Superseded by MS3459
M83723/66	A	MIL-DTL-83723	III	Plug Push Pull (Pin Contacts)
M83723/67	A	MIL-DTL-83723	III	Plug Push Pull (Socket Contacts)
M83723/68	A	MIL-DTL-83723	III	Plug Push Pull Lanyard (Pin Contacts)
M83723/69	A	MIL-DTL-83723	III	Plug Push Pull Lanyard (Socket Contacts)
M83723/71	A	MIL-DTL-83723	III	Receptacle Bayonet Flange Mount (Socket Contact)
M83723/72	A	MIL-DTL-83723	III	Receptacle Bayonet Flange Mount (Pin Contact)
M83723/73	A	MIL-DTL-83723	III	Receptacle Bayonet Single Hole Mount (Socket Contact)
M83723/74	A	MIL-DTL-83723	III	Receptacle Bayonet Single Mount (Pin Contact)
M83723/75	A	MIL-DTL-83723	III	Plug Bayonet (Socket Contact)
M83723/76	A	MIL-DTL-83723	III	Plug Bayonet (Pin Contact)
M83723/77	A	MIL-DTL-83723	III	Plug Bayonet RFI (Socket Contact)
M83723/78	A	MIL-DTL-83723	III	Plug Bayonet RFI (Pin Contact)
M83723/79	**	MIL-DTL-83723	III	Receptacle Bayonet Flange Mount Hermetic
M83723/80	**	MIL-DTL-83723	III	Receptacle Bayonet Solder Flange Mount Hermetic
M83723/81	**	MIL-DTL-83723	III	Receptacle Bayonet Single Hole Mount Hermetic
M83723/82	A	MIL-DTL-83723	III	Receptacle Threaded Flange Mount (Socket Contact)
M83723/83	A	MIL-DTL-83723	III	Receptacle Threaded Flange Mount (Pin Contact)
M83723/84	A	MIL-DTL-83723	III	Receptacle Threaded Single Hole Mount (Socket Contact)
M83723/85	A	MIL-DTL-83723	III	Receptacle Threaded Single Hole Mount (Pin Contact)
M83723/86	A	MIL-DTL-83723	III	Plug Threaded (Socket Contact)

\* Consult Factory

\*\* Connector does not accommodate rear accessories

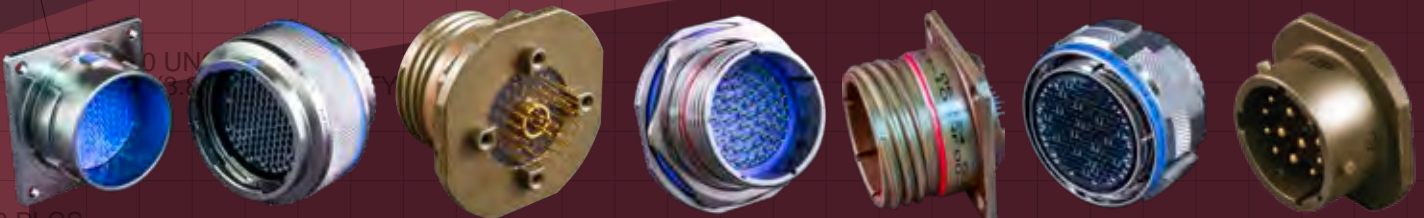
\*\*\*Inactive for new design TYP 2 PL

PART NO.	CONN. DESIGN.	SPECIFICATION	SERIES	DESCRIPTION
M83723/87	A	MIL-DTL-83723	III	Plug Threaded (Pin Contact)
M83723/88	**	MIL-DTL-83723	III	Receptacle Threaded Flange Mount (Pin Contact)
M83723/89	**	MIL-DTL-83723	III	Receptacle Threaded Single Hole Mount Hermetic
M83723/90	**	MIL-DTL-83723	III	Receptacle Threaded Solder Flange Mount Hermetic
M83723/91	A	MIL-DTL-83723	III	Plug Threaded RFI (Socket Contact)
M83723/92	A	MIL-DTL-83723	III	Plug Threaded RFI (Pin Contact)
M83723/93	**	MIL-DTL-83723	III	Receptacle Bayonet Solder Flange Mount Hermetic
M83723/94	**	MIL-DTL-83723	III	Receptacle Bayonet Single Hole Mount Hermetic
M83723/95	A	MIL-DTL-83723	III	Plug Threaded (Socket Contact) Self Locking
M83723/96	A	MIL-DTL-83723	III	Plug Threaded (Pin Contact) Self Locking
M83723/97	A	MIL-DTL-83723	III	Plug Threaded RFI (Socket Contact) Self Locking
M83723/98	A	MIL-DTL-83723	III	Plug Threaded RFI (Pin Contact) Self Locking
NATC00	H*	SSQ21635		Receptacle Flange
NATC06	H*	SSQ21635		Plug
NATC07	H*	SSQ21635		Receptacle Jam Nut
NATC09	***	SSQ21635		Receptacle Weld Mount
NATC77	***	SSQ21635		Receptacle Jam Nut Bulkhead Feed-Thru
NATC99	***	SSQ21635		Receptacle Weld Mount
NBO	A	40M39569		Receptacle Flange Mount
NBOH	**	40M39569		Receptacle Hermetic
NB3H	**	40M39569		Receptacle Hermetic
NB4	A	40M39569		Receptacle Flange Mount
NB5H	**	40M39569		Thru-Bulkhead Hermetic
NB6	A	40M39569		Plug Straight
NB6G	A	40M39569		Plug Straight,EMI
NB7	A	40M39569		Receptacle Jam Nut
NB7H	**	40M39569		Receptacle Hermetic
NB8H	**	40M39569		Receptacle Hermetic
NLSO	F	40M38277		Receptacle Flange Mount
NLS3H	**	40M38277		Receptacle Hermetic
NLS6	F	40M38277		Plug Straight
NLS6G	F	40M38277		Plug Straight EMI
NLS7	F	40M38277		Receptacle Jam Nut
NLS7H	**	40M38277		Receptacle Jam Nut
NZGL00	H**	SSQ21635		Receptacle Flange
NZGL03	***	SSQ21635		Receptacle Lever
NZGL06	H**	SSQ21635		Plug
NZGL07	H**	SSQ21635		Receptacle Weld Mount
NZGL09	***	SSQ21635		Receptacle Weld Mount
NZGL66	H**	SSQ21635		Plug
NZGL77	***	SSQ21635		Receptacle Jam Nut
NZGL99	***	SSQ21635		Receptacle Weld Mount

\* Consult Factory

\*\* Connector does not accommodate rear accessories

\*\*\* Inactive for new design



# Military Specification Comparison Tables for Circular Connectors

MILITARY SPECIFICATION	ENVIRONMENTAL AND MATERIAL CLASS	PERFORMANCE		
		DESCRIPTION	WATER RESISTANCE	RESILIENT MATERIAL
SAE AS50151 Solder Series I (IT)	A	Non-Environmental Solid Shell	Moisture-proof	–
	B	Non-Environmental Split Shell	Moisture-proof	–
	C	Pressurized	Moisture-proof	–
	E	Environmental Grommet Seal	Moisture-proof	Neoprene
	F	Environmental Grommet Seal with Clamp	Moisture-proof	Neoprene
	HS	Hermetic	Submersible	Silicone
	P	Environmental Potting Seal	Moisture-proof	Polyamide
	K	Non-Environmental Firewall	Moisture-proof	–
	R	Environmental Grommet Seal with 'O' Ring	Moisture-proof	Neoprene
SAE AS50151 Crimp Front Release Series II	D	Environmental High Shock	Splash-proof	Silicone
	DJ	Environmental High Shock	Splash-proof	Silicone
	DJS	Environmental High Shock	Splash-proof	Silicone
	DS	Environmental High Shock	Splash-proof	Silicone
	K	Environmental Firewall	Submersible	Silicone
	KS	Environmental Firewall	Submersible	Silicone
	KT	Environmental Firewall	Submersible	Silicone
	L	Environmental High Temperature	Submersible	Silicone
	LS	Environmental High Temperature	Submersible	Silicone
	U	Environmental High Temperature	Splash-proof	Silicone
	US	Environmental High Temperature	Splash-proof	Silicone
	W	Environmental General Purpose	Splash-proof	Silicone
SAE AS50151 Crimp Rear Release Series III	K	Environmental Firewall	Submersible	Silicone
	KS	Environmental Firewall	Submersible	Silicone
	KT	Environmental Firewall	Submersible	Silicone
	L	Environmental High Temperature	Submersible	Silicone
	LS	Environmental High Temperature	Submersible	Silicone
	U	Environmental High Temperature	Splash-proof	Silicone
	US	Environmental High Temperature	Splash-proof	Silicone
	W	Environmental General Purpose	Splash-proof	Silicone
MIL-C-10544	ALL	Environmental Signal Corps Audio U Series	Moisture-proof	Neoprene
MIL-DTL-12520	ALL	Environmental Signal Corps Power UW Series	Moisture-proof	Neoprene
MIL-C-22249	ALL	Environmental High Pressure Bulkhead	Submersible	Silicone
MIL-C-22539	ALL	Environmental High Pressure Bulkhead	Submersible	Diallyl Phthalate



		CONTACT TYPE			SHELL			
	OPERATING TEMP	SOLDER or EYELET	CRIMP		SIZE	SHELL MATERIAL	FINISH DESCRIPTION	COUPLING TYPE
			FRONT	REAR				
	125°C	•	–	–	16 12 8 4 1/0	Aluminum	96 hr. Cad O.D.	Threaded
	125° C	•	–	–		Aluminum	96 hr. Cad O.D.	
	125°C	•	–	–		Aluminum	96 hr. Cad O.D.	
	125°C	•	–	–		Aluminum	96 hr. Cad O.D.	
	125°C	•	–	–		Aluminum	96 hr. Cad O.D.	
	125°C	•	–	–		Stainless Steel	96 hr. Cad O.D.	
	125°C	•	–	–		Aluminum	96 hr. Cad O.D.	
	125°C	Non-Removable Crimp				Carbon Steel	96 hr. Cad O.D.	
	125°C	•	–	–		Aluminum	96 hr. Cad O.D.	
	175°C	–	•	–		16 12 8 4 1/0	Aluminum	
	175°C	–	•	–	Aluminum		500 hr. Cad O.D.	
	175°C	–	•	–	Stainless Steel		Black Cad	
	175°C	–	•	–	Stainless Steel		Black Cad	
	175°C	–	•	–	Carbon Steel		Electroless Nickel	
	175°C	–	•	–	Stainless Steel		Passivated	
	175°C	–	•	–	Carbon Steel		96 hr. Cad O.D.	
	200°C	–	•	–	Aluminum		Electroless Nickel	
	200°C	–	•	–	Stainless Steel		Passivated	
	200°C	–	•	–	Aluminum		Electroless Nickel	
	200°C	–	•	–	Stainless Steel		Passivated	
	175°C	–	•	–	Aluminum		96 hr. Cad O.D.	
	175°C	–	–	•	16 12 8 4 1/0		Carbon Steel	Electroless Nickel
	175°C	–	–	•		Stainless	Passivated	
	175°C	–	–	•		Carbon Steel	96 hr. Cad O.D.	
	200°C	–	–	•		Aluminum	Electroless Nickel	
	200°C	–	–	•		Stainless Steel	Passivated	
	200°C	–	–	•		Aluminum	Electroless Nickel	
	200°C	–	–	•		Stainless Steel	Passivated	
	175°C	–	–	•		Aluminum	96 hr. Cad O.D.	
	125°C	Solder & Taper Pin Terminations			16	Stainless Steel	Passivated	Reverse Bayonet
	125°C	•	–	–	20 16 12 8	Aluminum	Cad O.D.	Center Lock Screw
	73°C	•	–	–	20 16	Stainless Steel	Passivated	Threaded
	73°C	•	–	–	16 12	Stainless Steel	Passivated	Threaded

# Military Specification Comparison Tables for Circular Connectors

MILITARY SPECIFICATION	ENVIRONMENTAL AND MATERIAL CLASS	PERFORMANCE		
		DESCRIPTION	WATER RESISTANCE	RESILIENT MATERIAL
MIL-DTL-22992 Class C, J & R	C*C*	Environmental Pressurized	Moisture-proof	Neoprene
	C*N*	Environmental Pressurized	Moisture-proof	Neoprene
	J*C*	Environmental Pressurized, with Grommet	Moisture-proof	Neoprene
	J*N*	Environmental Pressurized, with Grommet	Moisture-proof	Neoprene
	R*C*	Environmental	Moisture-proof	Neoprene
	R*N*	Environmental	Moisture-proof	Neoprene
MIL-DTL-22992 Class L	L (C)	Environmental, Gland Seal Backshell	Moisture-proof	Neoprene
	L (N)	Environmental, Gland Seal Backshell	Moisture-proof	Neoprene
MIL-C-24217	ALL	High Pressure Bulkhead	Submersible	Silicone
MIL-DTL-25955	–	Environmental	Moisture-proof	Neoprene
	–	Hermetic	Moisture-proof	Neoprene
MIL-DTL-26482 Series 1 Solder (IPT)	E	Environmental with Grommet Nut	Moisture-proof	Neoprene
	F	Environmental with Strain Relief	Moisture-proof	Neoprene
	H*A*	Hermetic	Moisture-proof	
	H*B*	Hermetic	Moisture-proof	
	H*C*	Hermetic	Moisture-proof	
	H*Y*	Hermetic	Moisture-proof	
	J	Environmental Gland Seal	Moisture-proof	Neoprene
	P	Environmental Potting Seal	Moisture-proof	Neoprene
MIL-DTL-26482 Series 1 Crimp (IPT SE)	E	Environmental with Grommet Nut	Moisture-proof	Neoprene
	F	Environmental with Strain Relief	Moisture-proof	Neoprene
	P	Environmental Potting Seal	Moisture-proof	Neoprene
MIL-DTL-26482	A	Environmental	Submersible	Silicone
	E	Environmental	Submersible	Silicone
	H*A*	Hermetic	Submersible	Silicone
	H*B*	Hermetic	Submersible	Silicone
	H*C*	Hermetic	Submersible	Silicone
	H*Y*	Hermetic	Submersible	Silicone
	L	Environmental	Submersible	Silicone
	N	Hermetic	Submersible	Silicone
MIL-DTL-26500	W	Environmental	Submersible	Silicone
	E	Environmental, High Temperature	Splash-proof	Silicone
	F	Environmental, Fluid Resistant	Submersible	Silicone
	G	Environmental, Grounding	Splash-proof	Silicone
	H*C	Hermetic	Splash-proof	Silicone
	H*E	Hermetic	Splash-proof	Silicone
	K	Environmental, Firewall	Splash-proof	Silicone
	R	Environmental	Splash-proof	Silicone

		CONTACT TYPE			SHELL		
OPERATING TEMP	SOLDER or EYELET	CRIMP		SIZE	SHELL MATERIAL	FINISH DESCRIPTION	COUPLING TYPE
		FRONT	REAR				
125°C	•	–	–	16 12 8 4 1/0	Aluminum	500 hr Cad O.D.	Threaded Double Start
125°C	–	–	–		Aluminum	Black Anodize	
125°C	–	–	–		Aluminum	500 hr Cad O.D.	
125°C	–	–	–		Aluminum	Black Anodize	
125°C	–	–	–		Aluminum	500 hr Cad O.D.	
125°C	–	–	–		Aluminum	Black Anodize	
125°C	•			6 4 2 1/0 4/0	Aluminum	500 hr Cad O.D.	Threaded Double Start
125°C	•				Aluminum	Black Anodize	
75C	•	–	–	16 12 8 4 1/0	Stainless Steel	Passivated	Coupling
125°C	–	•	–	20	Aluminum	Cadmium	Threaded Double Start
125°C	•	–	–		Carbon Steel	Tinned	
125°C	•	–	–	20 16 12	Aluminum	96 hr Cad O.D.	Bayonet
125°C	•	–	–		Aluminum	96 hr Cad O.D.	
125°C	•				Stainless Steel	Passivate	
125°C	•				Stainless Steel	Passivate	
125°C	•				Carbon Steel	Tinned	
125°C	•				Carbon Steel	Tinned	
125°C	•				Aluminum	96 hr Cad O.D.	
125°C	•				Aluminum	96 hr Cad O.D.	
125°C	–	•	–	20	Aluminum	96 hr Cad O.D.	Bayonet
125°C	–	•	–	16	Aluminum	96 hr Cad O.D.	
125°C	–	•	–	12	Aluminum	96 hr Cad O.D.	
200°C	–	–	•	20 16 12	Aluminum	Black Anodize	Bayonet
175°C					Aluminum	Electroless Nickel	
200°C	•	–	–		Stainless Steel	Passivate	
200°C	•	–	–		Stainless Steel	Passivate	
175°C	•	–	–		Carbon Steel	Tinned	
175°C	•	–	–		Carbon Steel	Tinned	
200°C	–	–	•		Aluminum	Electroless Nickel	
175°C	–	–	•		Carbon Steel	Tinned	
175°C	–	–	•	20 16 12	Aluminum	500 hr Cad O.D.	Bayonet or Threaded
200°C	–	•	–		Stainless Steel	Passivate	
175°C	–	•	–		Aluminum	Anodic Coating	
200°C	–	•	–		Aluminum	Electroless Nickel	
200°C	•	–	–		Carbon Steel	Tinned	
200°C	•	–	–		Carbon Steel	Tinned	
200°C	–	•	–		Stainless Steel	Passivate	
175°C	–	•	–		Aluminum	Black Anodize	



# Military Specification Comparison Tables for Circular Connectors

MILITARY SPECIFICATION	ENVIRONMENTAL AND MATERIAL CLASS	PERFORMANCE		
		DESCRIPTION	WATER RESISTANCE	RESILIENT MATERIAL
MIL-DTL-27599 Series I	P*A	Potting Seal	–	None
	P*B	Potting Seal	–	None
	T*A	Non-Environmental	–	None
	T*B	Non-Environmental	–	None
MIL-DTL-27599 Series II	P*A	Potting Seal	–	None
	P*B	Potting Seal	–	None
	T*A	Non-Environmental	–	None
	T*B	Non-Environmental	–	None
MIL-DTL-28840	D	Environmental	Splash-proof	Fluorosilicone
	DS	Environmental	Splash-proof	Fluorosilicone
	T	Environmental	Splash-proof	Fluorosilicone
	Z	Environmental	Splash-proof	Fluorosilicone
MIL-PRF-28876	ALL	Environmental	Submersible	Fluorosilicone
SAE AS29600 Series A MIL-DTL-38999 Insert	E	Environmental	Submersible	Silicone
	G	Environmental, Space Grade	Submersible	Silicone
	R	Environmental	Submersible	Silicone
SAE AS29600 Series B SAE AS81511 Insert	E	Environmental	Submersible	Silicone
	G	Environmental, Space Grade	Submersible	Silicone
	R	Environmental	Submersible	Silicone
MIL-DTL-38999 Series I Scoop Proof and Series II Low Profile (231 & 232)	A	Environmental	Submersible	Silicone/Fluorosilicone
	B	Environmental	Submersible	Silicone/Fluorosilicone
	C	Environmental	Submersible	Silicone/Fluorosilicone
	F	Environmental	Submersible	Silicone/Fluorosilicone
	R	Environmental	Submersible	Silicone/Fluorosilicone
	T	Environmental with Accessory Threads	Submersible	Silicone/Fluorosilicone
	U	Environmental	Submersible	Silicone/Fluorosilicone
	Z	Environmental	Submersible	Silicone/Fluorosilicone
	D	Hermetic	Submersible	Silicone/Fluorosilicone
	E	Environmental (Superseded by Class T)	Submersible	Silicone/Fluorosilicone
	L	Environmental	Submersible	Silicone/Fluorosilicone
	N	Hermetic	Submersible	Silicone/Fluorosilicone

