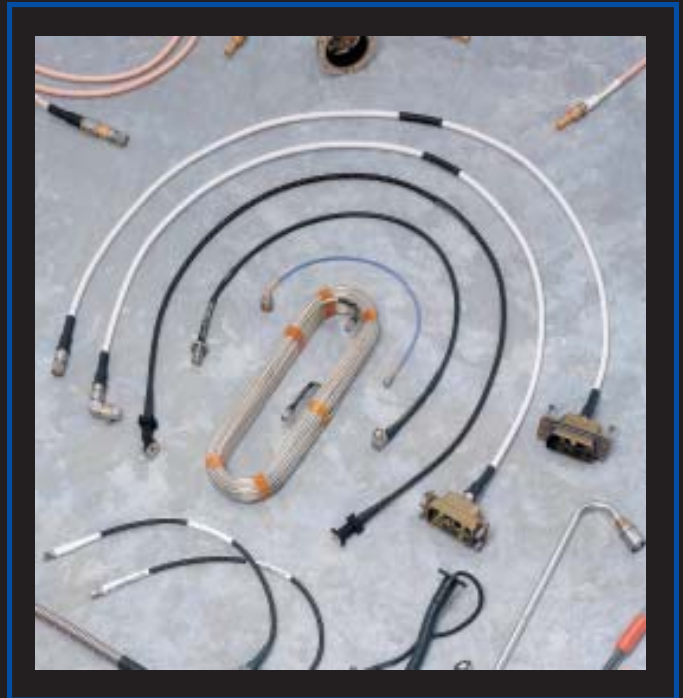
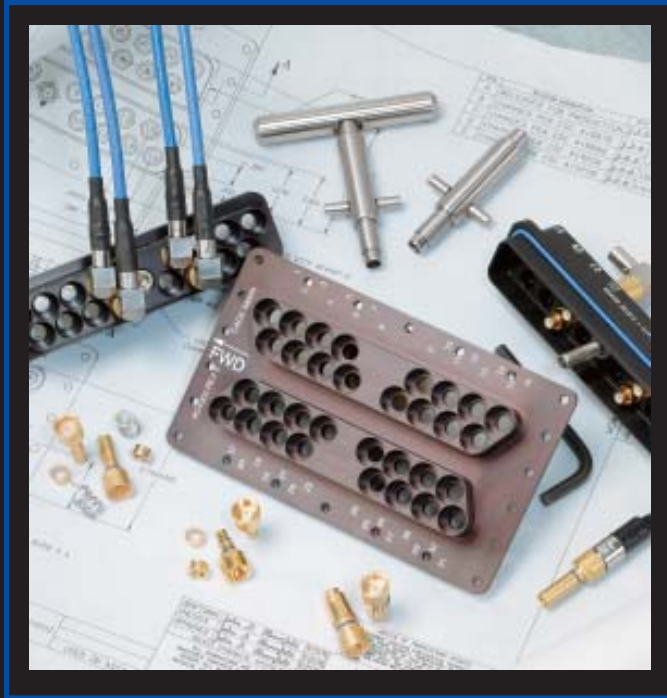


# COAXIAL CABLE ASSEMBLIES PRODUCTS & CAPABILITIES



# TIMES MICROWAVE SYSTEMS



TIMES MICROWAVE SYSTEMS, Inc., a Smiths Group Company, has been designing and manufacturing coaxial cables and cable subsystems for more than fifty years. From its inception, TIMES (TMS) continues to be in the forefront of this industry, pioneering a wide range of coaxial cable and connector developments. TMS cable assemblies are used to interconnect microwave transmitters, receivers, and antennas on commercial and military airframes, missiles, ships, satellites, and ground based communications systems. TMS cable assemblies are also used as test leads for test and instrumentation applications.

TIMES MICROWAVE SYSTEMS is a technically oriented coaxial cable manufacturer that has been able to continually meet and exceed the challenges for specialty engineered transmission lines for both the commercial and military sectors, drawing upon:

- Thousands of cable and connector designs
- Material and process controls
- ISO 9001 Certification
- RF and microwave design capability
- Unique in-house testing capabilities including RF shielding/leakage, vibration, moisture/vapor sealing, phase noise, flammability, etc.
- MIL-T-81490, MIL-C-87104, and MIL-PRF-39012 experience
- FAA, FAR25, DO-160



Customized solutions to meet the system interconnect needs of our customers that you can count on day in and day out is our business.

We invite you to put TIMES MICROWAVE SYSTEMS to the test:

***The test of experience,  
innovation, and support!***



## TMS QUALIFICATIONS & CAPABILITIES

### QUALIFICATIONS

TIMES MICROWAVE SYSTEMS products are qualified for service on the following airframes and platform applications:

|                |               |
|----------------|---------------|
| A-10           | B-717         |
| AGM-129A (ACM) | BAe 125       |
| AH-IS COBRA    | BAe 146       |
| AH-64 APACHE   | BOEING 727    |
| AIRBUS A300    | BOEING 737    |
| AIRBUS A319    | BOEING 747    |
| AIRBUS A320    | BOEING 757    |
| AIRBUS A321    | BOEING 767    |
| BAe 146        | BGM-109       |
| AWACS          | (TLAM & TASM) |
| B-52           | C-17          |

|            |                 |
|------------|-----------------|
| C-130      | F-16            |
| C-160      | F-18            |
| CANADAIR   | F-22            |
| CL-600     | F-111           |
| CG-47      | F-117           |
| CESSNA 208 | GRIPEN          |
| CN 235     | HARRIER         |
| CP-140     | JSF             |
| DD-963     | L-159           |
| DDG-51     | LAMPS           |
| DDG-91     | LOCKHEED L-1011 |
| E-2C       | LYNX            |
| EA-6H      | McDONNELL DC-8  |
| EF-111     | McDONNELL DC-9  |
| EH-101     | McDONNELL DC-10 |
| EH-IX      | McDONNELL MD-10 |
| F-14       | McDONNELL MD-11 |
| F-15       | McDONNELL MD-80 |

|                 |               |
|-----------------|---------------|
| McDONNELL MD-81 | P-3C          |
| McDONNELL MD-82 | PILATUS PC-12 |
| McDONNELL MD-83 | PPG-7         |
| McDONNELL MD-87 | S-3           |
| McDONNELL MD-88 | SOCATA        |
| MH-47           | TBM-700       |
| MH-60           | SEA KING      |
| MIRAGE 2000-5   | SH-60         |
| NIMROD MR4A     | BLACK HAWK    |
| OH-X            | TA-4          |
| OV-10           | TORNADO       |
| OV-1D           | V-22          |



# MARKETS SERVED



## CAPABILITIES

*TIMES MICROWAVE SYSTEMS* is a vertically integrated organization, allowing us to maintain complete control over all aspects of our business.



### ENGINEERING:

- Complete in-house design, development, prototyping and trouble-shooting capabilities
- Four CAD stations
- Twelve network analyzers
- Degreed engineers comprise over 25% of Times Microwave Systems' workforce



### TESTING:

- Complete parametric testing of all assemblies performed on state-of-the-art Network Analyzer equipment
- Assemblies sealed per MIL-T-81490 and MIL-C-87104 are verified by advanced Helium mass spectrometer equipment



### QUALITY:

- Manufacturing managed by the most advanced SPC techniques
- Quality system per MIL-I-45208
- Soldering per MIL-STD-2000

# TIMES QUALIFIED MILTECH CABLE ASSEMBLIES



Starting on page 5

## MILTECH Qualified Cable Assemblies

- Manufactured to the requirements of MIL-C87104 and MIL-T-81490, FAA FAR25 and DO-160
- Fully vapor sealed for system longevity
- Highly ruggedized for severe environments
- Used on the most advanced commercial and military platforms



Starting on page 18

## Special Products

- Phase matched/Amplitude matched cable assemblies
- Phase adjustable trimmers
- Equalized cable assemblies
- Millimeter wave cable products
- 18 GHz test leads
- Test adapters
- Tools



Starting on page 22

## MILTECH Qualified Cable Assemblies

- Standard interface for the F-22
- 1.2:1 VSWR per mated pair through 20 GHz
- Available for flexible and semi-rigid cables from 0.086"/2.18 mm through 0.340"/8.64 mm OD
- Many sizes available
- Redundant gasket seals
- Qualified for high vibration environments
- Simple field replacement of individual cables

# TIMES QUALIFIED MILTECH CABLE ASSEMBLIES

The Times Qualified *MILTECH* family of hermetically sealed flexible RF and microwave transmission line assemblies are optimized and qualified for commercial, military and other demanding applications. The proprietary application of a spiral flat strip braid results in a cable assembly with superior phase coaxial cables without sacrificing flexibility! There are now three versions of the popular *MILTECH* 340 cable, all providing the same electrical performance, but allowing a choice of cable weights – ideal for applications where both low loss and reduced weight are required. These *MILTECH* cable assemblies exhibit extremely long life in the rigorous environments found in airborne, shipboard and ground based applications.

TMS distinguishes itself by designing and manufacturing the cable, the connectors, and the cable/connector junction. This engineered integration of cable and connectors makes TMS cable assemblies unique. The integration optimizes the electrical and mechanical performance and includes a  $1 \times 10^{-5}$  cc/sec/ft vapor seal that ensures longevity. This control of the cable/connector interface guarantees the right mix of electrical and mechanical characteristics, strength and durability, resulting in a broadband transmission line perfectly suited for severe environments.