		CONTACT TYPE			SHELL		
OPERATING TEMP	SOLDER or EYELET	CRIMP		SIZE	SHELL MATERIAL	FINISH DESCRIPTION	COUPLING TYPE
150°C	•			22M	Aluminum	Bright/Gold Cad over Nickel	Bayonet
150°C	•			22D	Aluminum	Bright/Gold Cad over Nickel	
175°C	•			20	Aluminum	500 hr Cad O.D.	
175°C	•			16	Aluminum	500 hr Cad O.D.	
175°C	•			12	Aluminum	500 hr Cad O.D.	
150°C	•			22M	Aluminum	Bright/Gold Cad over Nickel	Bayonet
150°C	•			22D	Aluminum	Bright/Gold Cad over Nickel	
175°C	•			20	Aluminum	500 hr Cad O.D.	
175°C	•			16	Aluminum	500 hr Cad O.D.	
175°C	•			12	Aluminum	500 hr Cad O.D.	
175°C		•		20	Aluminum	500 hr Cad O.D. over Nickel	Threaded Double Start
175°C		•			Stainless Steel	Stainless Steel, Cadmium-Black over Nickel	
175°C		•			Aluminum	Nickel PTFE	
175°C		•			Aluminum	Black Zinc Nickel	
65°C	Fiber Optic			–	Aluminum	500 hr Cad O.D.	Threaded
175°C	•			22D	Composite	None	Threaded Triple Start
175°C	•			22	Composite	Tin	
175°C	•			20	Composite	Tin	
175°C	•			16	Composite	Tin	
175°C			•	23	Composite	None	Threaded Triple Start
175°C			•	20	Composite	Tin	
175°C			•	16	Composite	Tin	
175°C			•	12	Composite	Tin	
-65°C – +150°C			•	23 22D 22 20 16 12 10 8	Aluminum	Cadmium - Gold/Clear Chromate	Bayonet
-65°C – +175°C			•		Aluminum	Cadmium - Olive-Drab Chromate	
-65°C – +200°C			•		Aluminum	Hardcoat Anodize	
-65°C – +200°C			•		Aluminum	Electroless Nickel	
-65°C – +200°C			•		Aluminum	Electroless Nickel	
-65°C – +175°C			•		Aluminum	Nickel-PTFE	
-65°C – +150°C			•		Aluminum	Cadmium - Clear Chromate	
-65°C – +175°C			•		Aluminum	Zinc-Nickel - Black Chromate	
-65°C – +150°C	•				Stainless Steel	Fused Tin/3-10% Lead alloy (Carbon Steel)	
-65°C – +200°C			•		Stainless Steel	Passivated (Stainless Steel)	
-65°C – +200°C			•		Stainless Steel	Electrodeposited Nickel (Stainless Steel)	
-65°C – +200°C	•				Stainless Steel	Electrodeposited Nickel (Stainless Steel)	

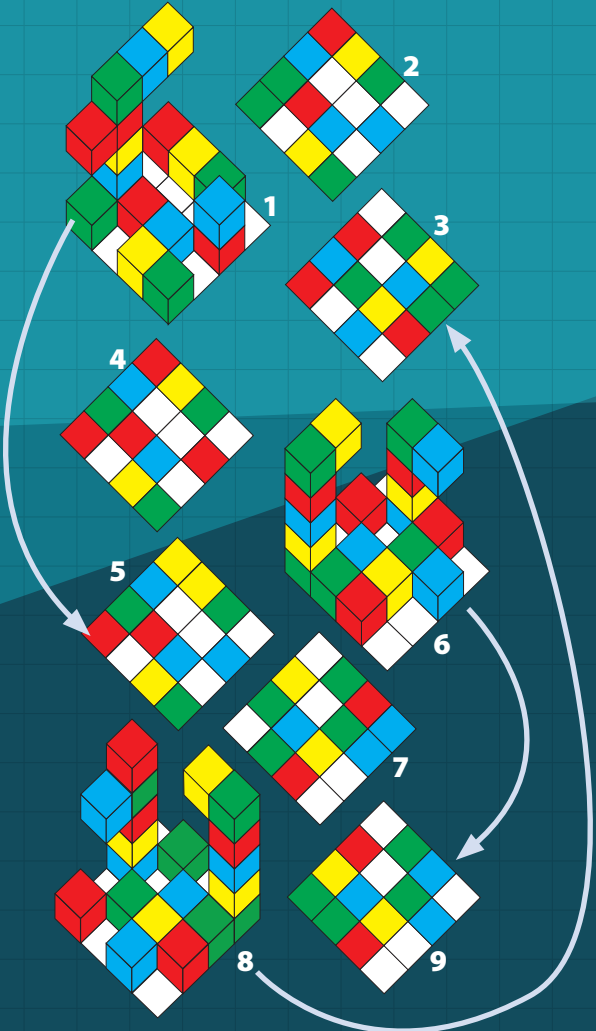
# Military Specification Comparison Tables for Circular Connectors

MILITARY SPECIFICATION	ENVIRONMENTAL AND MATERIAL CLASS	PERFORMANCE		
		DESCRIPTION	WATER RESISTANCE	RESILIENT MATERIAL
MIL-DTL-38999 Series III Scoop Proof and Series IV Scoop Proof (233 & 234)	C	Environmental Nonconductive	Submersible	Silicone or Fluorosilicone
	F	Environmental Conductive	Submersible	Silicone or Fluorosilicone
	G	Environmental, Space Grade	Submersible	Silicone or Fluorosilicone
	H	Hermetic, Space Grade	Submersible	Silicone or Fluorosilicone
	J	Environmental Composite	Submersible	Silicone or Fluorosilicone
	K	Environmental, Firewall	Submersible	Silicone or Fluorosilicone
	L	Environmental, Stainless	Submersible	Silicone or Fluorosilicone
	M	Environmental, Composite	Submersible	Silicone or Fluorosilicone
	N	Hermetic	Submersible	Silicone or Fluorosilicone
	R	Environmental Corrosion Resistant	Submersible	Silicone or Fluorosilicone
	S	Environmental Firewall	Submersible	Silicone or Fluorosilicone
	T	Environmental Nickel PTFE	Submersible	Silicone or Fluorosilicone
	W	Environmental	Submersible	Silicone or Fluorosilicone
	Y	Hermetic	Submersible	Silicone or Fluorosilicone
	Z	Environmental Zinc Nickel Plating	Submersible	Silicone or Fluorosilicone
MIL-DTL-55116	–	Environmental, Cable Seal	Splash-proof	Neoprene
MIL-DTL-55181	–	Environmental, Cable Seal	Splash-proof	Neoprene
MIL-C-55243	–	Environmental, Cable Seal	Splash-proof	Neoprene
SAE AS81511 Series 1 Gang Release* Superseded by Series III	A	Environmental	Submersible	Silicone
	E	Environmental	Splash-proof	Silicone
	F	Environmental	Submersible	Silicone
	H	Hermetic	Submersible	Silicone
SAE AS81511 Series 2 Gang Release* Superseded by Series IV	A	Environmental	Submersible	Silicone
	E	Environmental	Splash-proof	Silicone
	F	Environmental	Submersible	Silicone
	H	Hermetic	Submersible	Silicone
SAE AS81511 Series III	A	Environmental	Submersible	Silicone
	D	Hermetic	Submersible	Silicone
	F	Environmental	Submersible	Silicone
	W	Environmental	Submersible	Silicone
SAE AS81511 Series IV	A	Environmental	Submersible	Silicone
	D	Hermetic	Submersible	Silicone
	F	Environmental	Submersible	Silicone
	W	Environmental	Submersible	Silicone
SAE-AS81703 Series I	E	Environmental	Splash-proof	Neoprene
	H	Hermetic	Splash-proof	Neoprene
	J	Gland Seal	Splash-proof	Neoprene
	P	Environmental, Potting Seal	Splash-proof	Neoprene
SAE-AS81703 Series II	E	Environmental	Splash-proof	Neoprene
	J	Gland Seal	Splash-proof	Neoprene

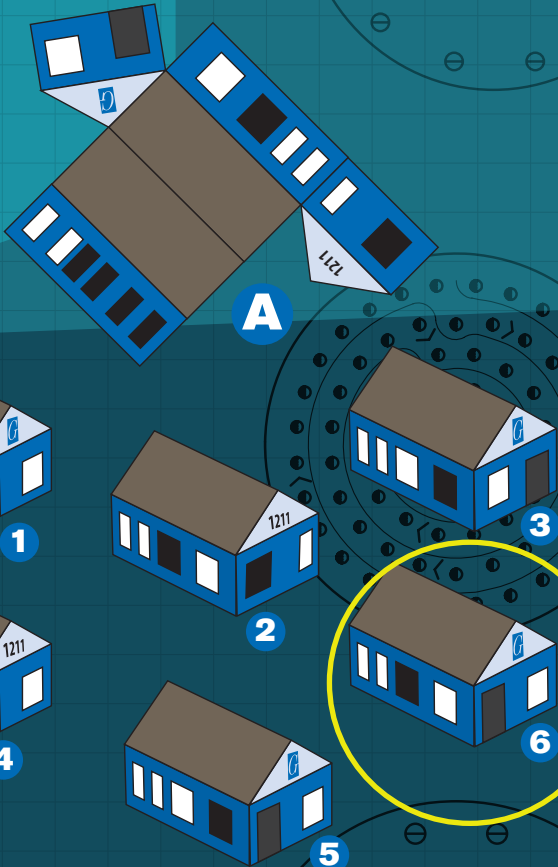


		CONTACT TYPE			SHELL		
OPERATING TEMP	SOLDER or EYELET	CRIMP		SIZE	SHELL MATERIAL	FINISH DESCRIPTION	COUPLING TYPE
		FRONT	REAR				
200°C			•	23 22D 22 20 16 12 10 8	Aluminum	Anodic (nonconductive)	Threaded Triple Start
200°C			•		Aluminum	Electroless Nickel	
200°C			•		Aluminum	Electroless Nickel	
200°C	•				Stainless Steel	Passivated	
175°C			•		Composite	Cadmium O.D. Chromate	
200°C			•		Stainless Steel	Passivated	
200°C			•		Stainless Steel	Electrodeposited Nickel	
200°C			•		Composite	Electroless or Electrodep. Nickel	
200°C	•				Stainless Steel	Electrodeposited Nickel	
200°C			•		Aluminum	Electroless Nickel	
200°C			•		Stainless Steel	Electrodeposited Nickel	
175°C			•		Aluminum	Nickel PTFE	
175°C			•		Aluminum	500 hr Cad O.D.	
200°C	•				Stainless Steel	Passivated	
175°C			•		Aluminum	Zinc Nickel - Black Chromate	
125°C	•			20	Stainless Steel	Passivated	Reverse Bayonet
125°C	•				Carbon Steel	96 hr Cad O.D.	Center Lock Screw
125°C	•				Aluminum	96 hr Cad O.D.	Reverse Bayonet
200°C			•	23	Aluminum	Electroless Nickel	Bayonet
150°C			*	20	Aluminum	96 hr Cad O.D.	
175°C			•	16	Aluminum	Electroless Nickel	
150°C	*			12	Carbon Steel	Tinned	
200°C			*	23	Aluminum	Electroless Nickel	Bayonet
150°C			*	20	Aluminum	96 hr Cad O.D.	
175°C			*	16	Aluminum	Electroless Nickel	
150°C	•			12	Carbon Steel	Tinned	
200°C			•	23	Aluminum	Electroless Nickel	Bayonet
175°C	•			20	Stainless	Passivated	
175°C			•	16	Aluminum	Electroless Nickel	
175°C			•	12	Aluminum	500 hr Cad O.D.	
200°C			•	23	Aluminum	Electroless Nickel	Bayonet
175°C	•			20	Carbon Steel	Passivated	
175°C			•	16	Aluminum	Electroless Nickel	
175°C			•	12	Aluminum	500 hr Cad O.D.	
125°C	•			20 16 12	Aluminum	96 hr Cad O.D.	Push Pull
125°C	•				Carbon Steel	Tinned	
125°C	•				Aluminum	96 hr Cad O.D.	
125°C	•				Aluminum	96 hr Cad O.D.	
175°C		•		20	Aluminum	96 hr Cad O.D.	Push Pull
175°C		•		12	Aluminum	96 hr Cad O.D.	

# Right Brain / Left Brain Performance Matrix



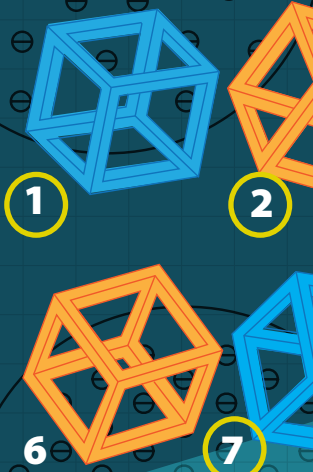
Find the top view for each of the 3 structures



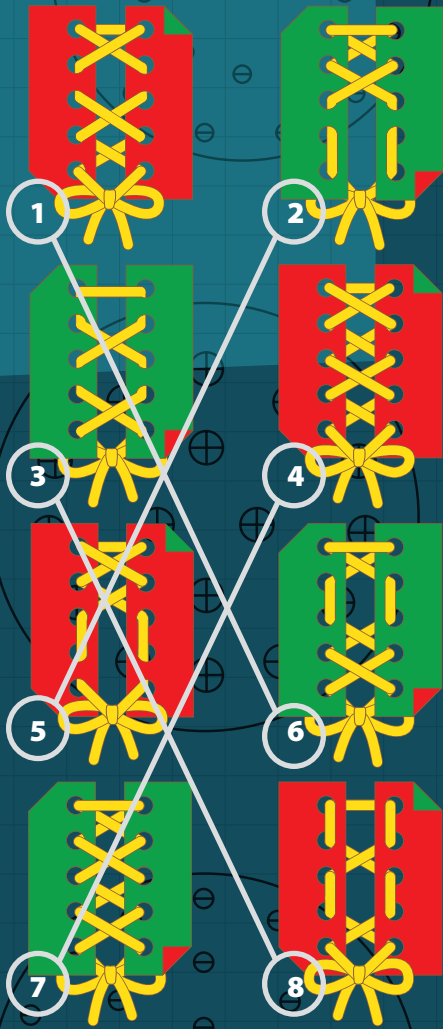
Fold up the paper house... which one is it?



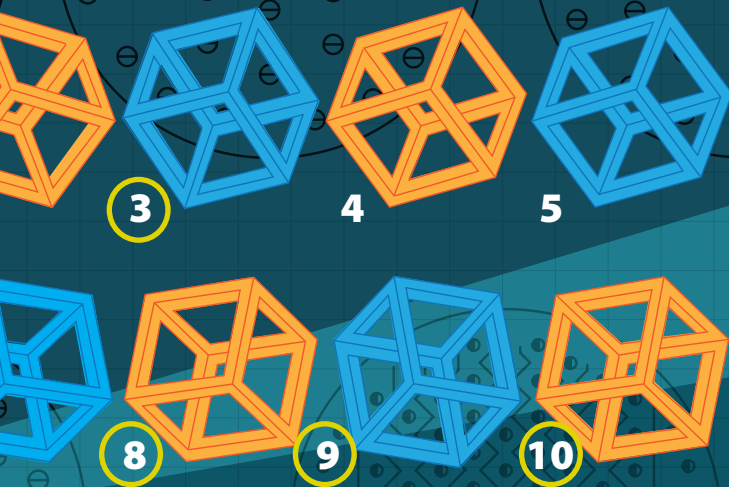
Find the three unduplicated stamps



Answers available at: [www.qwikconnect.com](#)

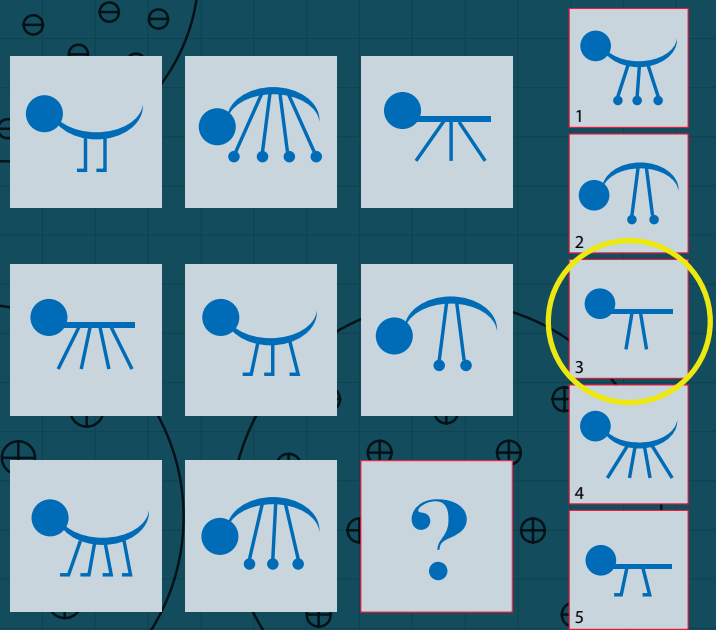


For each front, find the corresponding back



Which of these cubes would M.C. Escher draw?