## Cable Characteristics



### Cable materials – typical

- A Center conductor – Solid silver-plated copper\*
- A Dielectric – Taped polytetrafluoroethylene
- C First shield – Silver-plated copper strip
- D Interlayer – Aluminum backed tape
- E Second shield – Silver plated copper braid
- F Vapor shield – composite tapes/extruded FEP
- G Outer jacket – Nomex ®

\*Solid silver-plated copper covered steel on *MILTECH* 210  
Stranded silver-plated copper on *MILTECH* 480

Times qualified *MILTECH* flexible RF and microwave transmission line assemblies described here meet the following performance criteria:

| Cable Type         | Recommended Cable Clamp |
|--------------------|-------------------------|
| <i>MILTECH</i> 210 | MS2919-4                |
| <i>MILTECH</i> 230 | MS2919-4                |
| <i>MILTECH</i> 265 | MS2919-5                |
| <i>MILTECH</i> 340 | MS2919-7                |
| <i>MILTECH</i> 480 | MS1919-8                |

## Times Qualified *MILTECH* Cable

| Times Qualified Assembly Type | Cable Diameter (In./mm.) | Loss@ 18 GHz (dB/ft.) | TMS Specification    | Minimum Bend Radius ((In./mm.)) | Mass                |
|-------------------------------|--------------------------|-----------------------|----------------------|---------------------------------|---------------------|
| <i>MILTECH</i> ™ 210          | 0.21/5.3                 | 0.48                  | <i>MILTECH</i> 210   | 1.00/25.4                       | 0.035lb/ft (52g/m)  |
| <i>MILTECH</i> ™ 230          | 0.23/5.8                 | 0.38                  | <i>MILTECH</i> 230   | 1.15/29.2                       | 0.045lb/ft (68g/m)  |
| <i>MILTECH</i> ™ 265          | 0.265/6.7                | 0.32                  | <i>MILTECH</i> 265   | 1.30/33.0                       | 0.065lb/ft (97g/m)  |
| <i>MILTECH</i> ™ 340          | 0.34/8.6                 | 0.22                  | <i>MILTECH</i> 340   | 1.90/48.3                       | 0.105lb/ft (157g/m) |
| <i>MILTECH</i> ™ 340XL        | 0.34/8.6                 | 0.22                  | <i>MILTECH</i> 340XL | 1.90/48.3                       | 0.080lb/ft (120g/m) |
| <i>MILTECH</i> ™ 340EL        | 0.34/8.6                 | 0.22                  | <i>MILTECH</i> 340EL | 1.90/48.3                       | 0.070lb/ft (105g/m) |
| <i>MILTECH</i> ™ 480          | 0.46/12.2                | 0.13 (@ 10 GHz)       | <i>MILTECH</i> 480   | 2.25/57.2                       | 0.200lb/ft (303g/m) |

# DETAILED PERFORMANCE SPECIFICATIONS

Times qualified **MILTECH** flexible RF and microwave transmission line assemblies described here meet the following performance criteria:

## Electrical Characteristics

|                                 |   |
|---------------------------------|---|
| Tested frequency range .....    | 0.5 to 18 GHz (10 GHz for <i>MILTECH 480</i> )  |
| Characteristic impedance .....  | 50 Ohms   |
| VSWR .....                      | 1.4:1 maximum; add 0.05 per angle connector   |
| Insertion loss .....            | see following pages   |
| Velocity of propagation .....   | 76% Nom. For <i>MILTECH 210, 230, 265</i><br>80% Nom. For <i>MILTECH 340/340XL</i><br>78% Nom. For <i>MILTECH 480</i> |
| Maximum operating voltage ..... | 2500 Volts (1000 Volts with SMA)<br>1000 Volts for <i>MILTECH 210 and 230</i>   |
| RF leakage .....                | -90 dB maximum per foot over tested<br>Frequency range including connectors   |
| Insertion loss stability .....  | In accordance with MIL-T-81490  |
| VSWR stability .....            | In accordance with MIL-T-81490  |

## Mechanical Characteristics

|  |   |
|--|---|
| Temperature range .....                | -55°C to +200°C   |
| Chemical resistance .....              | In accordance with MIL-T-81490 and MIL-C-87104  |
| Flexure .....                          | In accordance with MIL-T-81490 and MIL-C-87104  |
| Salt fog .....                         | In accordance with MIL-T-81490 and MIL-C-87104  |
| Humidity .....                         | In accordance with MIL-T-81490 and MIL-C-87104  |
| Abrasion resistance .....              | In accordance with MIL-T-81490 and MIL-C-87104  |
| Cable/connector tensile strength ..... | 45 lbs. minimum ( <i>MILTECH 210, 230, 265</i> )<br>75 lbs. minimum ( <i>MILTECH 340/340XL, 480</i> ) |
| Vapor leakage .....                    | 1 x 10 <sup>-5</sup> cc/sec/ft of Helium maximum including connectors                                 |
| Vibration .....                        | In accordance with MIL-T-81490  |
| Shock .....                            | In accordance with MIL-T-81490  |

## Assembly Performance Overview

**Electrical characteristics** – All of the cable assembly styles noted above provide low loss, low VSWR and inherently stable performance. These sealed transmission line products provide the longest service life available.

**Mechanical characteristics** – The cable assemblies are designed, manufactured and tested to provide reliable interconnections in the most demanding installations and environments. This unparalleled combination of bending, torque and tensile strengths guarantee a long service life.

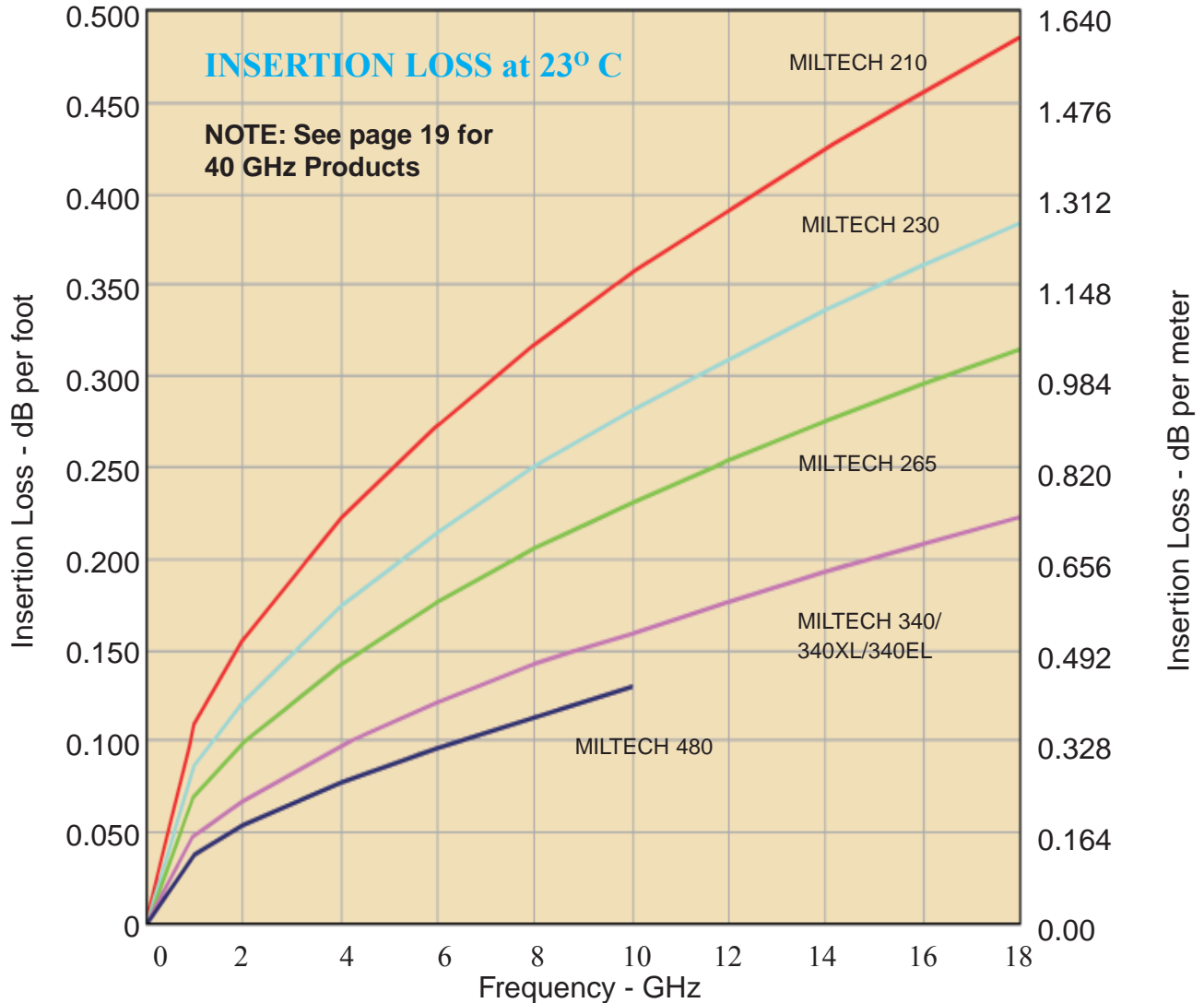
**Insertion loss** - Following is a graph of loss vs. frequency for *MILTECH* cables and equations to be used for calculating the loss at specific frequencies.

**Testing** - Each cable assembly is measured for insertion loss and VSWR over the test frequency range.

**Connectors** - All of the connectors used in these cable assemblies are of precision stainless steel design which meet or exceed the requirements of MIL-PRF-39012. They are uniquely designed to provide maximum electrical, mechanical and environmental performance.

# INSERTION LOSS

The following graph illustrates the cable insertion loss for each *MILTECH* cable at specific frequencies. The insertion loss at intermediate frequencies can be calculated from the formula below for each cable type. The loss for each pair of connectors must be added to the overall cable loss to determine the insertion loss for the complete cable assembly.



Insertion loss at intermediate frequencies can be calculated as follows:

$$IL = K_1 \times \text{SqRt}(\text{FMHz}) + 0.000146 \times (\text{FMHz}) \text{ dB per 100 feet}$$

or

$$IL = K_2 \times \text{SqRt}(\text{FMHz}) + 0.000480 \times (\text{FMHz}) \text{ dB per 100 meters}$$

(where FMHz is the frequency in MHz)

| Cable Type               | $K_1$ , dB/100 feet. | $K_2$ , dB/100 meters. |
|--------------------------|----------------------|------------------------|
| <b>MILTECH 210</b>       | <b>0.34158</b>       | <b>1.1207</b>          |
| <b>MILTECH 230</b>       | <b>0.26643</b>       | <b>0.87390</b>         |
| <b>MILTECH 265</b>       | <b>0.21603</b>       | <b>0.70876</b>         |
| <b>MILTECH 340/340XL</b> | <b>0.14582</b>       | <b>0.47775</b>         |
| <b>MILTECH 480</b>       | <b>0.11462</b>       | <b>0.37605</b>         |

| Frequency MHz | Straight connectors* Connector loss/pr. |
|---------------|---|
| 500           | 0.075                                   |
| 1000          | 0.10                                    |
| 2000          | 0.15                                    |
| 4000          | 0.20                                    |
| 6000          | 0.22                                    |
| 8000          | 0.25                                    |
| 10000         | 0.27                                    |
| 12000         | 0.28                                    |
| 14000         | 0.30                                    |
| 16000         | 0.31                                    |
| 18000         | 0.33                                    |

Insertion Loss @23°C

\*For angled connectors, add 0.1dB/conn.

# POWER HANDLING

The power handling values shown here apply to complete *MILTECH* assemblies with TNC connectors, based on a maximum assembly component temperature of 200°C. Figures 1 and 2 below illustrate the average power handling capability of the cable at 25°C/sea level and at 100°C/70,000 ft. *MILTECH* assemblies may be used at higher power levels if required, however, high ambient temperature and high altitude reduce the power rating of a particular cable by impeding the heat transfer out of the cable. The CW power rating must be derated by a correction factor for the ambient temperature and altitude. For estimated power ratings in conditions other than those shown, the derating factors shown in Tables 1 and 2 must be applied to the 25°C/sea level data to determine the power handling capability. Please consult the factory or your TMS representative for special conditions or requirements.

Fig. 1: *MILTECH* Maximum Power Handling Characteristics  
25°C/Sea Level

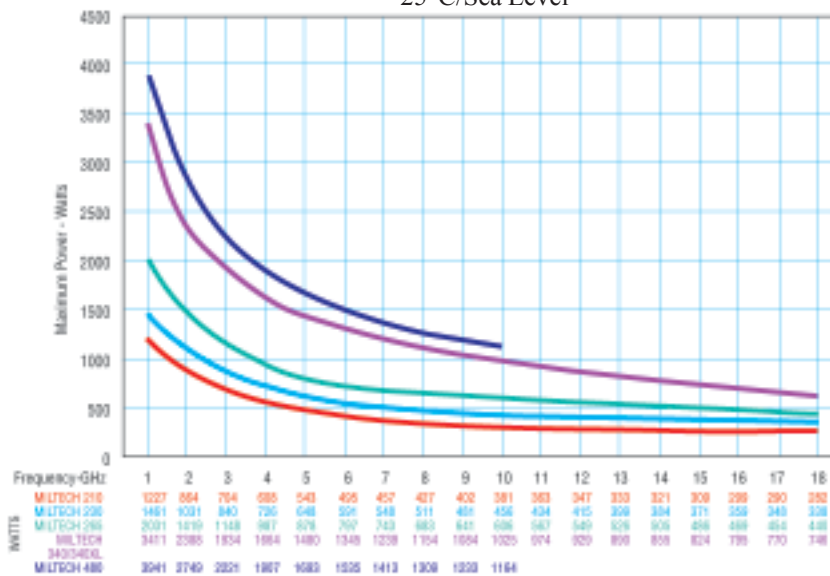


Fig. 2: *MILTECH* Maximum Power Handling Characteristics  
100°C/70,000 ft. (21.34 km)

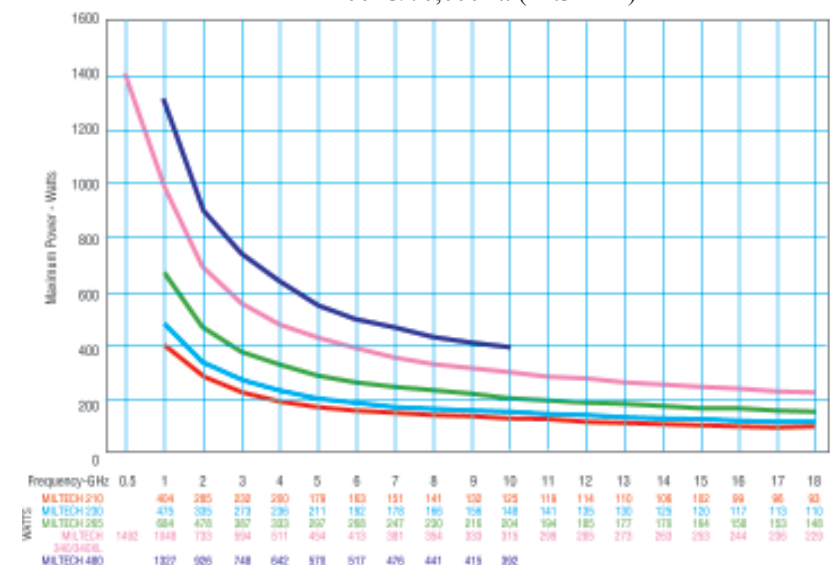


Table 1  
Altitude Correction Factor

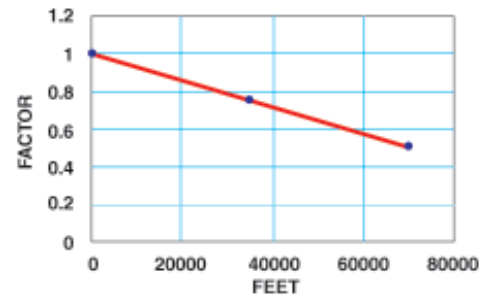
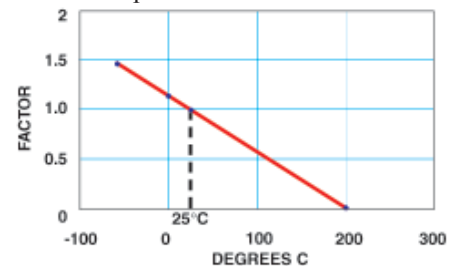


Table 2  
Temperature Correction Factor



Apply straight line derating factors, as follows:  
**TEMPERATURE:** Choose the applicable power level from the 25°C/sea level chart and multiply by the correction factor corresponding to the desired ambient temperature.  
**ALTITUDE:** After obtaining the temperature adjusted power handling, multiply by the correction factor corresponding to the desired ambient altitude.

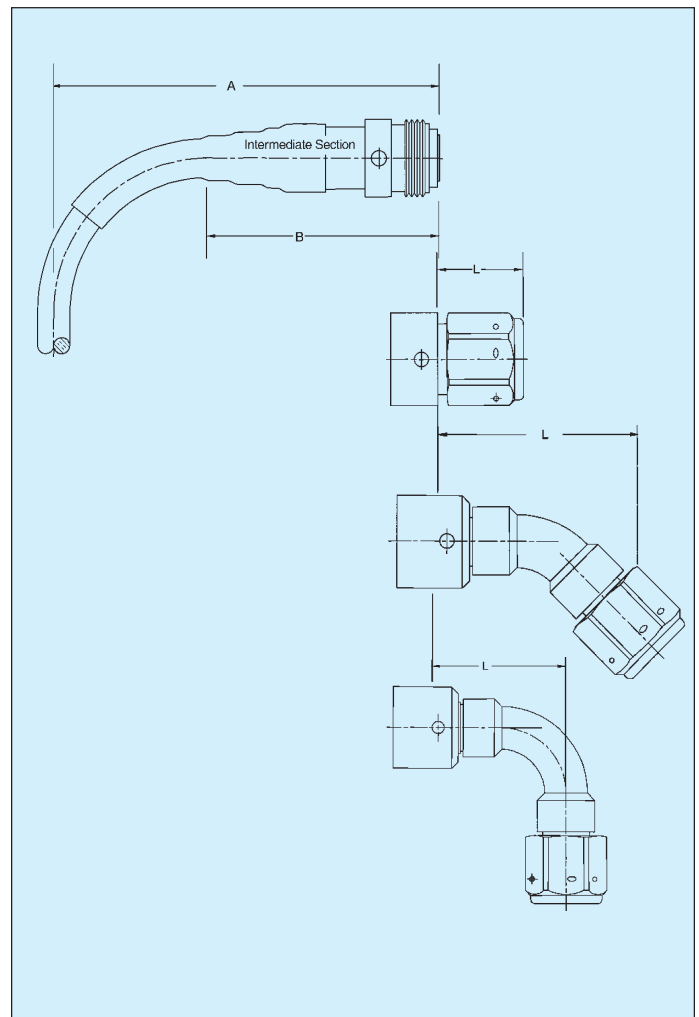


# MILTECH CABLE ASSEMBLY CONFIGURATIONS

*MILTECH* cable assemblies consist of a *MILTECH* cable terminated with specially designed and fabricated connectors. *TIMES MICROWAVE SYSTEMS* manufactures a complete line of connectors to complement the *MILTECH* coaxial cables. The completed assemblies are available with either non-replaceable or replaceable connectors. The replaceable feature allows a damaged front end interface to be quickly replaced in the field without the need to remove the complete transmission line. All connector interfaces are designed to comply with various requirements of *MIL-STD-348*, *MIL-PRF-39012*, *MIL-C-87104*, OR *MIL-T-81490* and feature passivated stainless steel bodies and coupling nuts, PTFE dielectrics and gold-plated beryllium copper center contacts. An intermediate section, ruggedly attached to the cable itself, provides a point of attachment for the replaceable connector front end without sacrificing the vapor seal of the cable assembly. To determine the insertion loss for the complete assembly, add the cable loss to the connector loss shown on page 7.