[www.glenair.com/qwikconnect](http://www.glenair.com/qwikconnect)



Find the missing beast



Find the top view for each teapot



# Military Specification Comparison Tables for Circular Connectors

MILITARY SPECIFICATION	ENVIRONMENTAL AND MATERIAL CLASS	PERFORMANCE		
		DESCRIPTION	WATER RESISTANCE	RESILIENT MATERIAL
SAE-AS81703 Series III	E	Environmental	Submersible	Silicone
	H	Hermetic	Submersible	Silicone
	L	Environmental	Submersible	Silicone
	N	Hermetic	Submersible	Silicone
MIL-DTL-83526 Fiber Optic	ALL	Environmental	Submersible	Aluminum
MIL-DTL-83723 Series II (Inactive for new design)	A	Environmental	Submersible	Silicone
	G	Environmental	Submersible	Silicone
	H	Hermetic	Splash-proof	Silicone
	J	Hermetic	Submersible	Silicone
	K	Environmental, Firewall	Submersible	Silicone
	L	Hermetic	Submersible	Silicone
	M	Environmental	Submersible	Silicone
	N	Hermetic	Submersible	Silicone
	P	Hermetic	Submersible	Silicone
	R	Environmental	Submersible	Silicone
	S	Environmental, Firewall	Submersible	Silicone
	T	Environmental	Submersible	Silicone
	W	Environmental	Submersible	Silicone
	Y	Hermetic	Submersible	Silicone
	Z	Environmental	Submersible	Silicone
MIL-DTL-83723 Series III Type B Bayonet or Type T Threaded	A	Environmental	Submersible	Silicone
	G	Environmental	Submersible	Silicone
	H	Hermetic	Splash-proof	Silicone
	J	Hermetic	Submersible	Silicone
	K	Environmental, Firewall	Submersible	Silicone
	L	Hermetic	Submersible	Silicone
	M	Environmental	Submersible	Silicone
	N	Hermetic	Submersible	Silicone
	P	Hermetic	Submersible	Silicone
	R	Environmental	Submersible	Silicone
	S	Environmental, Firewall	Submersible	Silicone
	T	Environmental	Submersible	Silicone
	W	Environmental	Submersible	Silicone
	Y	Hermetic	Submersible	Silicone
	Z	Environmental	Submersible	Silicone

CONTACT TYPE					SHELL		
OPERATING TEMP	SOLDER or EYELET	CRIMP		SIZE	SHELL MATERIAL	FINISH DESCRIPTION	COUPLING TYPE
		FRONT	REAR				
200°C			•	20 16 12	Aluminum	500 hr Cad O.D.	Push Pull
200°C	•				Stainless Steel	Passivated	
175°C			•		Aluminum	500 hr Cad O.D.	
200°C			•		Stainless Steel	Passivated	
65C	Fiber Optic			–	Aluminum	Grey Anodize	Threaded
200°C			•	16 12 8 4 1/0	Aluminum	Black Anodized	Threaded
200°C			•		Stainless Steel	Passivated	
150°C	•				Carbon Steel	Tinned	
150°C	•				Carbon Steel	Tinned	
200°C			•		Stainless Steel	Passivated	
200°C	•				Stainless Steel	Electrodeposited Nickel	
175°C			•		Aluminum	Electrodeposited Aluminum	
200°C	•				Stainless Steel	Electrodeposited Nickel	
200°C	•				Stainless Steel	Passivated	
200°C			•		Aluminum	Electronless Nickel	
200°C			•		Stainless Steel	Passivated	
175°C			•		Aluminum	Nickel PTFE	
175°C			•		Aluminum	500 Hr. Conductive Cadmium	
200°C	•				Stainless Steel	Passivated	
175°C			•		Aluminum	Conductive Zinc Nickel	
200°C			•	20 16 12	Aluminum	Black Anodized	Bayonet or Threaded
200°C			•		Stainless Steel	Passivated	
150°C	•				Carbon Steel	Tinned	
150°C	•				Carbon Steel	Tinned	
200°C			•		Stainless Steel	Passivated	
200°C	•				Stainless Steel	Electrodeposited Nickel	
175°C			•		Aluminum	Electrodeposited Aluminum	
200°C	•				Stainless Steel	Electrodeposited Nickel	
200°C	•				Stainless Steel	Passivated	
200°C			•		Aluminum	Electronless Nickel	
200°C			•		Stainless Steel	Passivated	
175°C			•		Aluminum	Nickel PTFE	
175°C			•		Aluminum	500 Hr. Conductive Cadmium	
200°C	•				Stainless Steel	Passivated	
175°C			•		Aluminum	Conductive Zinc Nickel	

# AS39029 Crimp Contact Selection Guide

Military Part Number	Glenair Part Number	Contact Size	Wire Accommodation	Pin / Socket	BIN Color Striping		
M39029/56-348	850-001-22-348	22	22-28 AWG	Socket	Orange	Yellow	Grey
M39029/56-351	850-001-20-351	20	20-24 AWG	Socket	Orange	Green	Brown
M39029/56-352	850-001-16-352	16	16-20 AWG	Socket	Orange	Green	Red
M39029/56-353	850-001-12-353	12	12-14 AWG	Socket	Orange	Green	Orange
M39029/56-527	850-001-10-527	10	10 AWG	Socket	Green	Red	Violet
M39029/57-354	850-003-22-354	22	22-28 AWG	Socket	Orange	Green	Yellow
M39029/57-357	850-003-20-357	20	20-24 AWG	Socket	Orange	Green	Violet
M39029/57-358	850-003-16-358	16	16-20 AWG	Socket	Orange	Green	Grey
M39029/57-359	850-003-12-359	12	12-14 AWG	Socket	Orange	Green	White
M39029/58-360	850-002-22-360	22	22-28 AWG	Pin	Orange	Blue	Black
M39029/58-363	850-002-20-363	20	20-24 AWG	Pin	Orange	Blue	Orange
M39029/58-364	850-002-16-364	16	16-20 AWG	Pin	Orange	Blue	Yellow
M39029/58-365	850-002-12-365	12	12-14 AWG	Pin	Orange	Blue	Green
M39029/58-528	850-002-10-528	10	10 AWG	Pin	Green	Red	Grey
M39029/63-368	850-021-20-368	20	20-24 AWG	Socket	Orange	Blue	Grey
M39029/64-369	850-022-20-369	20	20-24 AWG	Pin	Orange	Blue	White

BIN Color Coding									
0 BLACK	1 BROWN	2 RED	3 ORANGE	4 YELLOW	5 GREEN	6 BLUE	7 VIOLET	8 GREY	9 WHITE

## AS39029 Crimp Contact Selection Guide

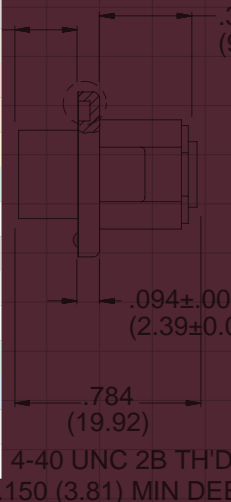
Military Part Number	Glenair Part Number	Contact Size	Wire Accommodation	Pin / Socket	BIN Color Striping		
M39029/83-450	850-004-20-450	20	22-26 AWG	Pin	Yellow	Green	Black
M39029/83-451	850-004-20-451	20	28-32 AWG	Pin	Yellow	Green	Brown
M39029/83-508	850-004-20-508	20	20-24 AWG	Pin	Green	Black	Grey
M39029/84-452	850-005-20-452	20	22-26 AWG	Socket	Yellow	Green	Red
M39029/84-453	850-005-20-453	20	28-32 AWG	Socket	Yellow	Green	Orange
M39029/84-509	850-005-20-509	20	20-24 AWG	Socket	Green	Black	White
M39029/106-614	850-006-22-614	22	22-28 AWG	Socket	Blue	Brown	Yellow
M39029/106-615	850-006-20-615	20	20-24 AWG	Socket	Blue	Brown	Green
M39029/106-616	850-006-16-616	16	16-20 AWG	Socket	Blue	Brown	Blue
M39029/106-617	850-006-12-617	12	12-14 AWG	Socket	Blue	Brown	Violet
M39029/106-618	850-006-10-618	10	10 AWG	Socket	Blue	Brown	Grey
M39029/107-620	850-007-22-620	22	22-28 AWG	Pin	Blue	Red	Black
M39029/107-621	850-007-20-621	20	20-24 AWG	Pin	Blue	Black	Brown
M39029/107-622	850-007-16-622	16	16-20 AWG	Pin	Blue	Red	Red
M39029/107-623	850-007-12-623	12	12-14 AWG	Pin	Blue	Red	Orange
M39029/107-624	850-007-10-624	10	10 AWG	Pin	Blue	Red	Yellow

BIN Color Coding									
0 BLACK	1 BROWN	2 RED	3 ORANGE	4 YELLOW	5 GREEN	6 BLUE	7 VIOLET	8 GREY	9 WHITE



# AS39029 Shielded Contact Selection Guide

Military Part Number	Glenair Part Number	Contact Size	Pin / Socket	Type	BIN Color Striping		
M39029/27-210	852-001-12-210	12	Socket	Coaxial	Red	Brown	Black
M39029/27-402	852-001-12-402	12	Socket	Coaxial	Yellow	Black	Red
M39029/27-403	852-001-12-403	12	Socket	Coaxial	Yellow	Black	Orange
M39029/27-404	852-001-12-404	12	Socket	Coaxial	Yellow	Black	Yellow
M39029/27-405	852-001-12-405	12	Socket	Coaxial	Yellow	Black	Green
M39029/27-406	852-001-12-406	12	Socket	Coaxial	Yellow	Black	Blue
M39029/27-407	852-001-12-407	12	Socket	Coaxial	Yellow	Black	Violet
M39029/27-408	852-001-12-408	12	Socket	Coaxial	Yellow	Black	Gray
M39029/28-211	852-002-12-211	12	Pin	Coaxial	Red	Brown	Brown
M39029/28-409	852-002-12-409	12	Pin	Coaxial	Yellow	Black	White
M39029/28-410	852-002-12-410	12	Pin	Coaxial	Yellow	Brown	Black
M39029/28-411	852-002-12-411	12	Pin	Coaxial	Yellow	Brown	Brown
M39029/28-412	852-002-12-412	12	Pin	Coaxial	Yellow	Brown	Red
M39029/28-413	852-002-12-413	12	Pin	Coaxial	Yellow	Brown	Orange
M39029/28-414	852-002-12-414	12	Pin	Coaxial	Yellow	Brown	Yellow
M39029/28-415	852-002-12-415	12	Pin	Coaxial	Yellow	Brown	Green
M39029/59-366	852-006-08-366	08	Socket	Coaxial	Orange	Blue	Blue
M39029/60-367	852-007-08-367	08	Pin	Coaxial	Orange	Blue	Violet
M39029/75-416	852-003-12-416	12	Socket	Coaxial	Yellow	Brown	Blue
M39029/75-417	852-003-12-417	12	Socket	Coaxial	Yellow	Brown	Violet
M39029/75-418	852-003-12-418	12	Socket	Coaxial	Yellow	Brown	Gray
M39029/75-419	852-003-12-419	12	Socket	Coaxial	Yellow	Brown	White
M39029/75-420	852-003-12-420	12	Socket	Coaxial	Yellow	Red	Black
M39029/75-421	852-003-12-421	12	Socket	Coaxial	Yellow	Red	Brown
M39029/75-422	852-003-12-422	12	Socket	Coaxial	Yellow	Red	Red
M39029/75-423	852-003-12-423	12	Socket	Coaxial	Yellow	Red	Orange
M39029/76-424	852-008-16-424	16	Pin	Coaxial	Yellow	Red	Yellow
M39029/76-425	852-008-16-425	16	Pin	Coaxial	Yellow	Red	Green
M39029/76-426	852-008-16-426	16	Pin	Coaxial	Yellow	Red	Blue
M39029/76-427	852-008-16-427	16	Pin	Coaxial	Yellow	Red	Violet
M39029/77-428	852-009-16-428	16	Socket	Coaxial	Yellow	Red	Gray
M39029/77-429	852-009-16-429	16	Socket	Coaxial	Yellow	Red	White
M39029/77-430	852-009-16-430	16	Socket	Coaxial	Yellow	Orange	Black
M39029/77-431	852-009-16-431	16	Socket	Coaxial	Yellow	Orange	Brown
M39029/78-432	852-010-16-432	16	Socket	Coaxial	Yellow	Orange	Red
M39029/78-433	852-010-16-433	16	Socket	Coaxial	Yellow	Orange	Orange
M39029/78-434	852-010-16-434	16	Socket	Coaxial	Yellow	Orange	Yellow
M39029/78-435	852-010-16-435	16	Socket	Coaxial	Yellow	Orange	Green
M39029/90-529	853-001-08-529	8	Pin	Concentric Twinax	Green	Red	White
M39029/91-530	853-002-08-530	8	Socket	Concentric Twinax	Green	Orange	Black
M39029/102-558	852-004-12-558	12	Pin	Coaxial	Green	Green	Gray
M39029/103-559	852-005-12-559	12	Socket	Coaxial	Green	Green	White
M39029/113-625	853-003-08-625	8	Pin	Concentric Twinax	Blue	Red	Green
M39029/113-626	853-003-08-626	8	Pin	Concentric Twinax	Blue	Red	Blue
M39029/114-628	853-004-08-628	8	Socket	Concentric Twinax	Blue	Red	Gray
M39029/114-629	853-004-08-629	8	Socket	Concentric Twinax	Blue	Red	White



## El Ochito® Octaxial Contacts Selection Guide

El Ochito® Contacts: How To Order									
Data Protocol	Connector Type	Wire Size	Cable Type	Cable		El Ochito® Type I		El Ochito® Type II	
				Glenair Part No. (Mfr. P/N)	Cable Dia.	Pin Contact Assembly Instr.	Skt Contact Assembly Instr.	Pin Contact Assembly Instr.	Skt Contact Assembly Instr.
1000BASE-T 10GBASE-T  El Ochito® White	ARINC 600	26	S/UTP	963-003-26 (PIC E6A3826)	.220 (5.56)	858-009-01 AI85074-01	858-010-01 AI85074-01		
			S/FTP	963-033-26 (Gore RCN9047-26)	.220 (5.56)	858-009-02 AI85084-01	858-010-02 AI85084-01		
	Series 23 SuperNine® Series 80 Mighty Mouse Series 28 HiPer-D®	24	S/UTP	963-037-24 (PIC E6A3824)	.260 (6.60)			858-005-03 AI85097-03	858-006-03 AI85097-03
			S/FTP	963-033-24 (Gore RCN9047-24)	.260 (6.60)			858-005-04 AI85097-04	858-006-04 AI85097-04
		26	S/UTP	963-003-26 (PIC E6A3826)	.220 (5.56)	858-003-01F AI85048-01	858-004-01F AI85048-01	858-005-01 AI85097-01	858-006-01 AI85097-01
			S/FTP	963-033-26 (Gore RCN9047-26)	.220 (5.56)	858-003-02F AI85048-02	858-004-02F AI85048-02	858-005-02 AI85097-01	858-006-02 AI85097-01
	Series 79	26	S/UTP	963-003-26 (PIC E6A3826)	.220 (5.56)	858-003-01F AI85048-01	858-032-01F AI85112-01		
			S/FTP	963-033-26 (Gore RCN9047-26)	.220 (5.56)	858-003-02F AI85048-02	858-032-02F AI85112-02		
	EPXB	26	S/UTP	963-003-26 (PIC E6A3826)	.220 (5.56)	858-014-02F AI85099-01	858-015-02F AI85099-01		
			S/FTP	963-033-26 (Gore RCN9047-26)	.220 (5.56)	858-014-01F AI85105-01	858-015-01F AI85105-01		
SuperSpeed USB  El Ochito® Blue	ARINC 600	26	Commercial Grade SuperSpeed USB	963-118	.217 (5.51)	858-038-01 AI852124-01	858-035-01 AI852124-01		
			Aerospace Grade SuperSpeed USB	963-110	.236 (5.99)	858-038-02 AI85124-02	858-035-02 AI85124-02		
	Series 79	26	Commercial Grade SuperSpeed USB	963-118	.217 (5.51)	858-028-01F AI85114-02	858-040-01F AI85125-01		
			Aerospace Grade SuperSpeed USB	963-110	.236 (5.99)	858-028-02F AI85090-01	858-040-02F AI85125-02		
	Series 23 SuperNine® Series 80 Mighty Mouse Series 28 HiPer-D®	26	Commercial Grade SuperSpeed USB	963-118	.217 (5.51)	858-028-01F AI85114-02	858-029-01F AI85114-02		
			Aerospace Grade SuperSpeed USB	963-110	.236 (5.99)	858-028-02F AI85090-01	858-029-02F AI85090-01		
HDMI, DisplayPort, SATA  El Ochito® Red	ARINC 600	26	Cat 6a S/FTP	963-033-26 (Gore RCN9047-26)	.220 (5.56)	858-039-01 AI85084-01	858-037-01 AI85084-01		
	Series 79	26				858-030-02F AI85048-02	858-041-01F AI85112-02		
	Series 23 SuperNine® Series 80 Mighty Mouse Series 28 HiPer-D®	26				858-030-02F AI85048-02	858-031-02F AI85048-02		

# Fiber Optic Contact Selection Guide

Glenair Part Number	Part Description	Contact Size	Pin / Socket	Connector Series
<b>MIL-DTL-38999 Fiber Optic Contacts</b>				
<b>181-001</b>	M29504/5 Socket Terminus	16	Socket	D38999 Series III
<b>181-002</b>	M29504/4 Pin Terminus	16	Pin	D38999 Series III
<b>181-035</b>	Socket, Large Core Fiber	16	Socket	D38999 Series III
<b>181-036</b>	Pin, Large Core Fiber	16	Pin	D38999 Series III
<b>181-052</b>	Jewel Pin Terminus	16	Pin	D38999 Series III
<b>181-053</b>	Jewel Socket Terminus	16	Socket	D38999 Series III
<b>181-048</b>	Sealing Plug	16	Pin	D38999 Series III
<b>181-065</b>	#20 Pin Terminus	20	Pin	D38999 Series III
<b>181-066</b>	#20 Socket Terminus	20	Socket	D38999 Series III
<b>MIL-PRF-28876 Fiber Optic Contacts</b>				
<b>181-039</b>	M29504/14 Pin Terminus	16	Pin	M28876
<b>181-040</b>	M29504/15 Socket Terminus	16	Socket	M28876
<b>181-051</b>	M29504/3 Dummy Terminus	16	Dummy	M28876
<b>Series 80 Mighty Mouse Fiber Optic Contacts</b>				
<b>181-057</b>	Mighty Mouse Pin Terminus	16	Pin	Series 80 Mighty Mouse
<b>181-075</b>	Mighty Mouse Socket Terminus	16	Socket	Series 80 Mighty Mouse
<b>181-084</b>	Mighty Mouse Pin Terminus	20HD	Pin	Series 80 Mighty Mouse
<b>181-085</b>	Mighty Mouse Socket Terminus	20HD	Socket	Series 80 Mighty Mouse
<b>Special Fiber Optic COTS Contacts Size 16 Front Release</b>				
<b>181-011</b>	Front Release Socket with Pressure Sealing O-Ring(s)	16	Socket	COTS
<b>181-012</b>	Front Release Pin	16	Pin	COTS
<b>181-051</b>	Dummy Terminus	16	Dummy	COTS
<b>ARINC Type Fiber Optic Contacts</b>				
<b>181-076</b>	ARINC 801 Terminus	16	Genderless Pin	ARINC 801
<b>187-079</b>	M29504/6 Pin Terminus	16	Pin	ARINC 404, 600
<b>187-080</b>	M29504/7 Socket Terminus	16	Socket	ARINC 404, 600
<b>Glenair High Density (GHD) Fiber Optic Contacts</b>				
<b>181-056</b>	GHD Terminus, Non-keyed	18	Genderless Pin	GHD
<b>181-047</b>	GHD Terminus, Keyed	18	Genderless Pin	GHD
<b>181-058</b>	Dummy Terminus	18	Dummy	GHD
<b>Glenair GFOCA Fiber Optic Contacts</b>				
<b>181-050</b>	GFOCA Terminus		Genderless Pin	GFOCA
<b>181-059</b>	Dummy Terminus		Dummy	GFOCA
<b>Next Generation Fiber Optic (NGCON) Contacts</b>				
<b>181-043</b>	M29504/18	16	Genderless Pin	M64266

## High-Frequency RF / Microwave Contacts

### AS39029 COAXIAL CONTACTS



Size #8 AS39029  
Coaxial  
DC – 700 MHz



Size #12 AS39029  
Coaxial  
DC – 3 GHz



Size #16 AS39029  
Coaxial  
DC – 500 MHz

### LOW-LOSS MATCHED IMPEDANCE COAXIAL CONTACTS



Size #8 50 Ohm  
Matched-Impedance  
Coaxial  
DC – 6 GHz



Size #12 50 Ohm  
Matched-Impedance  
Coaxial  
DC – 3 GHz



Size #8 75 Ohm  
Matched-Impedance  
Coaxial  
DC – 4 GHz



Size #12 75 Ohm  
Matched-Impedance  
Coaxial  
DC – 3 GHz

### SPRING-LOADED MICROWAVE COAXIAL CONTACTS



Size #8 Spring-Loaded BMB  
Coaxial  
DC – 18 GHz

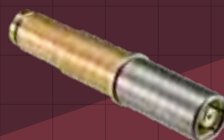


Size 12 Spring-Loaded SMPM  
Coaxial  
DC – 40 GHz

## High-Speed Datalink Contacts



Size #8 77 Ohm  
Concentric Twinax  
DC – 10 MHz



Size #8 100 Ohm  
Concentric Twinax  
frequency: application-dependent



Size #12 77 Ohm  
Concentric Twinax  
DC – 20 MHz



4-40 UNC 2B THD  
150 (3.175) IN DEEP TYP 2 PLCS  
Size #8  
Differential Twinax  
frequency: application-dependent