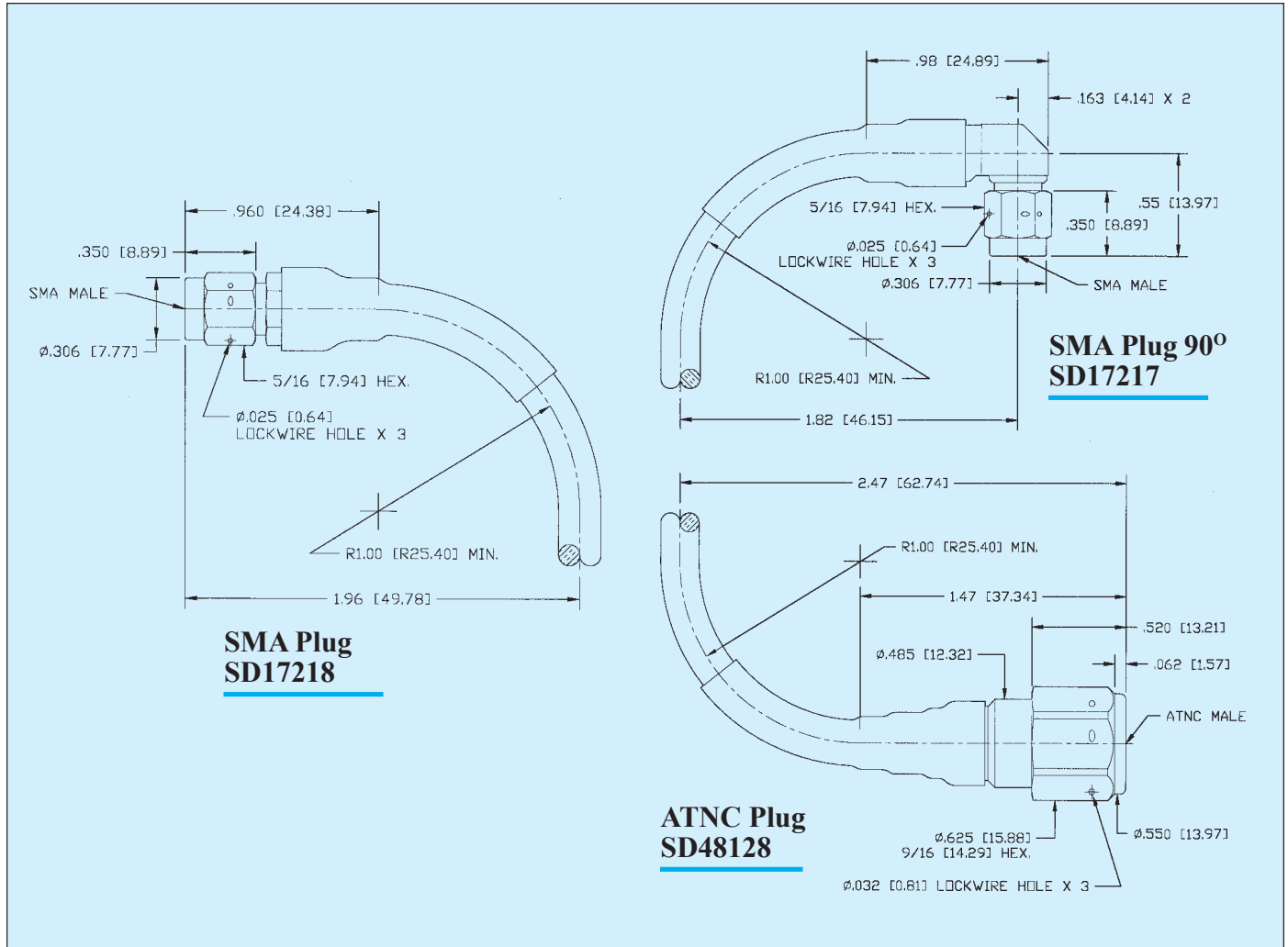
## MILTECH Cable Assembly Connector Envelopes

The installation envelopes for common *MILTECH* connectors installed on cables can be determined from the data on the following pages organized by the specific *MILTECH* cable size. The figure shown represents a typical transmission line assembly with the intermediate section attached. Dimension A is the distance from the front end dimension datum to the centerline of the cable when bent 90 degrees at the minimum bend radius of the cable. Dimension B is the solid length of the intermediate section where a cable can begin to be bent. Care must be exercised to be sure that the minimum bend radius of the cable is not reduced. For applications where space is limited, an angled connector (30, 45, or 90 degrees) should be considered to minimize stresses placed on the cable-to-connector junction. To determine the overall installation envelope, simply add dimension A to the overall connector length L. Dimensions for all replaceable front end connectors can be found on pages 14-17.