Size #12 Differential  
Ultra-Twinax  
DC – 10 GHz



Size #8  
Quadrax  
DC – 3 GHz



El Ochito® Size #8  
Octaxial  
DC – 4GHz



# MIL-DTL-38999 Series III (SuperNine®) and Series 806 Mighty Mouse Mil-Aero Performance Specifications

Performance Specification					
TEST DESCRIPTION	REQUIREMENT			PROCEDURE	
Dielectric withstanding voltage at sea level	Contact Size	Altitude	Voltage	MIL-DTL-38999M para. 4.5.11.1 EIA-364-20 Method A 2 mA maximum leakage current Unmated pairs	
	20HD	Sea level	1800		
	22HD	Sea level	1300		
Dielectric withstanding voltage at altitude	Contact Size	Altitude	Voltage	MIL-DTL-38999M para. 4.5.11.2 EIA-364-20 Method A 2 mA maximum leakage current Mated pairs	
	20HD	50,000 ft	1000		
		70,000 ft	1000		
		100,000 ft	1000		
	22HD	50,000 ft	800		
		70,000 ft	800		
		100,000 ft	800		
Insulation resistance at ambient temperature	5000 megohms minimum			MIL-DTL-38999M Para. 4.5.10.1 EIA-364-21	
Insulation resistance at elevated temperature	1000 megohms minimum			MIL-DTL-38999M Para. 4.5.10.2 EIA-364-21	
Contact resistance at 25°C, crimp contacts	Wire Size	Test Current Amperes	Maximum Voltage Drop (millivolts)		AS39029C Para. 4.7.5 EIA-364-06 Silver-plated wire
			Initial	After Conditioning	
	20	7.5	55	66	
	22	5	73	88	
	24	3	45	54	
	26	2	52	63	
	28	1.5	54	65	
	30	1	60	73	
	Contact resistance at 200° C, crimp contacts	Wire Size	Test Current Amperes	Maximum Voltage Drop (millivolts)	
20		7.5	94		
22		5	125		
24		3	77		
26		2	89		
28		1.5	92		
30		1	103		
Low level contact resistance, crimp contacts		Wire Size	Maximum Contact Resistance (milliohms)		AS39029C Para. 4.7.4 EIA-364-23 Silver plated wire
	Initial Values		After Conditioning		
	20	9	11		
	22	15	17		
	24	20	23		
	26	31	38		
	28	50	60		
	30	75	88		
	Contact resistance, glass-sealed hermetic connectors	Contact Size, Wire Size	Test Current Amperes	Maximum Millivolt Drop	
Initial				After Conditioning	
20		5	60	75	
22		3	85	95	
Shell-to-shell conductivity	Finish Code	Shell Matl/Fin	Millivolt Drop (mV)		MIL-DTL-38999M Para. 4.5.25 EIA-364-83
	NF	Al/OD Cad	2.5		
	MT	Al/Ni-PTFE	2.5		
	ME	Al/EN	1.0		
	ZR	Al/Zn-Ni	2.5		
	Z1	SST/pass.	10.0		
	ZL	SST/Ni	1.0		
	Backshell shield braid to shell conductivity	Finish Code	Shell Matl/Fin	Millivolt Drop (mV)	
NF		Al/OD Cad	5.0		
MT		Al/Ni-PTFE	5.0		
ME		Al/EN	3.5		
ZR		Al/Zn-Ni	5.0		
Z1		SST/pass.	15.0		
ZL		SST/Ni	3.5		
Indirect lightning strike		No evidence of damage which could impair proper functioning. Connectors shall meet shell-to-shell conductivity, DWV and coupling torque.			MIL-DTL-38999M Para. 4.5.47 EIA-364-75 10,000 Amps peak current

## Performance Specification


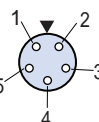
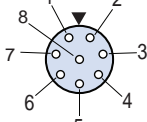
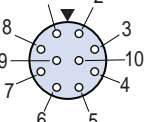
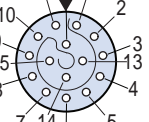
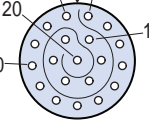
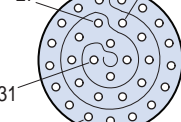
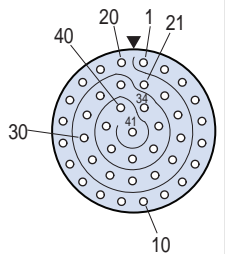
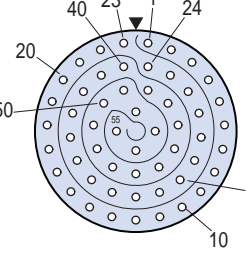
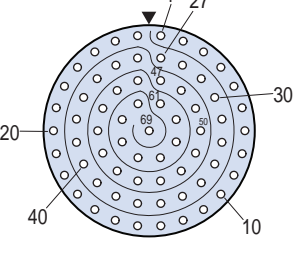
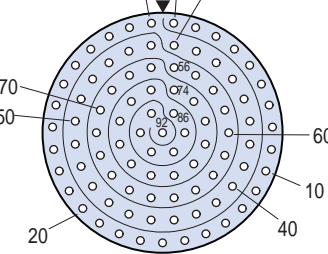







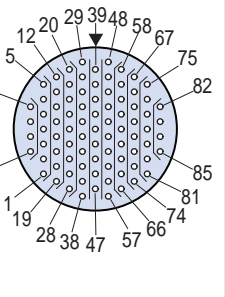
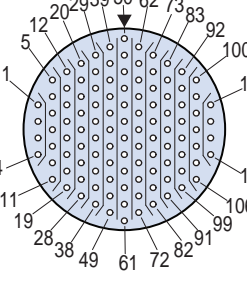
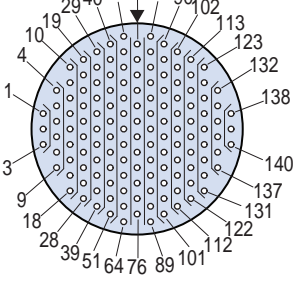
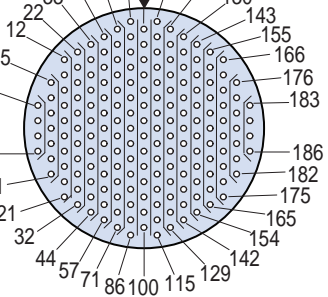
TEST DESCRIPTION	REQUIREMENT		PROCEDURE	
EMI shielding	Freq. MHz	Leakage Attenuation, (dB) minimum		
		Electroless Nickel Finish	Cadmium, Nickel-PTFE, Zinc-Nickel Finish	
	100	90	90	
	200	88	88	
	300	88	88	
	400	87	87	
	800	85	85	
	1,000	85	85	
	1,500	76	69	
	2,000	70	65	
	3,000	69	61	
	4,000	68	58	
	6,000	66	55	
	10,000	65	50	
	Durability	No evidence of damage which could impair proper function- ing following 500 cycles of mating and unmating.		MIL-DTL-38999M Para. 4.5.8 EIA-364-09
Coupling and uncoupling torque	Shell size	Maximum Engagement lbs.-inch.	Minimum Disengagement lbs.-inch.	
		8	8	2
	9	8	2	
	10	12	2	
	11	12	2	
	12	12	2	
	14	16	2	
	16	20	3	
	18	24	3	
	20	28	3	
	22	32	5	
	24	36	5	
	Insert retention	100 pounds per square inch, 25 pound minimum force		MIL-DTL-38999M Para. 4.5.12 EIA-364-35
	External bend moment	Shell size		Pound inches
		8	100	
9		100		
10		100		
11		200		
12		300		
14		400		
16		500		
18		600		
20		700		
22		800		
24		900		
Contact retention		Contact size		Pounds ± 10 percent
		22HD	10	
		20HD	10	
Magnetic permeability	2 μ maximum		MIL-DTL-38999M Para. 4.5.48 EIA-364-54	
Contact engaging /separation force	Contact forces shall meet AS39029 Table 9 requirements		AS39029C Para. 4.7.6 EIA-364-37	
Temperature cycling (thermal shock)	No evidence of damage detrimental to the function of the connector		MIL-DTL-38999M Para. 4.5.4 EIA-364-32 Mated connectors, -65° C to +200° C	
Random vibration, elevated tem- perature, 43g rms	No discontinuities of 1 microsecond or longer No resonance at frequencies less than 300 Hz		MIL-DTL-38999M Para. 4.5.23.2.3 with Figure 24 accessory load EIA-364-28 +200°C	
Random vibration, ambient tem- perature, 49g rms	No discontinuities of 1 microsecond or longer		MIL-DTL-38999M Para. 4.5.23.2.4 EIA-364-28 Test Condition V	
Sine vibration, 60g	No discontinuities of 1 microsecond or longer		MIL-DTL-38999M Para. 4.5.23.2.1 with Figure 24 accessory load 12 hours in each of 3 axes 4 hours at ambient, 4 hours at -55° C, 4 hours at +200° C	
Mechanical shock, 300g	No discontinuities of 1 microsecond or longer		MIL-DTL-38999M Para. 4.5.24.1 EIA-364-27	
High impact shock (901)	No discontinuities of 1 microsecond or longer No evidence of damage which could impair proper functioning.		MIL-DTL-38999M Para. 4.5.24.2 MIL-S-901 Grade A	

# MIL-DTL-38999 Series III (SuperNine®) and Series 806 Mighty Mouse Mil-Aero Performance Specifications

Performance Specification			
TEST DESCRIPTION	REQUIREMENT		PROCEDURE
Humidity, cyclic	Meet DWV and IR test		MIL-DTL-38999M Para. 4.5.26 EIA-364-31 Method 4 10 cycles, 10 days, 25 – 65°C 80 – 100% RH
Ozone exposure	No evidence of damage detrimental to the function of the connector		MIL-DTL-38999M Para. 4.5.29 EIA-364-14
Fluid immersion	No damage to plastic, elastomeric and bonding materials detrimental to the function of the connector. Connector shall meet coupling torque and DWV requirements when tested within 3 hours of immersion.		MIL-DTL-38999M Para. 4.5.30 EIA-364-10
Altitude immersion	No evidence of moisture on connector interface or contacts. At the end of the third cycle, while still submersed, connectors shall meet dielectric withstanding voltage and 1,000 megohms insulation resistance.		MIL-DTL-38999M Para. 4.5.9 EIA-364-03 75,000 feet
Altitude- low temperature	Connectors shall meet insulation resistance requirement while at -65°C and 100,000 ft. Connectors shall meet DWV requirement when returned to ambient conditions.		MIL-DTL-38999M Para. 4.5.21 EIA-364-105 -65°C 100,000 ft.
Thermal vacuum outgassing	All nonmetallic materials shall not exceed 1.0% Total Mass Loss and 0.1% Total Volatile Condensable Materials. Applicable only to connectors that have been subjected to optional thermal vacuum outgassing.		MIL-DTL-38999M Para. 4.5.42 ASTM E595
Salt Spray (dynamic)	Finish Code	Matl/Fin	Hours
	NF	Al/OD Cad	500
	MT	Al/Ni-PTFE	500
	ME	Al/EN	96
	ZR	Al/Zn-Ni	500
	Z1	SST/passivate	1000
	ZL	SST/Ni	1000
			MIL-DTL-38999M Para. 4.5.13.2 EIA-364-26 500 mating cycles

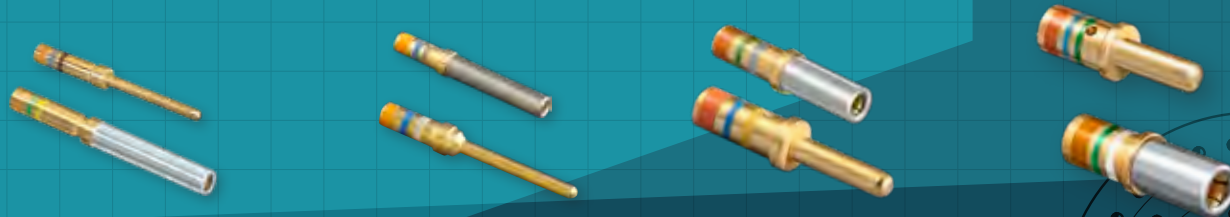
Standard Materials and Finishes		
DESCRIPTION	MATERIAL	FINISH
Pin Contact	Copper alloy	50 microinches gold over nickel
Socket Contact	Copper alloy, with stainless steel hood	50 microinches gold over nickel Contact hood: passivate
Insulators	High grade rigid dielectric	None
Seals	Fluorosilicone/silicone blend, blue	None
EMI Spring	Beryllium copper	Nickel
Shell, Coupling Nut, Jam Nut	Aluminum alloy or stainless steel	See sales drawing or catalog for finish options
Contact Retention Clip	Beryllium copper	None
Anti-Decoupling Ratchet Spring	Stainless steel	Passivate

## Series 806 Mighty Mouse Mil-Aero Contact Arrangements

Series 806 Arrangements with #20HD Contacts (1800 Vac, 7.5 A)							
Mating face of pin connector. Socket numbering is reversed.  Symbol ▼ indicates master key location.							
	Arrangement No. <b>8-3</b>	Arrangement No. <b>9-5</b>	Arrangement No. <b>10-8</b>	Arrangement No. <b>11-10</b>	Arrangement No. <b>12-15</b>	Arrangement No. <b>14-20</b>	Arrangement No. <b>16-31</b>
No. of Contacts	3	5	8	10	15	20	31
Mating face of pin connector. Socket numbering is reversed.  Symbol ▼ indicates master key location.							
	Arrangement No. <b>18-41</b>		Arrangement No. <b>20-55</b>		Arrangement No. <b>22-69</b>		Arrangement No. <b>24-92</b>
No. of Contacts	41		55		69		92
Series 806 Arrangements with #22HD Contacts (1300 Vac, 5 A)							
Mating face of pin connector. Socket numbering is reversed.  Symbol ▼ indicates master key location.							
	Arrangement No. <b>8-4</b>	Arrangement No. <b>8-7</b>	Arrangement No. <b>9-11</b>	Arrangement No. <b>10-15</b>	Arrangement No. <b>11-19</b>	Arrangement No. <b>12-26</b>	Arrangement No. <b>14-39</b>
No. of Contacts	4	7	11	15	19	26	39
Mating face of pin connector. Socket numbering is reversed.  Symbol ▼ indicates master key location.							
	Arrangement No. <b>18-85</b>		Arrangement No. <b>20-110</b>		Arrangement No. <b>22-140</b>		Arrangement No. <b>24-186</b>
No. of Contacts	85		110		140		186



# MIL-STD-1560 Standard Power and Signal Contact Arrangements for MIL-DTL-38999 Series III / SuperNine®



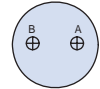
Size #22D	Size #20	Size #16	Size #12
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Environmental and Hermetic Contact Arrangements					
Contact	Number of Contacts				Insert Arrangement
	#22D	#20	#16	#12	
Size #22D 5 Amp Max. Current #22-#28 AWG	6				9-35
	13				11-35
	22				13-35
	37				15-35
	55				17-35
	66				19-35
	67				19-35
	79				21-35
	100				23-35
	128				25-35
Size #20 7.5 Amp Max. Current #20-#24 AWG		2			9-94
		3			9-98
		4			11-4
		5			11-5
		6			11-98
		7			11-99
		8			13-8
		10			13-98
		18			15-18
		19			15-19
		26			17-26
		32			19-32
		24			21-24
		25			21-25
		27			21-27
		41			21-41
		32			23-32
		34			23-34
		36			23-36
		53			23-53
		55			23-55
		61			25-61

Environmental and Hermetic Contact Arrangements					
Contact	Number of Contacts				Insert Arrangement
	#22D	#20	#16	#12	
Size #16 Contacts 13 Amp Max. Current #16-#20 AWG			2		11-2
			4		13-4
			5		15-5
			8		17-8
			11		19-11
			16		21-16
			21		23-21
			16		23-97
			11		23-99
			29		25-29
Size #12 Contacts 23 Amp Max. Current #12-14 AWG			37		25-37
				6	17-6
				11	21-11
				19	25-19

## Contact Legend

#22D • #16 ⊕  
#20 ⊖ #12 ◐



Insert Arrangement

9-35

9-98

11-2

11-4

11-5

11-35

11-98

No. of Contacts

6

3

2

4

5

13

6

Contact Size

#22D

#20

#16

#20

#20

#22D

#20

Service Rating

M

I

I

I

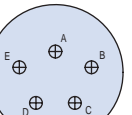
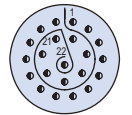
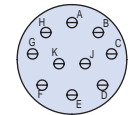
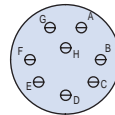
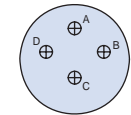
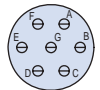
I

M

I

## Contact Legend

#22D • #16 ⊕  
#20 ⊖ #12 ◐



Insert Arrangement

11-99

13-4

13-8

13-98

13-35

15-5

No. of Contacts

7

4

8

10

22

5

Contact Size

#20

#16

#20

#20

#22D

#16

Service Rating

I

I

I

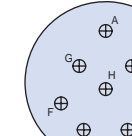
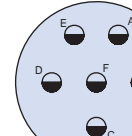
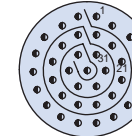
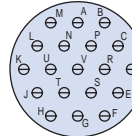
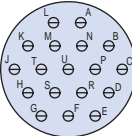
I

M

II

## Contact Legend

#22D • #16 ⊕  
#20 ⊖ #12 ◐



Insert Arrangement

15-18

15-19

15-35

17-6

17-8

No. of Contacts

18

19

37

6

8

Contact Size

#20

#20

#22D

#12

#16

Service Rating

I

I

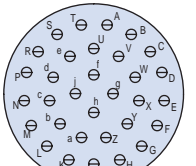
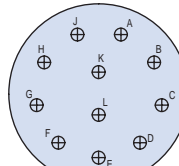
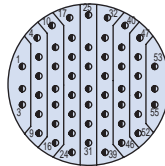
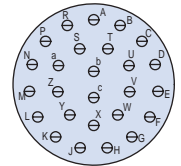
M

I

II

## Contact Legend

#22D • #16 ⊕  
#20 ⊖ #12 ◐



Insert Arrangement

17-26

17-35

19-11

19-32

No. of Contacts

26

55

11

32

Contact Size

#20

#22D

#16

#20

Service Rating

I

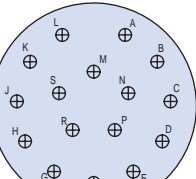
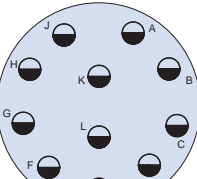
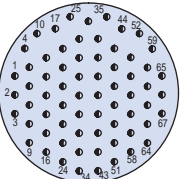
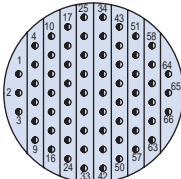
M

II

I

## Contact Legend

#22D • #16 ⊕  
#20 ⊖ #12 ◐



Insert Arrangement

19-35

19-45

21-11

21-16

No. of Contacts

66

67

11

16

Contact Size

#22D

#22D

#12

#16

Service Rating

M

M

I

II

# MIL-STD-1560 Standard Power and Signal Contact Arrangements for MIL-DTL-38999 Series III / SuperNine<sup>®</sup>

<b>Contact Legend</b> #22D • #16 ⊕ #20 ⊖ #12 ●				
Insert Arrangement	21-24	21-25	21-27	21-35
No. of Contacts	24	25	27	79
Contact Size	#20	#20	#20	#22D
Service Rating	I	I	I	M

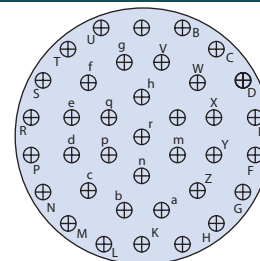
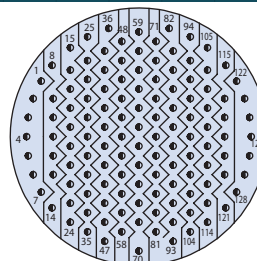
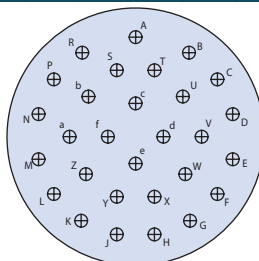
<b>Contact Legend</b> #22D • #16 ⊕ #20 ⊖ #12 ●				
Insert Arrangement	21-41	23-21	23-32	23-34
No. of Contacts	41	21	32	34
Contact Size	#20	#16	#20	#20
Service Rating	I	II	I	I

<b>Contact Legend</b> #22D • #16 ⊕ #20 ⊖ #12 ●				
Insert Arrangement	23-35	23-36	23-53	23-55
No. of Contacts	100	36	53	55
Contact Size	#22D	#20	#20	#20
Service Rating	M	I	I	I

<b>Contact Legend</b> #22D • #16 ⊕ #20 ⊖ #12 ●			
Insert Arrangement	23-97	23-99	25-19
No. of Contacts	16	11	19
Contact Size	#16	#16	#12
Service Rating	I	II	I

## Contact Legend

#22D • #16 ⊕  
#20 ⊖ #12 ◐



Insert Arrangement

25-29

25-35

25-37

No. of Contacts

29

128

37

Contact Size

#16

#22D

#16

Service Rating

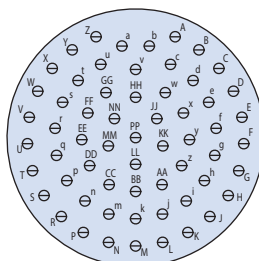
I

M

II

## Contact Legend

#22D • #16 ⊕  
#20 ⊖ #12 ◐



Insert Arrangement

25-61

No. of Contacts

61

Contact Size

#20

Service Rating

I


## Test Voltage AC RMS 60Hz IAW MIL-DTL-38999


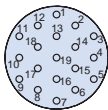
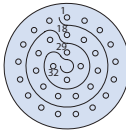
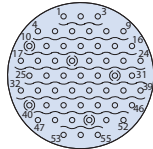
Service Rating	Sea Level		50,000 Ft.		70,000 Ft.		100,000 Ft	
	unmated	mated	unmated	mated	unmated	mated	unmated	mated
M	1300	1300	550	800	350	800	200	800
N	1000	1000	400	600	260	600	200	600
I	1800	1800	600	1000	400	1000	200	1000
II	2300	2300	800	1000	500	1000	200	1000

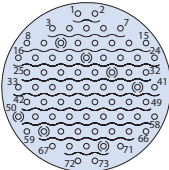
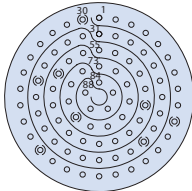
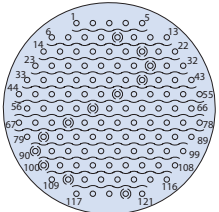
**Note:** The provision of electrical safety factors in each particular application, including peak voltages, switching currents, transients, etc. is the responsibility of the electrical engineer.

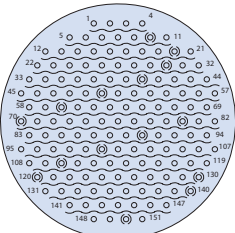
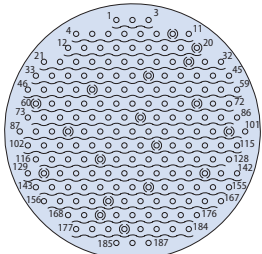


# MIL-STD-1560 High Density and Combo Contact Arrangements for MIL-DTL-38999 Series III / SuperNine<sup>®</sup>

Environmental and Hermetic Contact Arrangements		
Contact	Number of Size 23 Contacts	Insert Arrangement
 <p>Size #23 High-Density (HD) 5 Amp Max. Current #22-#26 AWG</p>	9	9-23
	19	11-23
	32	13-23
	55	15-23
	73	17-23
	88	19-23
	121	21-23
	151	23-23
	187	25-23

				
Insert Arrangement	9-23	11-23	13-23	15-23
No. of Contacts	9	19	32	55
Contact Size	#23	#23	#23	#23
Service Rating	N	N	N	N

			
Insert Arrangement	17-23	19-23	21-23
No. of Contacts	73	88	121
Contact Size	#23	#23	#23
Service Rating	N	N	N

		
Insert Arrangement	23-23	25-23
No. of Contacts	151	187
Contact Size	#23	#23
Service Rating	N	N

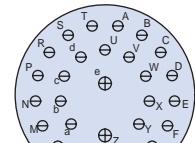
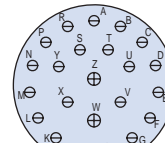
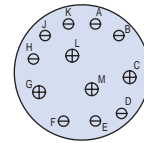
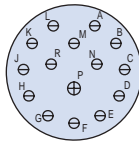
## Combo Contact Arrangements

Contact Size				Number of Contacts				Insert
				#20	#16	#12	10	
Size #20 Contacts 7.5 Amp Max. Current #20-#24 AWG	Size #16 Contacts 13 Amp Max. Current #16-#20 AWG	Size #12 Contacts 23 Amp Max. Current #12-#14 AWG	Size #10 Contacts 23 Amp Max. Current #10 AWG	14	1			15-15
				8	4			15-97
				21	2			17-99
				26	2			19-28
				29	1			19-30
				19	4	4		21-29
				37	2			21-39
				48	8			25-4
				2			9	25-11
					12	12		25-24
				23	20			25-43

### Contact Legend

#22D • #20 ⊖ #16 ⊕

#12 ⊖ #10 ⊕



### Insert Arrangement

No. of Contacts and Size  
Service Rating

15-15

1X #16 14X #20

15-97

4X #16 8X #20

17-99

2X #16 21X #20

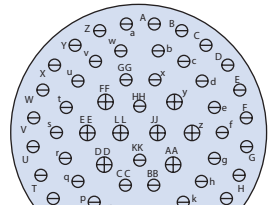
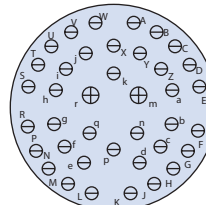
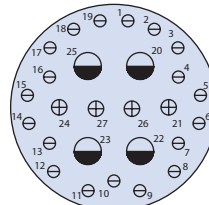
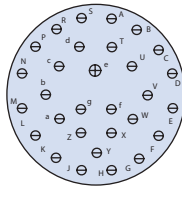
19-28

2X #16 26X #20

### Contact Legend

#22D • #20 ⊖ #16 ⊕

#12 ⊖ #10 ⊕



### Insert Arrangement

No. of Contacts and Size  
Service Rating

19-30

1X #16 29X #20

21-29

4X #12 19X #20

21-39

2X #16 37X #20

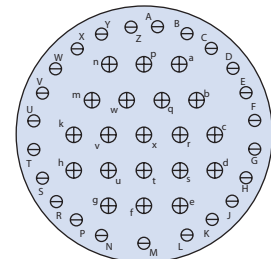
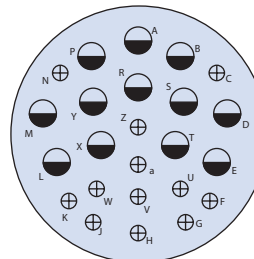
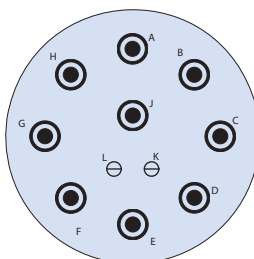
25-4

8X #16 48X #20

### Contact Legend

#22D • #20 ⊖ #16 ⊕

#12 ⊖ #10 ⊕



### Insert Arrangement

No. of Contacts and Size  
Service Rating

25-11

9X #10 2X #20

25-24

12X #12 12X #16

25-43

20X #16 23X #20

# MIL-DTL-38999 QPL-to-Glenair Finish Code Cross Reference

MIL-DTL-38999 Series I and II Class Code	Finish Description	Equivalent Glenair Material/Finish Code	Salt Spray Hours	Temperature Range	Conductive Yes/No	RoHS Yes/No
Aluminum Connectors						
A	Cadmium - Gold/Clear Chromate	J/LF	48	-65°C to +150°C	Yes	No
B	Cadmium - Olive-Drab Chromate	NF	500	-65°C to +175°C	Yes	No
C	Hardcoat Anodize	G	500	-65°C to +200°C	No	Yes
F	Electroless Nickel	M	48	-65°C to +200°C	Yes	Yes
R	Electroless Nickel	ME	96	-65°C to +200°C	Yes	Yes
T	Nickel-PTFE	MT	500	-65°C to +175°C	Yes	Yes
U	Cadmium - Clear Chromate	LF	96	-65°C to +150°C	Yes	No
Z	Zinc-Nickel - Black Chromate	ZR	500	-65°C to +175°C	Yes	Yes
Carbon Steel/Stainless Steel Connectors						
D	Fused Tin/3-10% Lead alloy (Carbon Steel)	FT	24	-65°C to +150°C	Yes	No
E	Passivated (Stainless Steel)	Z1	500	-65°C to +200°C	Yes	Yes
L	Electrodeposited Nickel (Stainless Steel)	ZL	500	-65°C to +200°C	Yes	Yes
N	Electrodeposited Nickel (Stainless Steel)	P	48	-65°C to +200°C	Yes	Yes
Aluminum Connectors						
C	Hardcoat Anodize	G	500	-65°C to +200°C	No	Yes
F	Electroless Nickel	ME	48	-65°C to +200°C	Yes	Yes
G	Electroless Nickel (Space Grade)	MA	48	-65°C to +200°C	Yes	Yes
R	Electroless Nickel	ME	96	-65°C to +200°C	Yes	Yes
T	Nickel-PTFE	MT	500	-65°C to +175°C	Yes	Yes
W	Cadmium - Olive-Drab Chromate	NF	500	-65°C to +175°C	Yes	No
Z	Zinc-Nickel - Black Chromate	ZR	500	-65°C to +175°C	Yes	Yes
Stainless Steel Connectors						
H	Passivated	Z1	500	-65°C to +200°C	Yes	Yes
K	Passivated	Z1	500	-65°C to +200°C	Yes	Yes
L	Electrodeposited Nickel	ZL	500	-65°C to +200°C	Yes	Yes
N	Electrodeposited Nickel	ZL	48	-65°C to +200°C	Yes	Yes
S	Electrodeposited Nickel	ZL	48	-65°C to +200°C	Yes	Yes
Y	Passivated	Z1	500	-65°C to +200°C	Yes	Yes
Composite Connectors						
J	Cadmium - Olive-Drab Chromate	XW	2000	-65°C to +175°C	Yes	No
M	Electroless Nickel	XM	2000	-65°C to +200°C	Yes	Yes

AS85049 Material and Finish Code	Finish Description	Equivalent Glenair Material/Finish Code	Salt Spray Hours	Temperature Range	Conductive Yes/No	RoHS Yes/No
Aluminum Accessories						
A (except /3, /4 and /5)	Anodize, Black	C	500	-65°C to +200°C	No	Yes
A (/3, /4 and /5)	Hardcoat Anodize	G	500	-65°C to +200°C	No	Yes
G	Electroless Nickel (Space Grade)	MA	96	-65°C to +200°C	Yes	Yes
N	Electroless Nickel	M	96	-65°C to +200°C	Yes	Yes
P	Cadmium - Olive-Drab Chromate (Selectively Plated)	NFP	96	-65°C to +175°C	Yes	No
W	Cadmium - Olive-Drab Chromate	NF	1,000	-65°C to +175°C	Yes	No
X	Nickel-PTFE	MT	500	-65°C to +175°C	Yes	Yes
Y	Alumiplate™	AL	1,000	-65°C to +175°C	Yes	Yes
YP	Alumiplate™ (Selectively Plated)	ALP	96*	-65°C to +175°C	Yes	Yes
Z	Zinc-Nickel - Black Chromate	ZR	1,000	-65°C to +175°C	Yes	Yes
ZP	Zinc-Nickel - Black Chromate (Selectively Plated)	ZS	96*	-65°C to +175°C	Yes	Yes
Stainless Steel Accessories						
B	Cadmium - Black Chromate	ZU	1,000	-65°C to +175°C	Yes	No
S	Passivated	Z1	1,000	-65°C to +200°C	Yes	Yes
XS	Nickel-PTFE	ZMT	1,000	-65°C to +175°C	Yes	Yes
YS	Alumiplate™	ZAL	1,000	-65°C to +175°C	Yes	Yes
ZS	Zinc-Nickel - Black Chromate	ZZR	1,000	-65°C to +175°C	Yes	Yes
Composite Accessories						
J	Cadmium - Olive-Drab Chromate	XW	2000	-65°C to +175°C	Yes	No
L	Cadmium - Olive-Drab Chromate (Selectively Plated)	XX	2000	-65°C to +175°C	Yes	No
M	Electroless Nickel	XM	2000	-65°C to +200°C	Yes	Yes
T	No Plating	XO	N/A	-65°C to +175°C	No	Yes
XC	Nickel-PTFE	XMT	2000	-65°C to +175°C	Yes	Yes
YC	Alumiplate™	XAL	2000	-65°C to +175°C	Yes	Yes
YL	Alumiplate™ (Selectively Plated)	XAP	2000	-65°C to +175°C	Yes	Yes
ZC	Zinc-Nickel - Black Chromate	XZR	2000	-65°C to +175°C	Yes	Yes
ZL	Zinc-Nickel - Black Chromate (Selectively Plated)	XZS	2000	-65°C to +175°C	Yes	Yes

\* Spec Requirement of 500 hours is in error



# Galvanic Corrosion and Anodic Index Reference Tables

Galvanic Corrosion Table		
	Metal	(V)
Most Noble/Cathodic	Gold, solid and plated, Gold-platinum alloy	0.00
	Rhodium plated on silver-plated copper	0.05
	Silver, solid or plated; monel metal. High nickel-copper alloys	0.15
	Nickel, solid or plated, titanium and special alloys such as Monel	0.30
	Copper, solid or plated; low brasses or bronzes; silver solder; German silvery high copper-nickel alloys; nickel-chromium alloys	0.35
	Brass and bronzes	0.40
	High brasses and bronzes	0.45
	18% chromium type corrosion-resistant steels	0.50
	Chromium plated; tin plated; 12% chromium type corrosion-resistant steels	0.60
	Tin-plate; tin-lead solder	0.65
Least Noble/Anodic	Lead, solid or plated; high lead alloys	0.70
	Aluminum, wrought alloys of the 2000 Series	0.75
	Iron, wrought, gray or malleable, plain carbon and low alloy steels	0.85
	Aluminum, wrought alloys other than 2000 Series aluminum, cast alloys of the silicon type	0.90
	Aluminum, cast alloys other than silicon type, cadmium, plated and chromate	0.95
	Hot-dip-zinc plate; galvanized steel	1.20
	Zinc, wrought; zinc-base die-casting alloys; zinc plated	1.25
	Magnesium & magnesium-base alloys, cast or wrought	1.75
	Beryllium	1.85

Galvanic corrosion occurs when dissimilar metals are in contact in the presence of an electrolyte. The corrosion of a metal, the anode, results from the positive current flowing from the anode to the less reactive (more noble) metal, the cathode, through the electrolyte. This form of corrosion has the potential to attack junctions of metals, or regions where one construction metal is changed to another. The critical point is the difference in potential of the two materials being considered as a joined pair.

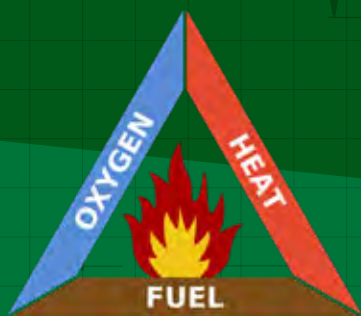
The "anodic" or "less noble" metals such as magnesium, zinc and aluminium are more likely to be attacked than those at the "cathodic" or "noble" end of the series such as gold and silver.

Environment	Examples	Acceptable Anodic Index Difference
Harsh Environments	Outdoors, high humidity, and salt environments	Not more than 0.15 V difference
Uncontrolled Environments	Storage in warehouses or non-temperature and humidity controlled environments	Not more than 0.25 V difference
Controlled Environments	Temperature and humidity controlled	Not more than 0.50 V difference

# Ex Hazardous Zone and Category Designations



## ATEX EXPLOSIVE ZONES AND CATEGORIES



Explosion Triangle

### Purpose of explosion zone connectors and glands

Glenair Series 927-072 ITS-Ex Hazardous Zone Connectors prevent explosions by eliminating the heat component in the explosion triangle. This is accomplished by preventing an ignition source, such as a flame or spark, from migrating through the cable or connector into a defined hazardous zone such as might be found in a petrochemical refinery or land/offshore drilling system. Hazardous zones are defined by frequency of presence of explosive gas or dust.

#### Hazardous Zone Fuel Types

- Gas, vapor and mists : methane, butane, ethylene, hydrogen, acetylene
- Dust : aluminum, sulfur, zinc grain, coal, sugar, epoxy resin

In the ATEX 1999/92/EC directive, hazardous areas are divided into three defined zones: 0, 1, and 2. These zones are designations used to describe the likelihood that explosive mixtures of fuel and oxygen exist during normal conditions of facility operation.

Zone 0 (20)	Zone 1 (21)	Zone 2 (22)
Area in which an explosive gas (dust) atmosphere is present continuously or for long periods or frequently.	Area in which an explosive gas (dust) atmosphere is likely to occur in normal operation occasionally.	Area in which an explosive gas (dust) atmosphere is likely to occur in normal operation but, if it does occur, will persist for a short period only.

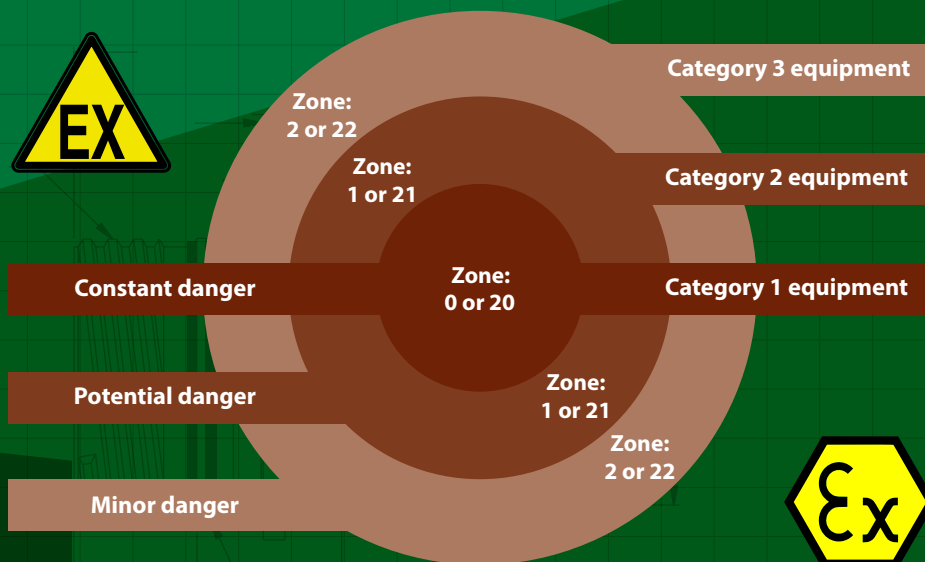
Operator

Manufacturer

Explosive area zone classifications are used by the operator to distinguish between explosive areas and their relative levels of risk. Operators use the triangular EX mark to indicate compliance with IECEx/ATEX requirements.

Manufacturers however use different classifications to describe where their products may be used.

The two systems generally conform in meaning but the words and symbols change.



# Ex Hazardous Zone and Category Designations



## IEC AND ATEX

ATEX 94/9/EC directive classifies the equipment into categories 1,2,3 (Group II), based on protection level. Standard EN/IEC 60079-0 introduces EPL (Equipment Protection Level).

ATEX Group II	EPL according to IEC/EN 60079-0	
	Gas	Dust
Category 1	Ga	Da
Category 2	Gb	Db
Category 3	Gc	Dc

The relation between the ATEX 1999/92/EC and the IEC is indicated below : in the Zone 0 you could mount an equipment Ga or 1G (according to 94/9/EC ATEX).

Atmosphere	Zone	EPL	ATEX Category
Gas	0	Ga	1G
	1	Gb or Ga	2G or 1G
	2	Gc or Gb or Ga	3G or 2G or 1G
Dust	20	Da	1D
	21	Db or Da	2D or 1D
	22	Dc or Db or Da	3D or 2D or 1D

Glenair Connectors 927-072 are qualified for Group IIA, IIB, IIC and for Group IIIA, IIIB, IIIC, Category 2 and Category 3.