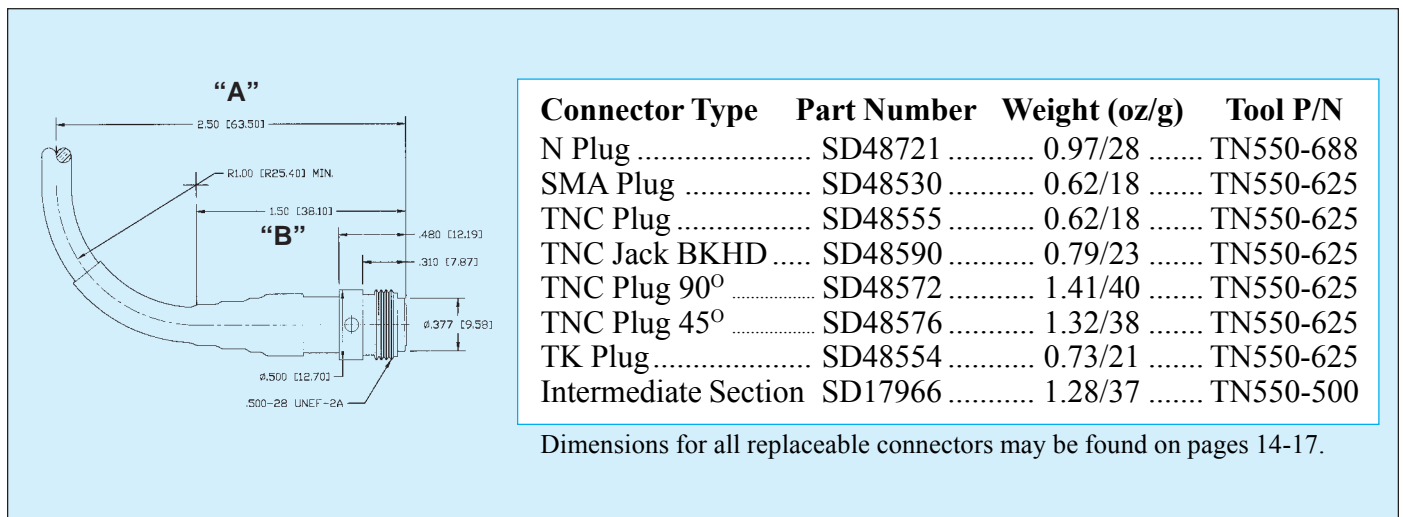


# MILTECH 210 ENVELOPE DIMENSIONS

## Non-replaceable Connectors

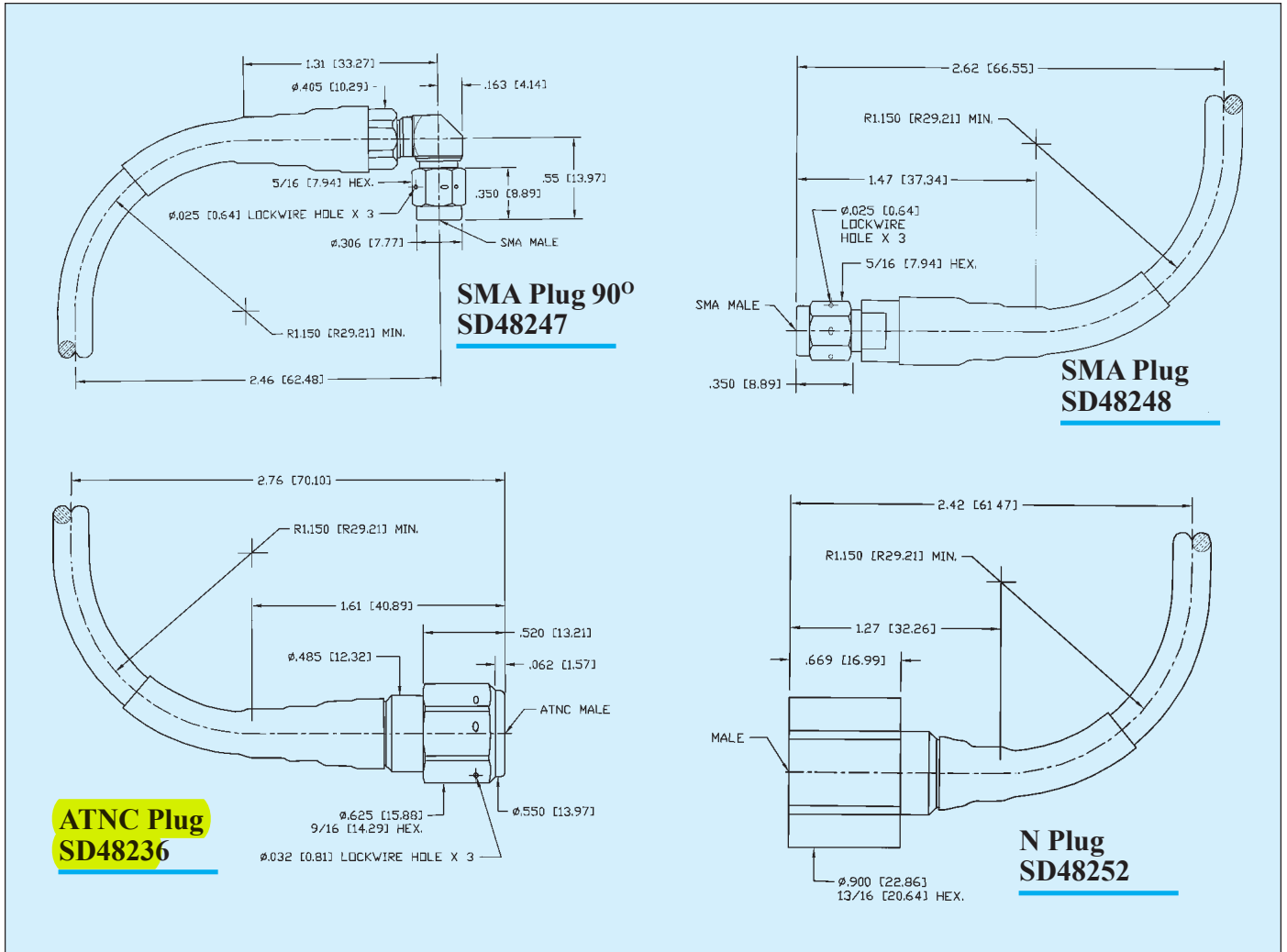


## Replaceable Connectors

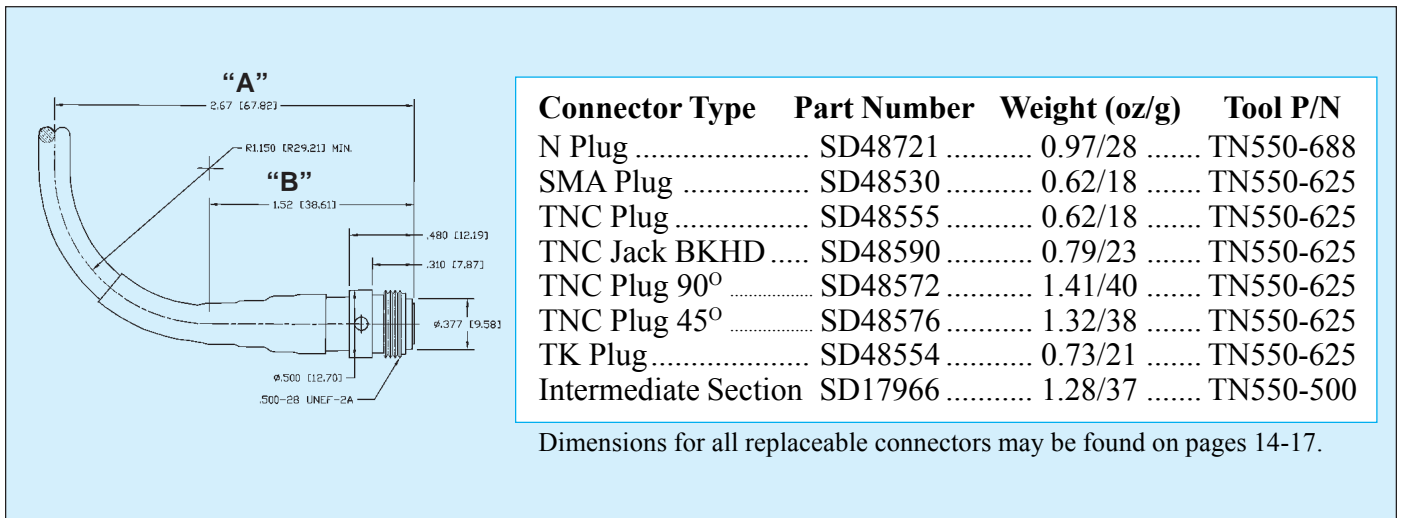


# MILTECH 230 ENVELOPE DIMENSIONS

## Non-replaceable Connectors

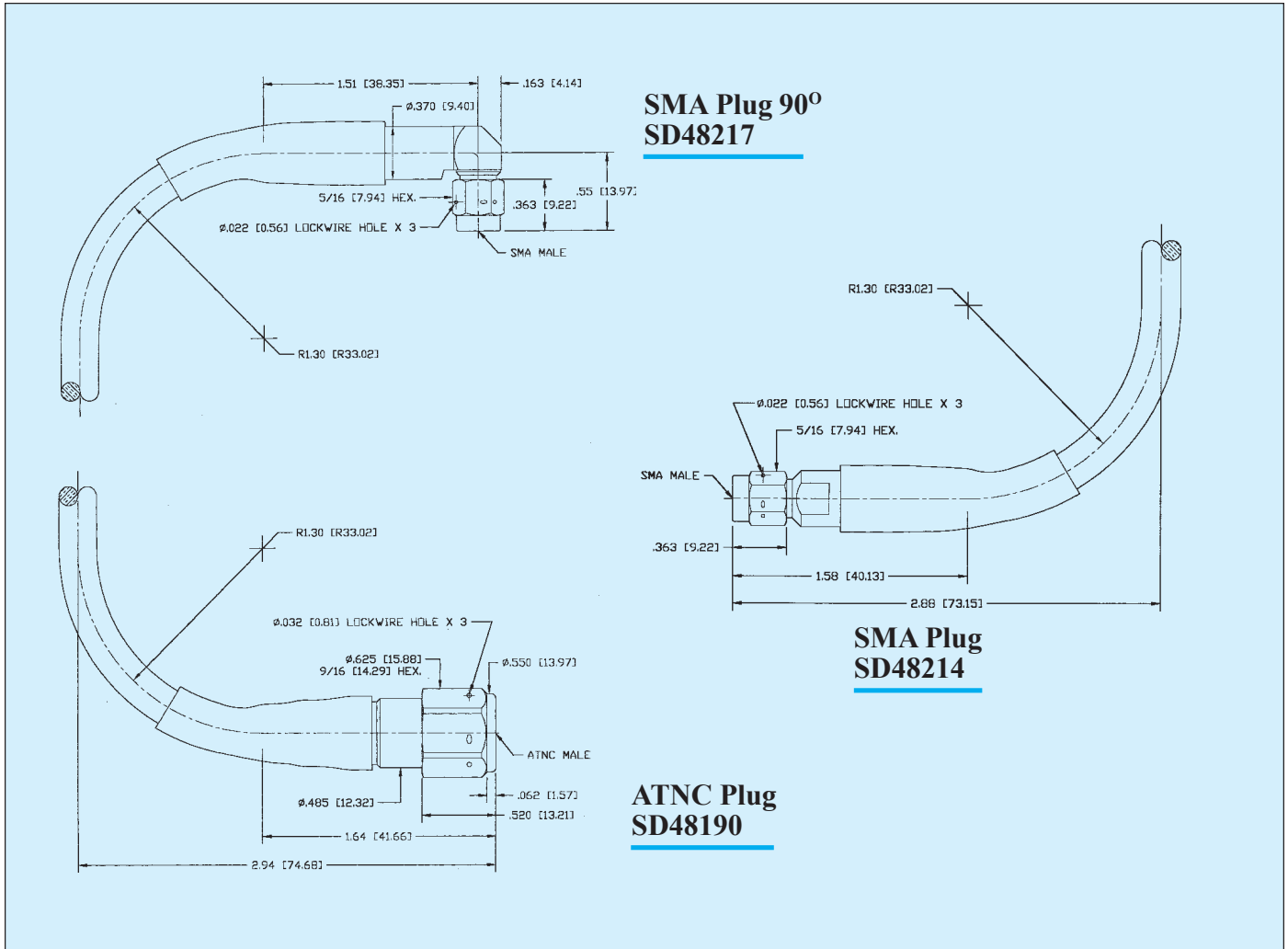


## Replaceable Connectors

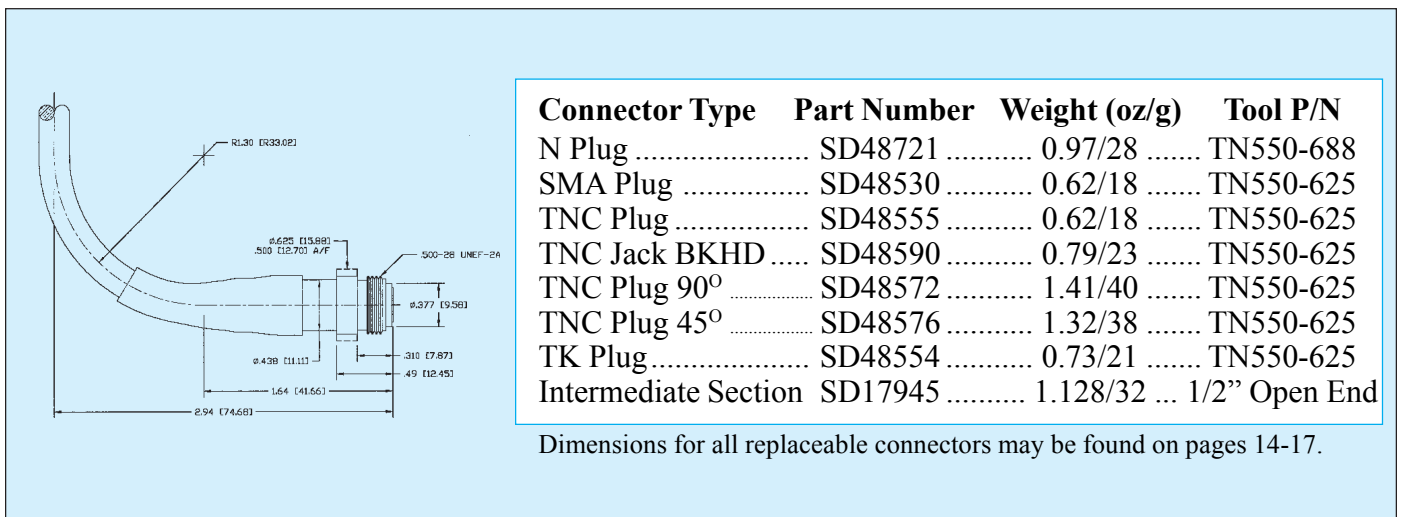


# MILTECH 265 ENVELOPE DIMENSIONS

## Non-replaceable Connectors



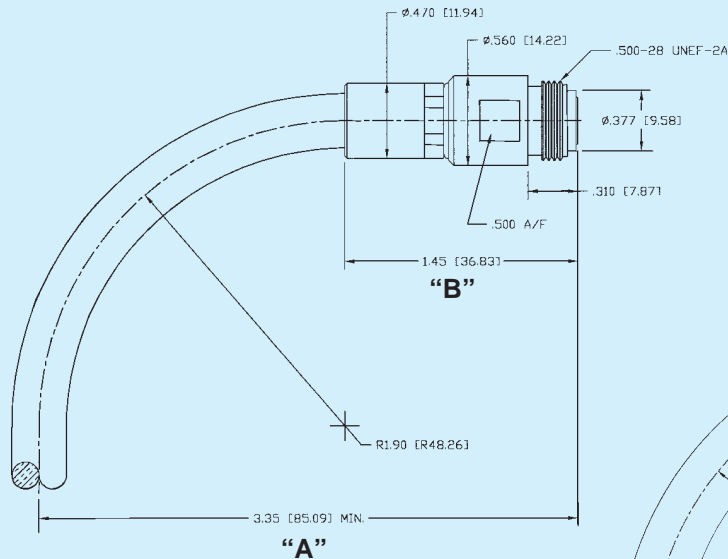
## Replaceable Connectors



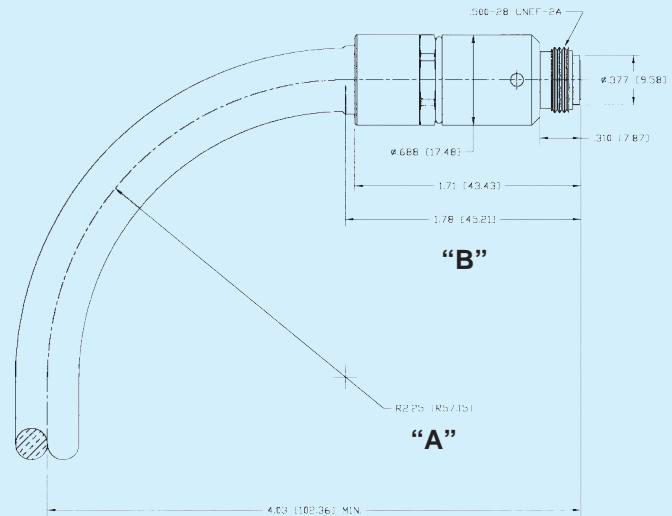
# MILTECH ENVELOPE DIMENSIONS

## MILTECH 340/340XL and MILTECH 480

### MILTECH 340/340XL



### MILTECH 480



### Standard Replaceable Connectors

#### COMMON FRONT ENDS

| Connector Type             | Part Number | Weight (oz/g) | Tool P/N      |
|----------------------------|-------------|---------------|---------------|
| ATNC Plug                  | SD48555     | 0.62/18       | TN550-625     |
| ATNC Plug 45°              | SD48576     | 1.32/38       | TN550-625     |
| ATNC Plug 90°              | SD48572     | 1.41/40       | TN550-625     |
| ATNC Plug 90°              | SD48573     | 1.50/43       | TN550-625     |
| ATNC Jack                  | SD48601     | 0.62/18       | TN550-625     |
| ATNC Jack BKHD             | SD48590     | 0.79/23       | TN550-625     |
| ATNC 90° Jack BKHD         | SD48609     | 1.58/45       | TN550-625     |
| ATNC 90° Jack BKHD         | SD48569     | 1.76/50       | TN550-625     |
| N Plug                     | SD48721     | 0.97/28       | TN550-688     |