Category 2	Category 3
Place where explosive atmosphere is likely to occur. Provides the protection level in case of failure of the connector/equipment.	Place where explosive atmosphere are unlikely to occur, or if they do occur not frequently and only for a short period of time. Provides the requisite level of protection during normal operation.

## GROUP II is for explosive GASES

Group II	Gases
IIA	Acetone, ethyl alcohol, ammonia, gasoline, butane, hexane, ethanol, natural gas, methanol, propane
IIB	Acetaldehyde, propane, ethylene
IIC	Hydrogen, gas mixture containing more than 25% hydrogen, acetylene, carbon disulphide

## GROUP III is for explosive DUST

Group III	Dust
IIIA	Fibers
IIIB	Non-conductive dust
IIIC	Conductive dust

## TEMPERATURE CLASSES

Glenair Series 927-072 ITS-Ex Hazardous Zone Connectors are qualified IAW class T6 to class T1. The temperature class identifies the hottest temperature that the equipment can reach.

Temperature Class	Permissible surface temperatures of the electrical equipment	Ignition temperature of the combustible gases
T1	450 °C	> 450 °C
T2	300 °C	300 - 450 °C
T3	200 °C	200 - 300 °C
T4	135 °C	135 - 200 °C
T5	100 °C	100 - 135 °C
T6	85 °C	85 - 100 °C

## TECHNICAL OVERVIEW

### Certified Uses:

- With flammable gases and vapors with apparatus group IIC and with temperature classes T6 and T5 in zones 1 and 2
- With flammable dusts with apparatus group IIIC and with temperature classes T80°C and T95°C in zone 21 and 22
- The connectors are certified IP68 (tested at a depth of 10 meters for 30 minutes)

The Glenair ITS-Ex Hazardous Zone series of connectors is comprised of metallic bodies and shells (aluminium alloy standard, optional materials available) with resilient silicone rubber inserts IAW MIL-DTL-5015. Pin or socket crimp contacts are available, and male and female inserts are reversible. Cable plugs and receptacles are available to form in-line cable connections. A fixed flange mount receptacle is available for Ex d boxes and Ex e bulkhead use. Connectors are coupled with a trapezoidal double-start threaded nut retained by grub (set) screws, and form a cylindrical flamepath when mated. When disconnected, plugs and receptacles are mated to an attached protective safety cap (or blanking cap). Absence of cap voids the Ex certification. Mate plug and receptacle caps together when not in use to prevent thread damage. Both plug and receptacle cable configurations are equipped with back-end accessory threads for the attachment of mechanical cable clamps and wire mesh Kellums grip-style attachments (potting required). A third style of rear-end accessory, an industry-standard Ex-certified explosion-proof cable gland, is also available and supplied by Glenair. The Ex certified cable gland does not require potting by the customer to achieve Ex d certified performance.

## ATEX / IECEx LABELS

All Glenair ITS-Ex connectors are supplied with a non-removable label containing the following information per ATEX and IECEx directives:

### ATEX Marking

CE 2460 Ex

II 2 G Ex db IIC T6, T5 Gb

II 2 D Ex tb IIIC T80°C, T95°C Db IP68

-40°C ≤ Tamb ≤ +40°C (T6, T80°C) or +55°C (T5, T95°C)

### IECEx Marking

Ex db IIC T6, T5 Gb

Ex tb IIIC T80°C, T95°C Db IP68

-40°C ≤ Tamb ≤ +40°C (T6, T80°C) or +55°C (T5, T95°C)

### FOR PANEL MOUNT CONNECTORS ONLY:

### ATEX Marking

CE 2460 Ex

II 2 G Ex de IIC T6, T5 Gb

II 2 D Ex tb IIIC T80°C, T95°C Db IP68

-40°C ≤ Tamb ≤ +40°C (T6, T80°C) or +55°C (T5, T95°C)

### IECEx Marking

Ex de IIC T6, T5 Gb

Ex tb IIIC T80°C, T95°C Db IP68

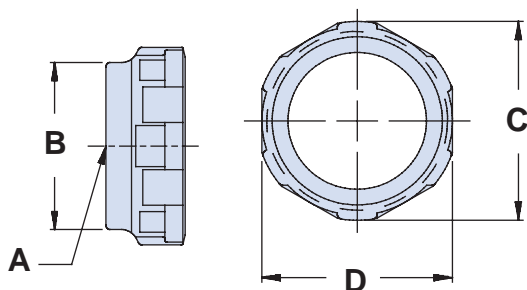
-40°C ≤ Tamb ≤ +40°C (T6, T80°C) or +55°C (T5, T95°C)

Materials	
Item	Material
Hardware Body	Standard Base Material: aluminium alloy EN AW 6082-T6 UNI EN 573-3 (0.7÷1.3% Si, 0.6÷1.2% Mg, <0.2% Ti). All aluminium parts finished with a hard, scratch-resistant coating per MIL-A-8625, type III, class 2.
Insert	Silicone rubber
Cable Seal Glands	Silicone rubber
Grommet and Gasket	Silicone fire resistant rubber
O-Ring	Silicone MVQ / VMQ
Grub Screws (Set Screws)	UNI EN 10088-3, Alloy 316, stainless steel, passivated
Crimp Socket and Pin Contacts	Copper alloy ISO CuZn37Pb2/CuZn35Pb2 (OT61B/OT62A) for size AWG 20, 18, 16, 12 and 8 and copper alloy ISO CuTe for size 4,0 4/0. Both of them are silver plated as standard and gold plated as option.
Cement for potting	Bi-component epoxy resin (applied by the customer), flame retardant and thermally conductive, cure at room temperature for 24 hours.



# Circular Connector-to-Backshell Interface Standards / Designator Codes

Circular Connector Front End Dimensional Details								
Shell Size for Connector Designator					A Thread Ref	B Dia Max	C Dia Max	D Flats Ref
A	F/L	G	H	U				
-	08 09	-	-	-	7/16-28 UNEF	.59 (15.0)	.86 (21.8)	.75 (19.1)
-	-	-	09 A	-	M12 X 1 - 6H	.65 (16.5)		
08	-	-	-	-	1/2-20 UNF	.65 (16.5)		
-	-	-	-	08 9 A B	1/2-28 UNEF	.65 (16.5)	.98 (24.9)	.88 (22.2)
03	10 11	-	-	-	9/16-24 UNEF	.72 (18.3)		
-	-	-	11 B	-	M15 x 1 - 6H	.77 (19.6)		
10	-	-	-	-	5/8-24 UNEF	.77 (19.6)		
-	-	-	-	10 11 C D	5/8-28 UN	.77 (19.6)	1.16 (29.4)	1.00 (25.4)
-	12 13	-	-	-	11/16-24 UNEF	.84 (21.3)		
-	-	-	13 C	-	M18 x 1 - 6H	.89 (22.6)		
12 7	-	11 A	-	-	3/4-20 UNEF	.91 (23.1)		
-	-	-	-	12 13 F	3/4-28 UNS	.91 (23.1)	1.28 (32.5)	1.13 (28.6)
-	14 15	-	-	-	13/16-20 UNEF	.97 (24.6)		
-	-	-	-	-	M22 x 1 - 6H	1.03 (26.2)		
14 12	-	13 B	13 B	-	7/8-20 UNEF	1.03 (26.2)		
-	-	-	-	14 15 G H	7/8-28 UN	1.03 (26.2)	1.41 (35.7)	1.25 (31.8)
-	16 17	-	-	-	15/16-20 UNEF	1.09 (27.7)		
-	-	-	17 E	-	M25 x 1 - 6H	1.15 (29.2)		
16 19	-	15 C	-	-	1-20 UNEF	1.15 (29.2)		
-	-	-	-	16 17 J K	1-28 UN	1.15 (29.2)	1.52 (38.5)	1.38 (35.1)
18 27	18 19	-	-	-	1-1/16-18 UNEF	1.22 (31.0)		
-	-	-	19 F	-	M28 x 1 - 6H	1.28 (32.5)		
-	-	17 D	-	-	1-1/8-18 UNEF	1.28 (32.5)		
-	-	-	-	18 19 M N	1-1/8-28 UN	1.28 (32.5)	1.64 (41.7)	1.50 (38.1)
20 37	20 21	-	-	-	1-3/16-18 UNEF	1.34 (34.0)		
-	-	-	21 G	-	M31 x 1 - 6H	1.41 (35.8)		
-	-	19 E	-	-	1-1/4-18 UNEF	1.41 (35.8)		
-	-	-	-	20 21 P R	1-1/4-28 UN	1.41 (35.8)	1.77 (44.9)	1.63 (41.3)
22	22 23	-	-	-	1-5/16-18 UNEF	1.47 (37.3)		
-	-	-	23 H	-	M34 x 1 - 6H	1.53 (38.9)		
-	-	-	-	22 23 S T	1-3/8-28 UN	1.53 (38.9)	1.89 (48.0)	1.75 (44.5)
24	24 25	23 F	-	-	1-7/16-18 UNEF	1.59 (40.4)		
-	-	-	25 J	-	M37 x 1 - 6H	1.66 (42.2)		
61	-	-	-	-	1-1/2-18 UNEF	1.66 (42.2)		
-	-	-	-	24 25 U M	1-1/2-28 UN	1.66 (42.2)	2.02 (51.2)	1.88 (47.6)
-	-	25 G	-	-	1-9/16-18 UNEF	1.66 (42.2)		2.00 (50.8)
28	-	-	-	-	1-3/4-18 UNS	1.97 (50.0)	2.16 (54.8)	-



## NOTES:

1. Connector shell size designations in blue are for reference only; do not use in part numbers.
2. Metric dimensions (mm) are in parentheses and are for reference only. (1 inch = 25.4 mm)
3. Consult factory for accessory interface data not listed.
4. Use Glenair 600-091 or 600-157 tool to tighten coupling nut. Rubber jaw pliers or strap wrench may damage the parts.

## Circular Connector Common Interface Standards

### Connector Designator

#### SPECIFICATION

MIL-DTL-5015  
MIL-DTL-26482  
MIL-C-81703  
MIL-DTL-83723  
40M39569  
DEF 5326-3  
LN 29504  
NFC 93422  
PAN 6432-1  
PAN 6432-2  
PATT 602  
EN2997

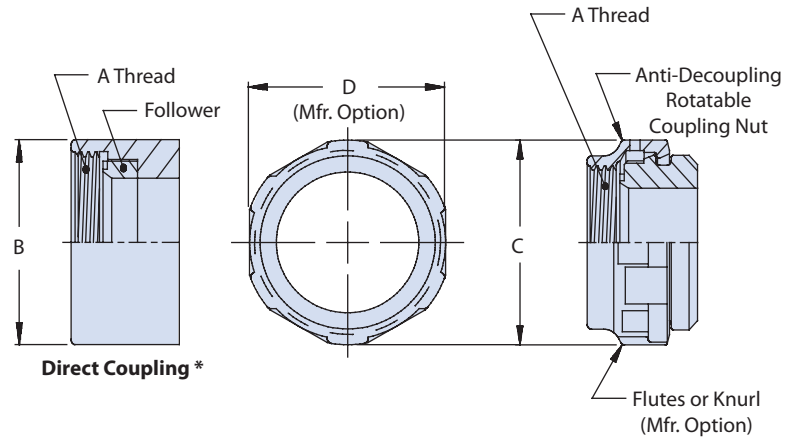
# A

#### SERIES

MS34XX  
2  
3  
1 & 3  
NB

HE 302

Note: Code A, rotatable coupling supplied without O-ring.  
Environmental seal performed by interface geometry.  
\* Consult factory for direct coupling part numbers.



### Connector Designator

#### SPECIFICATION

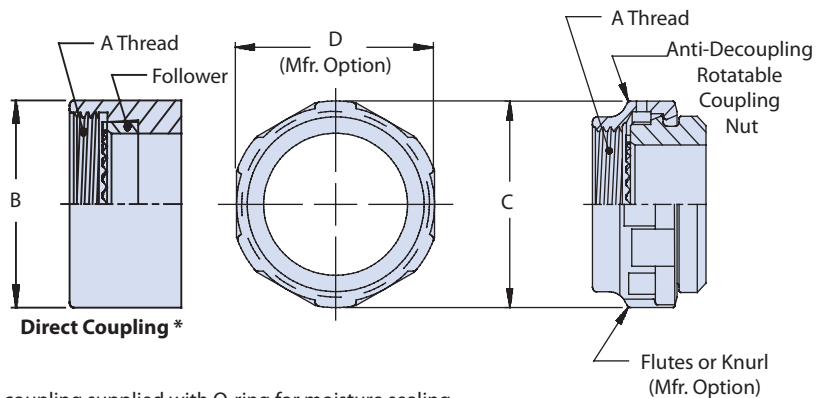
MIL-DTL-38999  
40M38277  
NFC 93422  
NFC93422  
PAN 6433-1  
PATT 614  
PATT 616

# F

#### SERIES

I & II  
NLS  
HE 309  
HE 308

Note: Direct coupling supplied with O-ring for moisture sealing.  
Add modifier code 101A to end of part number for O-ring to be supplied on rotatable coupling.  
\* Consult factory for direct coupling part numbers.



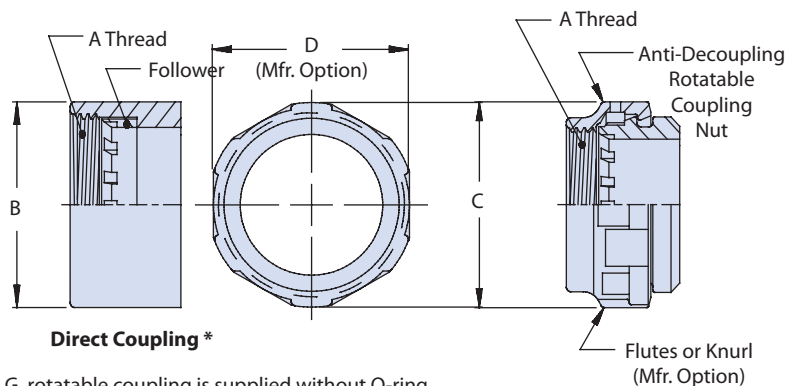
### Connector Designator

#### SPECIFICATION

MIL-DTL-28840

# G

Note: Code G, rotatable coupling is supplied without O-ring.  
Environmental seal performed by interface geometry.  
\* Consult factory for direct coupling part numbers.



# Circular Connector-to-Backshell Interface Standards / Designator Codes

## Circular Connector Common Interface Standards

### Connector Designator

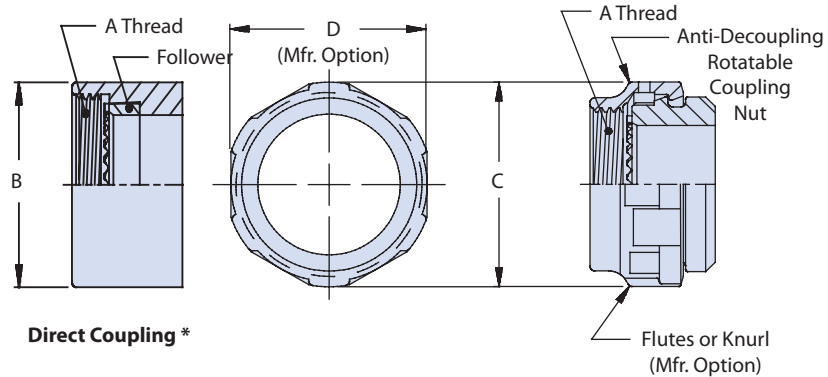
**H**

#### SPECIFICATION

MIL-DTL-38999  
EN3645

#### SERIES

III & IV



**Direct Coupling \***

Note: Direct coupling supplied with O-ring for moisture sealing. Add modifier code 101A to end of part number for O-ring to be supplied on rotatable coupling.

\* Consult factory for direct coupling part numbers.

### Connector Designator

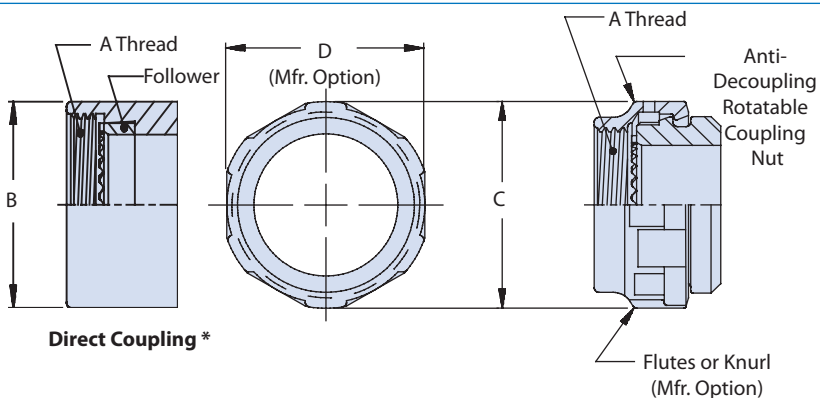
**L**

#### SPECIFICATION

EN3372  
JN1003  
LN 29729  
NFC93422  
PAN 6433-2  
PATT  
615  
VG 96912

#### SERIES

HE306



**Direct Coupling \***

Note: Direct coupling supplied with O-ring for moisture sealing. Add modifier code 101A to end of part number for O-ring to be supplied on rotatable coupling.

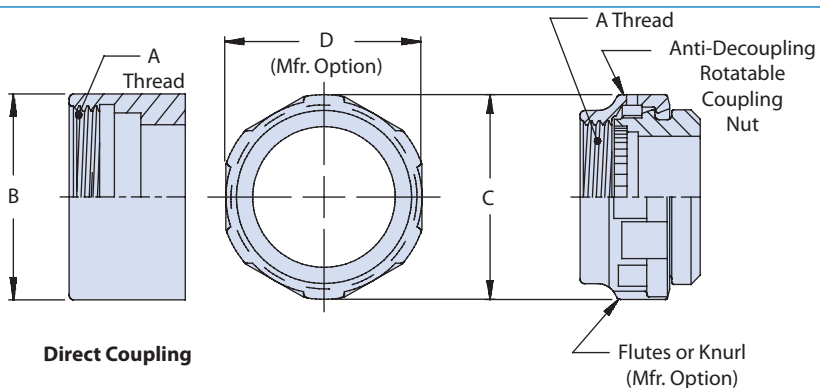
\* Consult factory for direct coupling part numbers.

### Connector Designator

**U**

#### SPECIFICATION

MIL-C-29600



**Direct Coupling**

Note: Direct coupling supplied with O-ring for moisture sealing. Add modifier code 101A to end of part number for O-ring to be supplied on rotatable coupling.