| N Plug 90°                 | SD48628-1   | 2.06/59       | TN550-625     |
| N 90° Jack BKHD            | SD48629     | 2.90/83       | TN550-625     |
| N Jack BKHD                | SD48667     | 1.25/36       | TN550-625     |
| SC Plug                    | SD48642     | 1.65/47       | TN550-688     |
| SC Jack BKHD               | SD48680     | 2.50/71       | TN550-625     |
| SMA Plug                   | SD48530     | 0.62/18       | TN550-625     |
| SMA Plug 90°               | SD48608     | 1.02/30       | TN550-625     |
| TK Plug                    | SD48554     | 0.73/21       | TN550-625     |
| MILTECH 340/340XL Int. Sec | SD17944     | 1.12/32       | 1/2" Open End |
| MILTECH 480 Int. Sec       | SD17935     | 1.60/46       | TN550-688     |

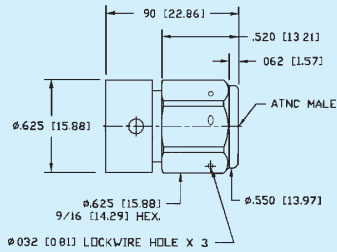
### Self-Locking Replaceable Connectors

#### COMMON FRONT ENDS

| Connector Type | Part Number | Weight (oz/g) | Tool P/N  |
|----------------|-------------|---------------|-----------|
| ATNC Plug      | SD48606     | 1.06/30       | TN550-688 |
| ATNC Plug 90°  | SD48645     | 2.11/60       | TN550-625 |
| N Plug         | SD48669     | 1.55/44       | TN550-625 |
| N Plug 90°     | SD48647     | 2.55/73       | TN550-625 |
| SMA Plug       | SD48689     | 1.30/37       | TN550-625 |
| SMA Plug 90°   | SD48688     | 0.70/20       | TN550-625 |
| TNC Plug 45°   | SD48674     | 2.15/61       | TN550-625 |

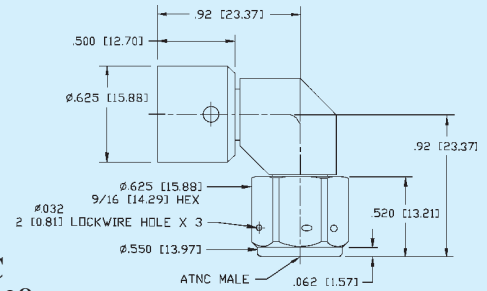
Dimensions for all replaceable connectors may be found on pages 14-17

# MILTECH REPLACEABLE FRONT END CONNECTORS



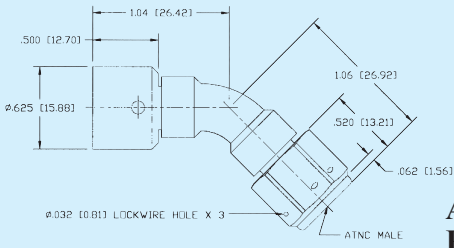
**L = 0.605 (15.37)**

**ATNC Plug SD48555**



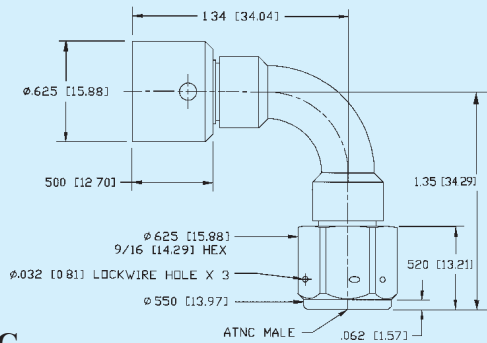
**L = 0.640 (16.26)**

**ATNC Plug 90° SD48573**



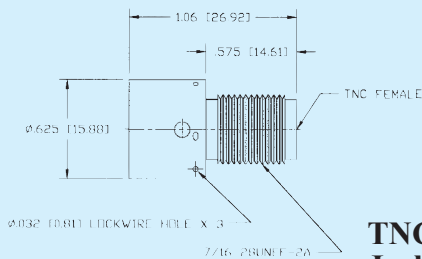
**L = 1.505 (38.23)**

**ATNC Plug 90° SD48576**



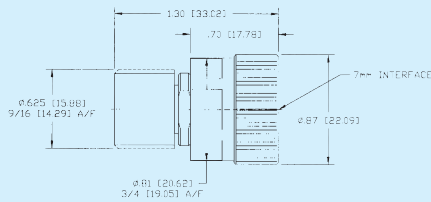
**L = 1.05 (26.67)**

**ATNC Plug 90° SD48572**



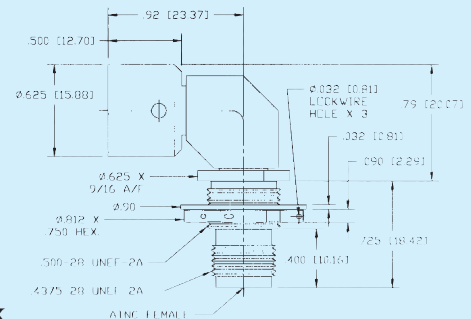
**L = 0.768 (19.51)**

**TNC Jack SD48621-1**



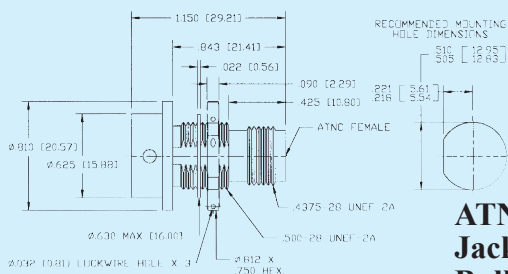
**L = 1.050 (26.67)**

**7MM SD48576**



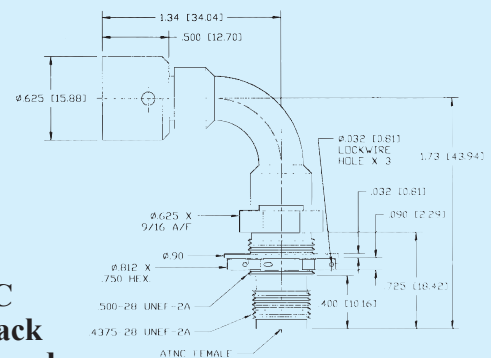
**L = 0.640 (16.26)**

**ATNC 90° Jack Bulkhead SD48609**



**L = 0.863 (21.92)**

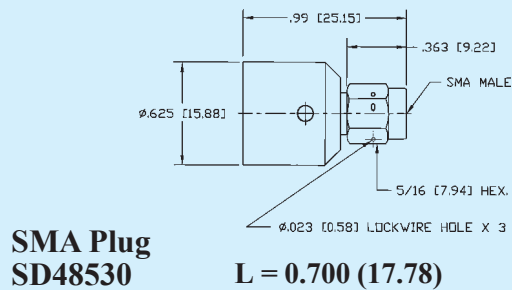
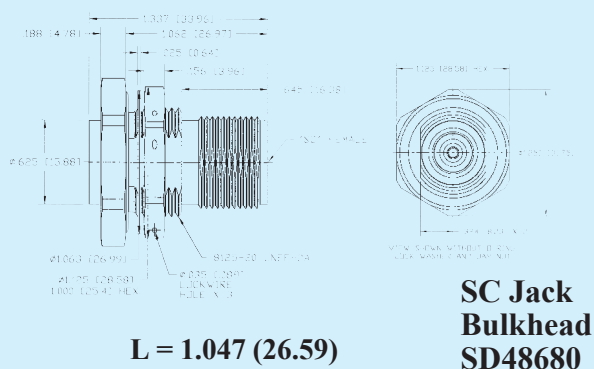
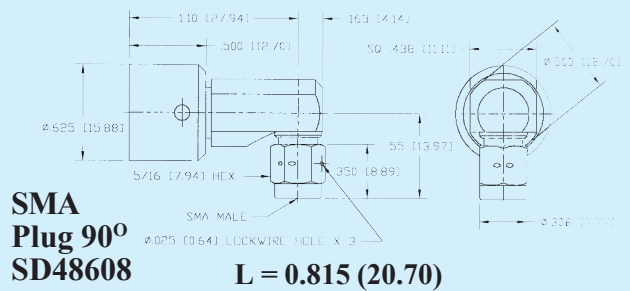
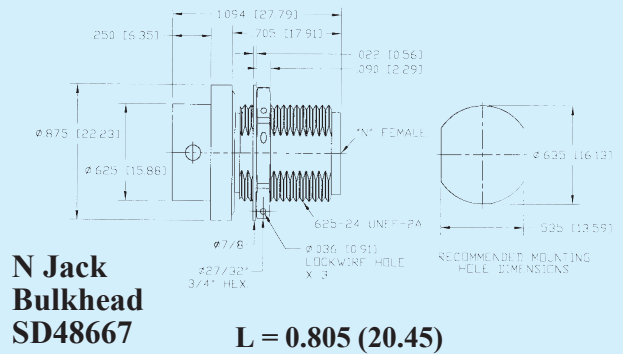
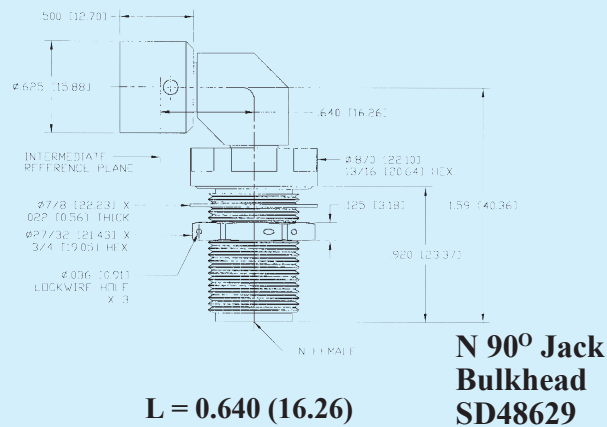
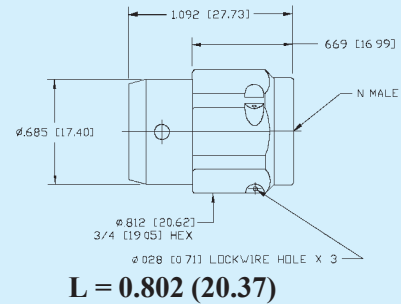
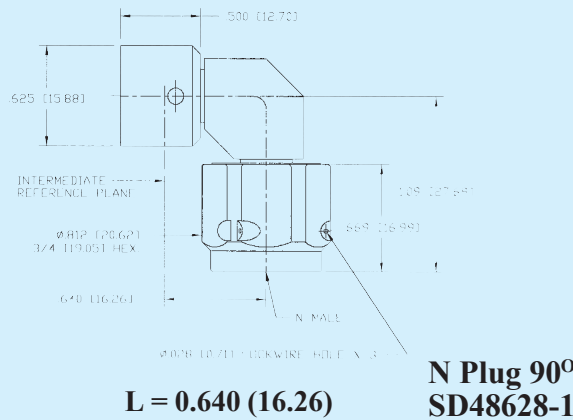
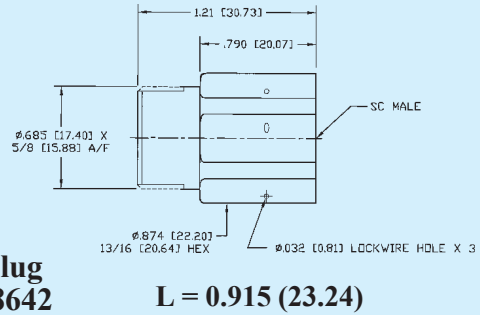
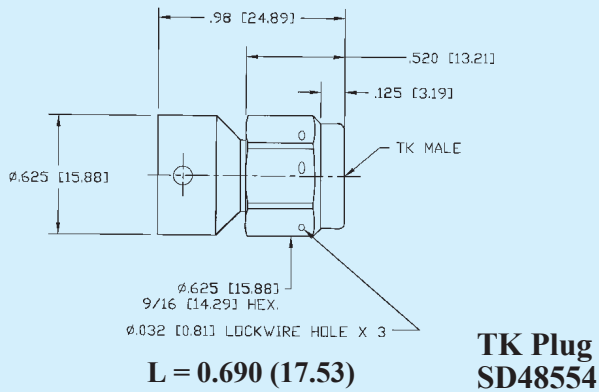
**ATNC Jack Bulkhead SD48590**