## Connector Manufacturers' Index for Backshell and Accessory Specifications

MFG SERIES	GLENAIR CONNECTOR DESIGNATOR	SPECIFICATION REFERENCE	SERIES
<b>Aero-Electric Connector Company</b>			
AE22	H	MIL-DTL-38999	III
AE46	F	MIL-DTL-38999	I
AE47	F	MIL-DTL-38999	II
AE48	F	MIL-DTL-38999	II
AE49	F	MIL-DTL-38999	I
AE55	A	SAE AS50151	MS3400
AE66	E	MIL-DTL-26500	Aluminum
AE77	A	MIL-DTL-26482	II
AE83	A	MIL-DTL-83723	III
<b>AB Electronics</b>			
CT-R	F	MIL-DTL-38999	II
MK	8	S	PATT 105
MK	12	S	PATT 603
MK	18	S	PATT 608
<b>Amphenol Limited</b>			
JT	F	PAN	6433-1
SJT	L	JN	1003
SJT	L	LN29729	
SJT	L	PAN	6433-2
118	A	LN	29504
162GB	S	PATT	603
348	J	VG	95329
418-1	F	PATT	616
418-2	F	PATT	614
418-5	L	NFC 93422	HE 306
418-5	L	PATT	615
602GB	A	PAN	6432-1
602GB	A	PATT	602
62GB	S	PATT	105
652	A	LN	29504
<b>Amphenol Products</b>			
BG	D	MIL-DTL-26482	I
JT	*	MIL-C-27599	
JT-R	F	MIL-DTL-38999	II

MFG SERIES	GLENAIR CONNECTOR DESIGNATOR	SPECIFICATION REFERENCE	SERIES
<b>Amphenol Products (Continued)</b>			
JT-R	F	40M38277	
LJT	*	MIL-C-27599	
LJT-R	F	MIL-DTL-38999	I
MF-S	D	MIL-DTL-26482	I
PT	D	MIL-DTL-26482	I
PT-SE	D	MIL-DTL-26482	I
PTS-DR	A	MIL-DTL-26482	II
PTS-DR	A	MIL-DTL-83723	I
QWLD	C	MIL-DTL-22992	R
SC	B	SAE AS50151	MS3100
SJT	L	LN	29729
SM	B	SAE AS50151	MS3100
TV	H	MIL-DTL-38999	III
TVRB	H	CECC 75201.002	III
TVS	H	MIL-DTL-38999	III
10-72	B	SAE AS50151	MS3100
10-214	B	SAE AS50151	MS3100
10-475	F	40M38277	
48	E	MIL-DTL-26500	Aluminum
69	B	SAE AS50151	MS3100
97	B	SAE AS50151	MS3100
118	A	MIL-DTL-26482	II
118	A	MIL-DTL-83723	I
246	*	SAE AS50151	
348	J	SAE AS81511	I-II
418-1	F	MIL-DTL-38999	I
418-2	F	MIL-DTL-38999	II
518	A	MIL-DTL-83723	III
71	B	SAE AS50151	MS3100
91-483	A	MIL-DTL-26482	II
91-483	A	MIL-DTL-83723	I
<b>Amphenol/Pyle National</b>			
B	A	MIL-DTL-83723	III
T3	H	MIL-DTL-38999	III



# Connector Manufacturers' Index for Backshell and Accessory Specifications

MFG SERIES	GLENAIR CONNECTOR DESIGNATOR	SPECIFICATION REFERENCE	SERIES
<b>Amphenol/Pyle National (Continued)</b>			
ZZW	E	MIL-DTL-26500	Aluminum
ZZY	E	MIL-DTL-26500	Aluminum
	A	ESC 10, ESC 11	
<b>Amphenol/Tuchel Electronics GmbH</b>			
118	A	LN	29504
162GB	*	VG	95328
348	J	VG	95329
602GB	A	DEF	5326-3
602GB	A	PAN	6432-1
602GB	A	PATT	602
62GB	*	DEF	5326-3
652	A	LN	29504
<b>Cie Deutsch &amp; Compagnie Deutsch GmbH</b>			
AFD	A	LN	29504
AFD	A	MIL-DTL-26482	I
AFD	A	PAN	6432-1
DBAS	A	QPL-81703	III
DBAS	A	PAN	6432-2
DFE	A	LN	29504
DVG	A	VG	95328
FDBA	A	LN	29504
951	A	PRL	53125
9.815	J	SAE AS81511	III & IV
991	A	PAN	6432-4
999.1	F	MIL-DTL-38999	I
	A	ESC 10	
	A	ESC 11	
<b>Deutsch Engineered Connecting Devices</b>			
AFD5	A	MIL-DTL-26482	II
AFD	A	MIL-DTL-83723	I
A815	J	SAE AS81511	III
B815	J	SAE AS81511	IV
BMS	E	MIL-DTL-26500	
BTK	D	MIL-DTL-26482	I
DBA	A	40M39569	
DBA7	A	QPL-81703	III
DTS	H	MIL-DTL-38999	III
DIV4	H	MIL-DTL-38999	IV
DL6	A	MIL-DTL-83723	III
D817	A	QPL-81703	III
LPT	D	MIL-DTL-26482	I
381	A	40M39569	
450	D	MIL-DTL-26482	I
460	D	MIL-DTL-26482	I

MFG SERIES	GLENAIR CONNECTOR DESIGNATOR	SPECIFICATION REFERENCE	SERIES
<b>Deutsch Engineered Connecting Devices (Continued)</b>			
837	A	MIL-DTL-83723	III
<b>Deutsch Limited</b>			
LL	J	SAE AS81511	III-IV
DBAS	A	PAN	6432-2
DTS	H	MIL-DTL-38999	III
HDJ	L	JN	1003
RR	A	PAN	6432-1
RR	A	PATT	602
RR70	A	QPL-81703	III
SLPT	*	MIL-DTL-26482	I
<b>Glenair</b>			
90	G	MIL-DTL-28840	
80	M	Mighty Mouse	800 Thru 805
22	W	Geo-Marine®	
ITS, IT	R	SAE AS50151	
231	F	MIL-DTL-38999	I
232	F	MIL-DTL-38999	II
233	H	MIL-DTL-38999	III
<b>Souriau</b>			
BT	D	MIL-DTL-26482	I
G	D	MIL-DTL-26482	I
L	D	MIL-DTL-26482	I
L-T	D	MIL-DTL-26482	I
M-T	D	MIL-DTL-26482	I
JVS	H	CECC 75201.002	
8LT	F	MIL-DTL-38999	I
8LT	F	NFC 93422	HE 308
8ST	L	JN 1003	8ST-034
8ST	L	LN 29729	
8ST	L	NFC 93422	HE 306
8ST	L	PAN 6433-2	
8ST	L	PATT 615	
8ST	L	VG 96912	
8T	F	MIL-DTL-38999	II
8T	F	NFC 93422	HE 309
85	D	MIL-DTL-26482	I
851	S	PATT 603	
851-50	*	NFL53125	
851-50	*	VG 95328	
8525	A	NFC 93422	HE 302
8525.1	A	LN 29504	
8526	A	MIL-DTL-26482	II
8526	A	PAN 6432-1	
8526	A	PATT 602	

MFG SERIES	GLENAIR CONNECTOR DESIGNATOR	SPECIFICATION REFERENCE	SERIES
<b>Souriau (continued)</b>			
8533	A	EN 2992	
8533	A	ESC 10	
8534	A	ESC 11	8534
<b>Flight Connector Corporation</b>			
FC	*	SAE AS50151	
FF	A	SAE AS50151	MS3400
FH	*	SAE AS50151	
FHA	K	MIL-DTL-83723	II
PL	H	MIL-DTL-38999	IV
<b>G &amp; H Technologies</b>			
BL	H	MIL-DTL-38999	IV
NC	G	MIL-DTL-28840	
<b>ITT Cannon</b>			
CA3106B	*	VG95234	
CA-E / R	B	SAE AS50151	MS3100
CA-RX	B	SAE AS50151	MS3100
CVA	K	MIL-DTL-83723	II
CV340	A	SAE AS50151	MS3400
CV345	A	SAE AS50151	MS3450
KFS	G	MIL-DTL-28840	
KJ	F	MIL-DTL-38999	II
KJ	F	40M38277	
KJA	H	MIL-DTL-38999	III
KJL	F	MIL-DTL-38999	I
KPSE	D	MIL-DTL-26482	I
KPT	D	MIL-DTL-26482	I
MF	A	MIL-DTL-83723	III
PV-G	A	40M39569	
PVA	A	MIL-DTL-83723	I
PV7	A	MIL-DTL-26482	II
A	ESC 10	KE, SE	
<b>ITT Cannon Electric France SA</b>			
KJ	F	MIL-DTL-38999	II
KJ	F	PAN	6433-1
KJL	F	MIL-DTL-38999	I
251	*	MIL-DTL-26482	I
<b>ITT Cannon UK Ltd.</b>			
KJ	F	PATT	614
KPSE	D	MIL-DTL-26482	I
PV-S	A	MIL-DTL-83723	I
PVW	A	LN29504	
PVX	A	PAN	6432-1
PVX	A	PATT	602
A	ESC 10	KE, SE	

MFG SERIES	GLENAIR CONNECTOR DESIGNATOR	SPECIFICATION REFERENCE	SERIES
<b>ITT Cannon Electric GmbH</b>			
CA3106B	*	VG 95234	
CGK	L	LN 29729	
CWLD	C	MIL-DTL-22992	R
KJ	F	PAN 6433-1	
KPSE	*	VG 95328	
KPT	*	VG 95328	
PVW	A	LN 29504	
PVX	A	PAN 6432-1	
<b>J-Tech</b>			
JT 3400	A	SAE AS50151	MS3400
JT 3450	A	SAE AS50151	MS3450
JTVG95234	A	VG95234	
<b>Labinal/Cinch</b>			
CNO930	A	MIL-DTL-83723	III
48	E	MIL-DTL-26500	Aluminum
<b>RMS</b>			
RO	MIL-DTL-26500	Aluminum	
<b>Schaltbau GmbH</b>			
650	J	VG 95329	
674	*	VG 95328	
675	*	VG 95328	
679	J	VG 95329	
<b>SICEM</b>			
SCB	*	VG 95234	
<b>Sunbank</b>			
JSC	MIL-DTL-28840		
<b>ITT Cannon</b>			
TT	F	PAN 6433-1	
PT	S	PATT 105	
PT-SE	S	PATT 603	
STT	L	LN 29729	
STT	L	PAN 6433-2	
STT	L	PATT 615	
STT	L	VG 96912	
<b>ITT VEAM</b>			
CIR	*	VG 95234	
VPT	D	MIL-DTL-26482	I
VPT-SE	*	MIL-DTL-26482	I
VPT-SE	*	VG 95328	

# AS85049 Qualified Backshells and Connector Accessories

Part No.	Description
AS85049/1	Straight Strain Relief
AS85049/2	Straight Environmental Strain Relief
AS85049/3	Straight Environmental Backshell
AS85049/4	Straight Step-Up Environmental Backshell
AS85049/5	Straight Step-Down Environmental Backshell
AS85049/6	45° RFI/EMI Environmental Backshell
AS85049/7	45° Environmental Backshell
AS85049/8	90° RFI/EMI Environmental Backshell
AS85049/9	90° Environmental Backshell
AS85049/10	Straight RFI/EMI Environmental Backshell
AS85049/11	Straight Environmental Backshell
AS85049/14	E Nuts
AS85049/15	45° Qwik-Ty® Strain Reliefs
AS85049/16	90° Qwik-Ty® Strain Reliefs
AS85049/17	Straight RFI/EMI Environmental Backshell
AS85049/18	Straight RFI/EMI Environmental Backshell
AS85049/19	Straight Environmental Backshell
AS85049/20	Straight Crimp Ring Backshell and Crimp Ring
AS85049/21	Straight Non-Environmental Strain Relief
AS85049/23	45° RFI-EMI Non-Environmental Backshell
AS85049/24	90° RFI-EMI Non-Environmental Backshell
AS85049/25	Straight RFI-EMI Non-Environmental Backshell
AS85049/26	Adapter / Crimp Ring
AS85049/27	E Nuts
AS85049/28	Strt. Rectangular Non-Environmental Backshell
AS85049/29	Straight Non-Environmental Strain Relief
AS85049/30	Straight RFI-EMI Shield Termination Backshell
AS85049/31	E Nuts
AS85049/33	Straight Crimp Ring Non-Env. Backshell
AS85049/34	Straight Adapter and Extender
AS85049/36	Straight RFI-EMI Non-Environmental Backshell
AS85049/37	90° RFI-EMI Non-Environmental Backshell
AS85049/38	Straight Strain Reliefs
AS85049/39	90° Strain Reliefs
AS85049/41	Straight Strain Relief
AS85049/42	Straight Strain Relief
AS85049/43	45° Strain Relief
AS85049/44	Straight Rectangular Strain Relief Backshell
AS85049/45	Straight Strain Relief
AS85049/46	90° Non-Self-Locking Composite Strain Relief
AS85049/47	90° Strain Reliefs
AS85049/48	Rectangular Strain Relief Backshell
AS85049/49	Straight Strain Relief
AS85049/50	Rectangular Strain Relief Backshell
AS85049/51	90° Strain Reliefs
AS85049/52	Straight Strain Reliefs

Part No.	Description
AS85049/53 /54 /55	Qwik-Ty® Strain Reliefs
AS85049/56 /57	Qwik-Ty® Strain Reliefs
AS85049/58	Potting Boot Ring
AS85049/59	Straight Shrink Boot Adapter
AS85049/60	Straight Shrink Boot Adapters
AS85049/61	Potting Boot Ring
AS85049/62	Straight Shrink Boot Adapter
AS85049/63	90° Qwik-Ty® Strain Relief
AS85049/69	Straight Shrink Boot Adapter
AS85049/74	Potting Boot
AS85049/75	Potting Boot
AS85049/76	90° EMI/RFI Environmental Backshell
AS85049/77	45° EMI/RFI Environmental Backshell
AS85049/78	45° EMI/RFI Environmental Backshell
AS85049/79	90° EMI/RFI Environmental Backshell
AS85049/80	Sealing Plug, Sizes 8, 12 and 16
AS85049/81	Sealing Plug
AS85049/82 /83 /84	Banding Backshells
AS85049/85 /86 /87	Banding Backshells
AS85049/88 /89 /90	Banding Backshells
AS85049/91 /92	Strain Reliefs
AS85049/93	Banding Split Ring
AS85049/94	Full Perimeter Mounting Flange
AS85049/95	3/4 Perimeter Mounting Flange
AS85049/96	1/4 Perimeter Mounting Flange
AS85049/103	Straight Shield Sock Composite Adapter
AS85049/104	45° Shield Sock Composite Adapter
AS85049/105	90° Shield Sock Composite Adapter
AS85049/109	Straight Shield Sock Shrink Boot Adapter
AS85049/111	90° Shield Sock Sock Shrink Boot Adapter
AS85049/112	Straight Shield Sock Sock Shrink Boot Adapter
AS85049/114	90° Shield Sock Shrink Boot Adapter
AS85049/115	Straight Shield Sock Shrink Boot Adapter
AS85049/118	Straight Strain Relief
AS85049/120	90° Strain Relief
AS85049/121	Straight Strain Relief
AS85049/123	90° Strain Relief
AS85049/124	Sraight Strain Relief
AS85049/126	90° Strain Relief
AS85049/127	Bushing Strip
AS85049/128-3, -4	Clamping Bands
AS85049/130	Gasket
AS85049/139	Telescoping Bushing, C or L
AS85049/140	Straight Lipped Heat Shrink Boots
AS85049/141	90° Lipped Heat Shrink Boots
AS85049/142	Wide Body Heat Shrink Boot Transitions

## Recommended Backshell-to-Connector Torque Values

INSTALLATION TORQUE VALUES FOR CIRCULAR ELECTRICAL CONNECTOR ACCESSORIES			
Shell Sizes	Column 1 Light and Medium Duty AS50151 (AS31001 Series) MIL-DTL-26482 Series I MIL-DTL-26500, MIL-DTL-27599 MIL-DTL-38999 Series I and II SAE AS81511 Series I, II, III and IV AS81703 Series I	Column 2 Heavy Duty AS50151 (AS34001 Series) MIL-DTL-22992, MIL-DTL-28840 MIL-DTL-26482 Series II MIL-DTL-38999 Series III and IV MIL-DTL-83723 Series I, II and III, AS81703 Series III	Column 3 Composite Material Coupling Threads (See Notes 1 and 2)
	In-Lbs, Min/Max	In-Lbs, Min/Max	In-Lbs, Min/Max
8, 9, A	30/40	51/61	20/25
3, 10, 10SL, 11, B	30/40	71/81	20/30
7, 12, 12S, 13, C	35/45	103/113	25/35
14, 14S, 15, D	35/45	111/121	25/35
16, 16S, 17, E	35/45	111/121	30/40
18, 19, 27, F	35/45	111/121	30/40
20, 21, 37, G	75/85	131/141	35/45
22, 23, H	75/85	131/141	35/45
24, 25, 61, J	75/85	131/141	35/45
28, 29	115/125	143/153	115/125
32, 33	115/125	143/153	115/125
36	115/125	142/153	112/125
40	155/165	159/169	N/A
44	155/165	159/169	N/A
48	155/165	159/169	N/A

RECOMMENDED TORQUE VALUES for MIL-DTL-38999			
Series II		Series I, III, IV	
Shell Size	In-Lbs Min/Max	Shell Size	In-Lbs Min/Max
8	46/50	9	30/36
10	55/60	11	40/46
12	70/75	13	55/60
14	80/85	15	70/75
16	90/95	17	80/85
18	100/110	19	90/95
20	110/120	21	100/110
22	120/130	23	110/120
24	140/150	25	120/130

TORQUE VALUES FOR CABLE CLAMP SCREWS <sup>5,6</sup>	
Screw Size	In-Lbs Min/Max
2-56	1.5/2.5
4-40	3.5/4.5
6-32	5.0/7.0
8-32	7.0/9.0
10-32	9.0/11.0
.250-20	11.0/13.0

CABLE CLAMP TORQUE VALUES		
Clamp Size	With Grommet <sup>4</sup>	Without Grommet
	In-Lbs Min/Max	In-Lbs Min/Max
3	8/12	30/40
4	10/15	30/40
6	10/15	35/55
8	12/20	35/55
10	12/20	35/55
12	15/30	40/60
16	20/40	40/60
20	20/40	40/60
24	25/45	80/100
28	30/50	80/100
32	30/50	80/100
40	40/60	80/100

- 1) Use Glenair 600-091/157 and 600-007 torque tools when tightening hexagonal composite accessory couplings.
- 2) Metal and composite torque values per SAE AIR 6151. All values provided in Inch-Pounds.
- 3) For additional guidance or values/conditions not listed, refer to SAE AIR6151.
- 4) Values are based on lubricated grommets and clamp threads.
- 5) For stainless-steel or plated steel screws into aluminum or stainless-steel.
- 6) Not applicable for light-duty saddles unless bottomed on clamp nut.

EMI/RFI shielding terminated with conical metal ferrule(s) should employ a minimum recommended torque of 35 in-lb.



# Band-Master ATS®

## Performance Matrix and Sizing Information

Criteria	Standard	Slim Standard	Micro	Nano
Material	304 SS	304 SS	304 SS	304 SS
Part Numbers (Flat)	601-005 (9"), 601-040 (14"), 601-049 (18")	601-570 (9"), 601-572 (14")	601-024 (5"), 601-060 (8"), 601-064 (14")	601-500 (6"), 601-504 (9"), 601-508 (14")
Part Numbers (precoiled)	601-006 (9"), 601-041 (14"), 601-050 (18")	601-571 (9"), 601-573 (14")	601-025 (5"), 601-061 (8"), 601-065 (14")	601-501 (6"), 601-505 (9"), 601-509 (14")
Lengths (inch)	18", 14" and 9"	14" and 9"	14", 8" and 5"	14", 9" and 6"
Fits Diameters (inch)	.30" to 2.5"	.30" to 1.8"	.15" to 1.8"	.08" to 1.8"
Width (inch)	.24"	.24"	.12"	.075"
Thickness (Inch)	.02"	.01"	.015"	.01"
Weight before installation (grams)	14" is 9.06g	14" is 4.46g	8" is 1.76g	9" is .84g
Tooling Information				
Hand Tool Part Number	601-100	601-109	601-101	601-108
Pneumatic Tool Part Number	601-106	601-110	601-107	601-118
Recommended Tool Setting	150 ±5 lbs.	100 ± 3 lbs.	80 ±5 lbs.	50 ±3 lbs.
Performance Data				
Termination Resistance (mΩ)	0.082	0.083	0.087	0.155
Termination Construction	Ni/Al backshell Size 25, Tin Copper Braid	Ni/Al backshell Size 25, Tin Copper Braid	Ni/Al backshell Size 15, Tin Copper Braid	Ni/Al backshell Size 16, Tin Copper Braid
Avg. Resistance Across Band (mΩ)	0.84	0.99	0.763	1.227
Avg. Single Junction Resistance (mΩ)	0.42	0.532	0.382	0.613
Cable Pull Out (pounds)	160 lbs	150 lbs	80 lbs	100 lbs
Clamping Tension (pounds)	100 to 180 lbs	50 to 100 lbs	50 to 85 lbs	20 to 50 lbs
Random Vibration	46grms at +175°C 8 hrs each axis, EIA-364-28E cond. V, letter K	46grms at +175°C 8 hrs each axis, EIA-364-28E cond. V, letter K	46grms at +175°C 8 hrs each axis, EIA-364-28E cond. V, letter K	46grms at +175°C 8 hrs each axis, EIA-364-28E cond. V, letter K
Thermal Shock	-65°C to +200°C 5 cycles	-65°C to +200°C 5 cycles	-65°C to +200°C 5 cycles	-65°C to +200°C 5 cycles
Temperature Life	1,000 hrs at +200°C	1,000 hrs at +200°C	1,000 hrs at +200°C	1,000 hrs at +200°C
Associated Test Report (Available Upon Request)	Test Report GT-14-75	Test Report GT-14-75	Test Report NTS 978-7382	Test Report NTS PR021798
Mil-Spec (85049)	Yes	No	Yes	No

## Band-Master ATS® Manual Tool Selection



### 601-100 Hand Tool for Standard Bands

The 601-100 Standard Band-Master ATS® Tool weighs 1.18 lbs., and is designed for standard .24" width clamping bands in a tension range from 100 to 180 lbs. Calibrate at 150 lbs.  $\pm$  5 lbs. for most shield terminations. Tool and band should never be lubricated.



### 601-109 Hand Tool for Slim Standard Bands

The 601-109 Slim Standard Band-Master ATS® Tool weighs 1.2 lbs., and is designed for slim standard .24" width clamping bands in a tension range from 50 to 100 lbs. Calibrate at 100 lbs.  $\pm$  5 lbs. for most shield terminations. Tool and band should never be lubricated.



### 601-101 Hand Tool for Micro Bands

The 601-101 Micro Band-Master ATS® Tool weighs 1.18 lbs., and is designed for micro .120" width clamping bands in a tension range from 50 to 85 lbs. Calibrate at 80 lbs  $\pm$  5 lbs. for most shield terminations. Tool and band should never be lubricated.



### 601-108 Hand Tool for Nano Bands

The 601-108 Nano Band-Master ATS® Tool weighs 1.18 lbs., and is designed for nano .075" width clamping bands in a tension range from 20 to 50 lbs. Calibrate at 50 lbs.  $\pm$  3 lbs. for most shield terminations. Tool and band should never be lubricated.



3 lengths and 3 widths of EMI braid termination bands plus new Slim Standard bands for size and weight savings—50% lighter and lower-profile than standard bands. Terminated "Slim" style bands have a tighter, smoother buckle with no sharp edge to injure assembly technicians. Plus, say goodbye to protective tape wrapping!

## Band-Master ATS® Band Selection

Bands	Length		Part Number		Fits Diameter	
	in.	mm.	Flat	Pre-Coiled	in.	mm.
Short Standard Band	9.0	228.6	<a href="#">601-005</a>	<a href="#">601-006</a>	1.0	25.4
Medium Standard Band	14.0	355.6	<a href="#">601-040</a>	<a href="#">601-041</a>	1.8	47.8
Long Standard Band	18.0	457.2	<a href="#">601-049</a>	<a href="#">601-050</a>	2.5	63.5
Short Micro Band	5.0	127.0	<a href="#">601-024</a>	<a href="#">601-025</a>	0.5	12.7
Medium Micro Band	8.0	203.2	<a href="#">601-060</a>	<a href="#">601-061</a>	.88	22.4
Long Micro Band	14.0	355.6	<a href="#">601-064</a>	<a href="#">601-065</a>	1.8	47.8
Short Nano Band	6.0	152.4	<a href="#">601-500</a>	<a href="#">601-501</a>	.60	15.2
Medium Nano Band	9.0	228.6	<a href="#">601-504</a>	<a href="#">601-505</a>	.94	23.9
Long Nano Band	14.0	355.6	<a href="#">601-508</a>	<a href="#">601-509</a>	1.8	47.8
Short Slim Standard Band	9.0	228.6	<a href="#">601-570</a>	<a href="#">601-571</a>	1.0	25.4
Medium Slim Standard Band	14.25	362.0	<a href="#">601-572</a>	<a href="#">601-573</a>	1.8	47.8

# Glossary of Connector Terms and Definitions

**Back-Mounted:** A connector design used in panel or box applications in which the mounting flange is located inside the equipment enclosure.

**Bayonet Coupling:** A mating design utilizing pins on the receptacle and slots on the plug for quick-connect and disconnect coupling. "Reverse" bayonet puts the pins on the plug and slots on the receptacle.

**Circular Connector:** Any of a thousand flavors of multipin interconnects with cylindrical contact housings and circular contact interface geometries. Circular connectors are selected for ease of engagement and disengagement, their ability to conveniently house different types of contacts, their wide range of allowable contact voltages and currents, their ease of environmental sealing and their rugged mechanical performance. In military and other high-rel applications, the MIL-DTL-5015 and MIL-DTL-38999 are commonly specified examples. Note: A disadvantage of the circular design is loss of panel space when used in arrays.

**Closed Entry:** A contact cavity design in which the entry diameter of the socket insulator is smaller than the outside dimension of the socket contact. Closed entry limits the size or position of the mating contact to a maximum dimension.

**Connector Body:** The metal or plastic housing of a connector plug. Its main purpose is to house the contacts, maintain their position and shield them from dust, dirt, moisture, and electrical interference.

**Coaxial Contacts (and Cable):** A contact with inner and outer conductive elements separated by a center dielectric element. Coaxial contacts terminate coaxial cable, and are employed in high bandwidth, high-frequency RF applications such as video and audio. The cable offers a closed, controlled impedance medium for the transmission of RF energy. It also provides high-frequency performance and RFI shielding.

**Contact:** The conductive element in a connector. Contacts mate mechanically and electrically to transmit signals and/or power across a connector interface. Crimp style contacts are the most common type found in high-reliability cylindrical connectors. Male contacts are sometimes referred to as leads, posts or pins. Female contacts are universally known as sockets.

**Contact Arrangement or Pattern:** The gauge, number, spacing and arrangement of contacts in a connector. Contact arrangement selections are based on the current and voltage requirements of the application, and the space available for the connector package.

**Contact Engaging and Separating Force:** Tensile force required to engage or separate mating contacts. Measured in ounces, the force increases with contact size.

**Contact (or Circuit) Identifier:** Wiring schematics identify and label each and every circuit with numbers, letters or special codes. On the connector, this process is maintained by marking small numbers or letters next to each contact cavity.

**Contact Resistance:** The measure of electrical resistance across a pair of fully mated contacts. Measured in ohms or millivolt drop at a specified current, contact resistance is affected by normal force (the static force on the contact interface), plating quality and the physical geometry of the contact.

**Contact Retainer:** A locking clip or tang used to secure a crimp contact in place within the connector insert. Contact retention specifications define the force required to remove a properly seated contact for each class of connector.


**Contact Retention:** The pressure a contact can withstand, in either direction, without being dislodged from the retaining clip which holds it within the connector insert.

**Contact Size:** An assigned number denoting the outside diameter of the engaging end of the pin contact. The larger the number, the smaller the size.


**Contact Spacing:** Also referred to as pitch, the distance, center-to-center, between adjacent contacts.

**Coupling Ring:** An accessory feature of the connector plug which aids in mating and unmating plugs and receptacles and prevents decoupling of the connector. Self-locking coupling rings are used for high-vibration applications.

**Crimp:** The physical compression (deformation) of a contact barrel around a wire conductor in order to make an electrical connection.



**Crimp Contact:** A contact pin or socket, shipped loose with the connector body, and designed to be crimped onto the end of the wire conductor with a special tool. Often referred to as “crimp and poke” contacts, the terminated contact is poked into the connector body either by hand, or in the case of small gauge wires, with the aid of a hand-held tool. The ease of assembly and maintenance afforded by crimp contacts is preferred for aerospace and other high-reliability applications not requiring a hermetic seal.



**Dielectric:** A material having electrical insulating properties, such as the contact insulator in a connector or the jacketing on a wire.

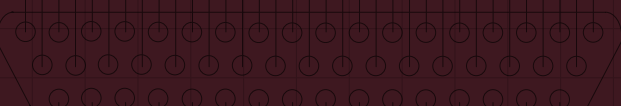
**Electrical Connector:** A separable device which provides mechanical and electrical contact between two elements of an interconnect system without unacceptable signal distortion or power loss.

**Electromagnetic interference** (EMI) is conducted, radiated or magnetically induced voltage that degrades, obstructs, or repeatedly interrupts performance of electronic equipment.

**Environmentally Sealed:** Connectors and backshells designed to prevent fluids, moisture, air or dust from degrading the performance of electrical contacts and conductors. “Environmental” components typically use gaskets, grommets, potting materials or interfacial and O-ring seals to prevent the penetration of foreign substances into the inner-workings of the part.


**Filter Contact or Filter Connector:** Contact design which provides EMI suppression in addition to its normal function of transmitting electrical energy. Filtered connectors are typically specified for high-speed signal paths. Filtering is accomplished through the integration of capacitors into the contact to separate high-frequency noise from low-frequency signals.

**Firewall Connector:** A class of high-reliability, feedthrough connectors designed to prevent fire or sparks from penetrating through a sealed bulkhead. Firewall connectors must continue to function for a specific period of time when exposed to fire, and are typically specified in military applications such as fighter jets and Navy ships.



**Flange:** The integral mounting plate on some bulkhead and feed-through receptacles used to attach the connector to the chassis or panel. The connector flange is typically square, and is mounted to the panel with threaded screws.

**Front Mounted:** A receptacle connector design used in panel or box applications in which the connector mounting flange is located on the outside of the equipment enclosure.



**Front Release:** “Crimp and poke” style contacts may be removed from the connector for maintenance using a special hand-held tool. The proper insertion and removal tool must be used at all times. In front release designs, the tool is inserted into the mating face of the connector to disengage the contact from its retaining clip. The disengaged contact is then removed from the back (cable-side) of the connector by lightly pulling on the attached wire.

**Grommet:** An elastomeric seal used on the back side of a connector to seal out fluids, moisture, air and dust.

**Grounding (or EMI) Fingers:** A set of spring fingers in certain connectors, used to facilitate shell to shell grounding and enhance EMI performance. The grounding fingers engage before contact mating and remain engaged until after contact separation.

**Guide Pins:** Metal posts with a rounded or pointed tip which projects beyond the contact interface, used to assist in the correct alignment and mating of connector shells and contacts. The post mates with a corresponding cavity on the mating connector before contacts are allowed to engage. Guide pins are typically used in rack and panel packaging and in other “blind-mate” applications. Guide pins can also be used to ensure correct polarization.

**Hermetic Connector:** A class of connectors equipped with a pressure seal for use in maintaining pressurized application environments. The hermetic element of the connector is typically fabricated from vitreous glass.

**Insert:** A molded piece of dielectric material that fits inside the connector shell to house the connector contacts. Inserts are tooled for each shell size, and contact arrangement. Inserts made from resilient materials also contribute to environmental properties.



# Glossary of Connector Terms and Definitions

**Insulation Displacement:** Forcing an insulated wire into a terminal slot smaller than the conductor diameter, displacing the insulation to make electrical contact.

**Interfacial Seal:** An elastomeric seal providing overall sealing of the mated connectors and their individual contacts. "Cork & bottle" style seals feature a raised shoulder around each pin contact that compresses into a corresponding hole on the socket contact insulator.

**Key:** A raised shoulder (referred to as a "dog" by crusty old machinists) which slides into a corresponding slot or keyway to guide the plug and receptacle together during mating. The principal function of the key is to insure polarization of the mating contacts.

**Levels of Interconnection:** A classification system defining connector types in terms of interconnect system function. Environmental levels include Level 4 (sub-assembly to sub-assembly), Level 5 (sub-assembly to I/O) and Level 6 (system to system). The lower levels (1, 2 and 3) cover printed circuit board interconnections inside equipment housings.

**Mating and Unmating Force:** The force required to join and separate two halves of a connector. This is the sum of contact engaging forces plus any additional force necessary to overcome minor misalignment of connector halves and any dimensional variations in the connector shells.

**Normal Force:** A measure of the spring pressure applied perpendicularly to contacts in mated connectors. The force of this spring pressure creates the gas-tight interface between contact surfaces which prevents corrosive contaminants from penetrating or forming between the contacts. High normal force reduces resistance across the contacts, but contributes to contact wear and may overstress the connector housing and even damage the spring properties of contact sockets. However, maintaining a constant normal force is an essential requirement for electrical integrity in the connector.

**Package Size:** The length, width and height of the connector; or alternatively the dimensions of the entire interconnect system. Package size is an issue in many applications where system miniaturization, faster operating speeds, higher operating temperatures and

other application requirements place demands on the envelope of space the connector and its accessories may occupy.

**Plug:** The half of a connector pair which is designed to attach to a wire or cable; as opposed to the receptacle half which is typically mounted to a bulkhead, panel or box. Even though we usually picture plugs as having male (pin) contacts, they can in fact house any type of contact—pins, sockets or even both. Thus it is the design and location of the connector which makes it a plug, not the gender of its contacts.

**Polarize:** Design features on mating connectors—such as keyways or keystone shell geometries—that insure connectors can be mated in only one possible orientation. The shape of a D-Sub connector shell, for example, assures that the two halves of the connector can be mated in only one way.

**Potting:** The permanent sealing of the cable end of a connector with a compound or material to exclude moisture or to provide a strain relief. Glenair typically uses epoxy compounds for this purpose because of their dimensional stability and high-temperature resistance.

**Radio frequency interference (RFI)** is a type of EMI that occurs between the audio and infrared frequencies in the electromagnetic spectrum. Many natural RF signals exist in nature, but typically RFI is a man-made electromagnetic wave such as might originate in unfiltered electronic circuitry.

**Rear Mounted:** A square-flanged receptacle connector in which the mounting flange is located on the inside of the equipment enclosure.

**Rear Release:** "Crimp and poke" style contacts (see Crimp Contacts above) may be removed from the connector for maintenance using a special hand-held tool. The proper insertion and removal tool must be used to install and remove wires from such crimp and poke connectors. In rear release designs, the tool is inserted into the rear (cable side) of the connector to disengage the contact from its retaining clip. The disengaged contact is then removed from the connector by lightly pulling on the attached wire.

Technical drawing details visible in the background include:  
- Dimensions: .094±.00, (2.39±0.0), .784, (19.92), .150 (3.81) MIN DEE  
- Feature callouts: 40 UNC 2B TH'D, 10°



**Receptacle:** The other half of the connector pair, designed to be mounted—with jam nut fittings or other fastener hardware—to a bulkhead, panel or box. Inline receptacles are also available for cable-to-cable connections. As with the plug, it is the design and location of the receptacle in the system, not the gender of its contacts, which makes it a receptacle.

**Rectangular Connector:** Any of the many of multipin interconnects with rectangular shell housings and rectangular insert interface geometries. Some rectangular connectors are mounted in rack and panel configurations in which large arrays of fixed receptacle connectors are mated with plugs attached to a movable rack for efficient utilization of space. D-Subminiatures are the world's most common rectangular connectors.

**Scoop-proof:** Scoop-proof connectors feature a nice, long shell on the receptacle which prevents damage to the exposed contact pins during mating. No matter how hard that swabbie tries, it is impossible to cock the mating plug so as to damage the pins or electrically short the contacts.

**Service Rating:** Also called Current Rating, the maximum voltage or current load a connector is designed to carry during continuous, long-term use. Good engineering practice usually entails preliminary testing of connectors which will be operated with most or all contacts at the maximum rated load. Designers will often maximize contact and wire size in such situations.

**Solder Cup:** A connector design that typically uses potting material to permanently affix the contacts inside the connector shell. Termination of contact to wire is then accomplished by soldering the wire into the cup-like barrel on the back of the contact. In the United Kingdom it is important to pronounce the "l" in solder. Brits also prefer to say "bucket" rather than "cup" when specifying solder contacts.

**Standoff** Part of a connector shell, a standoff provides additional working room between the connector shell, and, for example, a printed circuit board

**Surface Mount:** A termination method in which solder "tails" or leads on the connector are soldered directly to a printed circuit board. In high-reliability commercial and military applications, surface mount receptacle connectors are typically limited to rectangular designs

such as D-Subminiatures and Micro-D's. But some surface-mount applications do use a cylindrical connector mounted to the box with ribbon cable or flying leads soldered directly to the PCB. The reason here is to provide a low-resistance pathway to ground of the shielded cable. In severe EMI applications, it is less satisfactory to bring the shielded cable directly to the printed circuit board because of the difficulty in shielding out interference conducted along the cable.

**Termination:** Termination is the physical act of attaching a wire conductor to a contact. Effective termination contributes to electrical performance and to the durability and reliability of the interconnect system. Common termination methods include crimp, insulation displacement, surface mount, and soldering. Termination can also refer to the mechanical attachment of EMI shielding to the connector backshell.

**Threaded Coupling:** An interconnect mating design which utilizes a threaded nut on the plug, and a corresponding set of threads on the receptacle, to mate the pair of components. The coupling nut is usually equipped with flats or knurling for easy assembly. Different thread types, profiles and geometries provide different functionality. "Buttress" threads, for example, are often specified on plastic connectors due to their enhanced tensile strength. The MIL-DTL-38999 Series III connector incorporates a triple-start threaded coupling mechanism for greater vibration protection and faster mating and unmating.

**Wiping Effectiveness:** Maintaining a clean, metallic path is essential if contacts are to perform with low and stable contact resistance. Surface films and contaminants are removed from the surface of plated contacts each time mating occurs. This displacement of surface contaminants during mating is called contact wiping. Wiping effectiveness depends on the contact geometry, engagement length and normal force. Interestingly, oxide film does not form on gold plated contacts, so wiping pressure can be lighter to displace the occasional surface contaminant.

**Wire Pull-Out Force:** This defines the force required to separate a wire from a contact. In properly terminated crimp contacts, the wire will generally break before it pulls away from the contact.

# Outlook

## Take Action

Most of you know that I cut my teeth in the interconnect industry as a field sales rep, a role I look back on fondly for the solid foundation it provided me for my longer-term work at Glenair. There is of course no better way to understand your customers than substantive, daily interaction. And let me tell you, the field sales rep is the tip of the spear when it comes to Glenair's outreach and interaction with the folks who buy and use our products.

Working directly with customers is all about getting stuff done; and job one is doing your utmost to understand exactly what the customer needs, and getting to work on it right away. We have a guiding principle that speaks directly to this idea, which is, simply, *Take Action*—a kind of a wrap-up to the other principles on the Glenair list as well as an exhortation to get out there and solve problems and drive solutions. I have a colleague who likes to say that, "a good idea by itself is worthless. But a good idea put into action can be worth a fortune." Another way to say this is "knowledge of an effective approach only has value when that knowledge is put to good use."

And that's exactly why we illustrate this guiding principle with Rosie the Riveter. What a perfect image to remind us all how big an impact we can each have by stepping up to the big jobs and hammering away at them until they are done.

I'd like to repeat something to the team here at Glenair that I believe I have stated before in this column. And that is that the doors to upper management are always open at Glenair if you are ever in doubt as to what action to take in any particular situation. Unlike many organizations, there is no "Chief of Staff" guarding access to our most senior people (and potentially keeping that "worthless" good idea from becoming a "fortune"). We are sincere about this. Our goal is a nice flat organization in which we all work together as a team, and truly feel empowered to take action to solve problems on behalf of our customers.

By the way, isn't this issue of *QwikConnect* a keeper? What a fabulous compendium of useful reference information for all of us that call the interconnect industry our home. Thanks to everyone who contributed.

*Chris Toomey*



# QwikConnect

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