**L = 1.05 (26.67)**

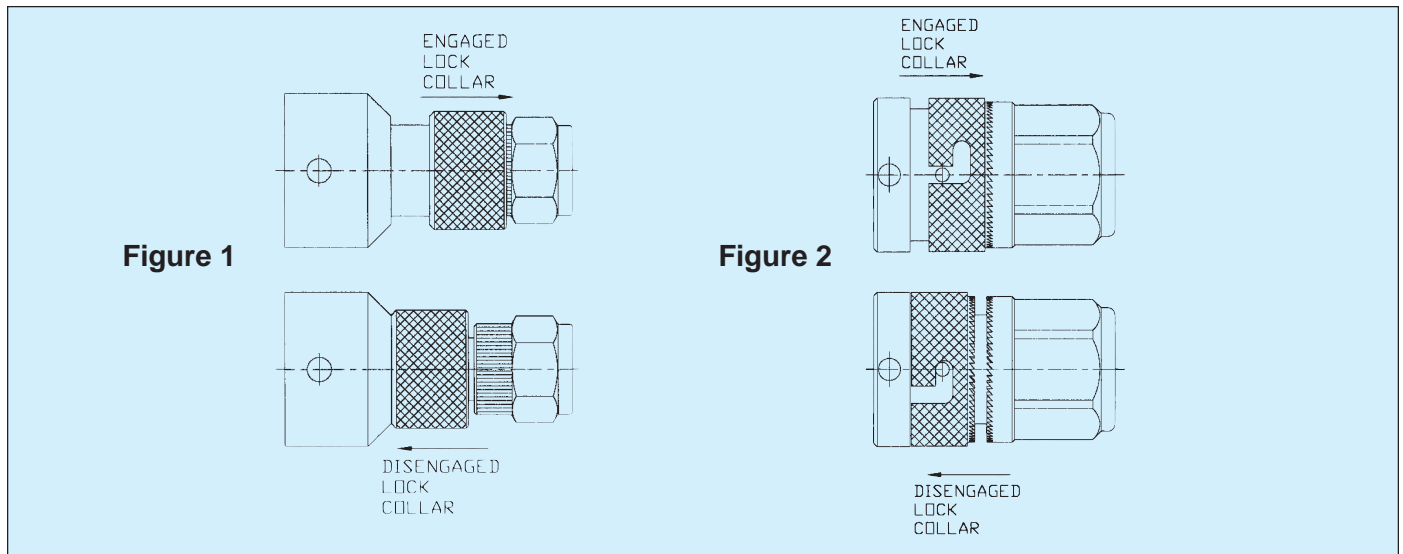
**ATNC 90° Jack Bulkhead SD48569**

# MILTECH REPLACEABLE FRONT END CONNECTORS

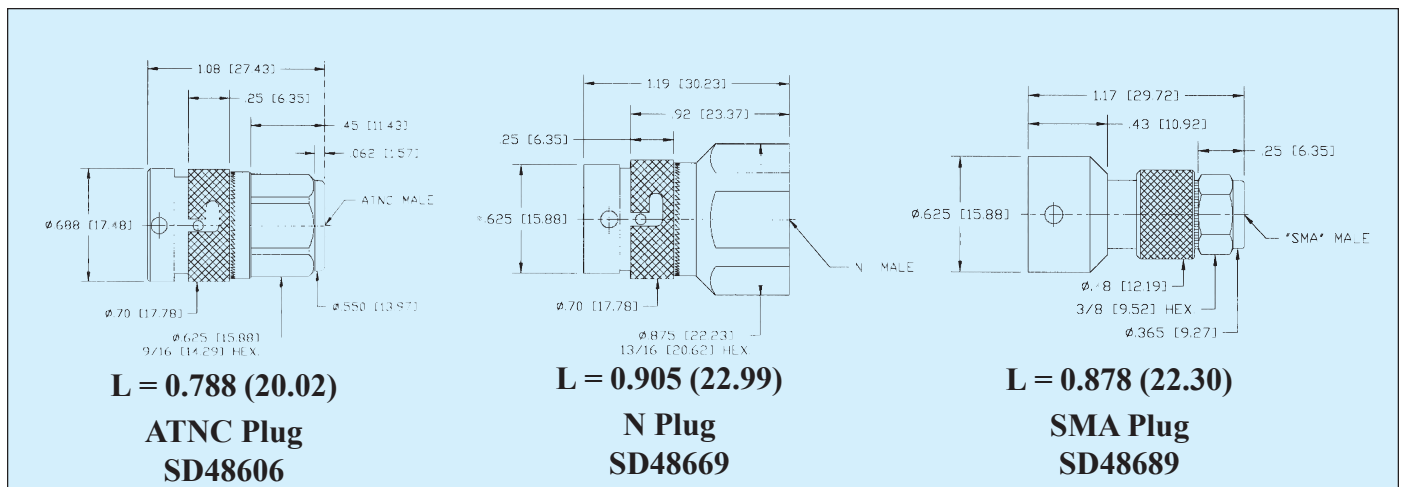


# SELF LOCKING CONNECTORS

*TIMES MICROWAVE SYSTEMS* has been a pioneer in the development of self-locking connectors for high performance connectors used in the aerospace industry. Originally developed for the USAF F-15 Program, the self-locking feature eliminates the need for expensive torque wrenches and makes the mating connection a simple, one hand operation! The self-locking feature eliminates the need for time consuming safety wire connectors, yet they provide positive engagement during vibration. All interfaces comply with MIL-C-39012 and the connectors are made from the same high quality corrosion resistant materials used on other TMS connectors. Illustrated below are two different styles of self-locking connectors. Figure 1 utilizes a “lock collar” to provide the locking mechanism and is typically used on smaller connectors, i.e. SMA. Figure 2 utilizes a “bayonet” locking collar and is typically used on larger connectors. Both designs incorporate a knurled outer surface for slip free hand operation. Both are illustrated in the locked and unlocked positions.

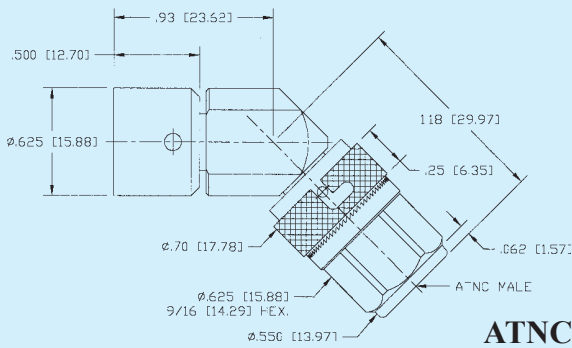


## MILTECH REPLACEABLE FRONT END SELF-LOCKING CONNECTORS



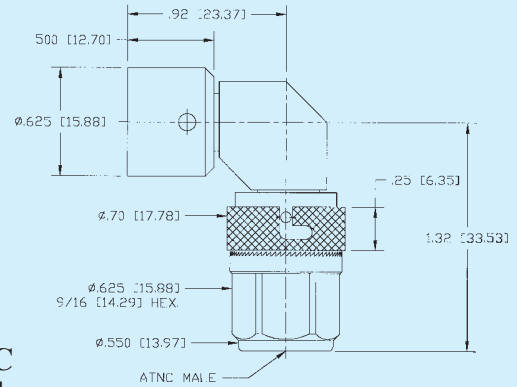


# MILTECH REPLACEABLE FRONT END SELF-LOCKING CONNECTORS



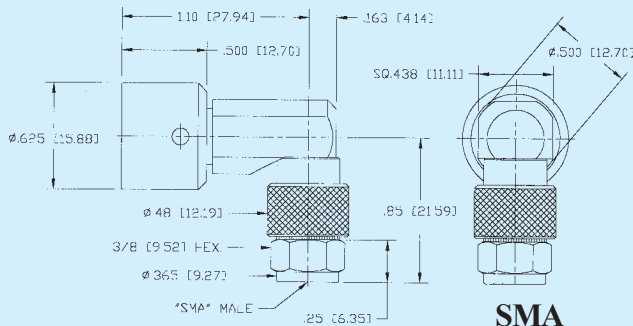
**L = 1.475 (37.47)**

**ATNC  
45° Plug  
SD48674**



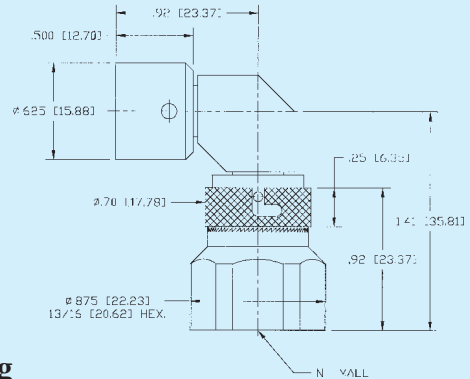
**L = 0.640 (16.26)**

**ATNC  
90° Plug  
SD48645**



**L = 0.815 (20.70)**

**SMA  
Plug 90°  
SD48688**



**L = 0.640 (16.26)**

**N  
90° Plug  
SD48647**

## SPECIALIZED CONNECTORS

TIMES MICROWAVE SYSTEMS has produced specialized connectors for unique applications that require modifications to the standard connectors and interfaces. Most are manufactured to the requirements of MIL-T-81490, MIL-C-87104 and MIL-PRF-39012. With almost 10,000 connector designs to choose from, there's a good chance that we have the connector you need for your application with little or no modification.

Please contact us regarding your specific requirements.



# PHASE MATCHED/AMPLITUDE MATCHED CABLE ASSEMBLIES

*TIMES MICROWAVE SYSTEMS* has extensive experience in the design and manufacture of phase and amplitude matched cable assemblies for use in a broad range of applications. We fabricate and store reference standards. In many cases, our existing cable designs will satisfy the requirements, however, when necessary, a new cable can be designed to meet the specific application.

For phase sensitive applications, *TIMES MICROWAVE SYSTEMS* has a dedicated temperature and humidity controlled facility in which we assemble and test all high precision, phase-matched cable assemblies. Our facility includes HP8510 Vector Automatic Network Analyzers.

Precise temperature and humidity control allows us to establish an unmistakable reference base line for all tests related to phase. This dedicated facility is used for both the development and high-volume production of cable assemblies. The primary benefits of such a dedicated facility include unambiguous results and prompt delivery of cable assemblies that meet the most demanding state-of-the-art requirements such as those found in MIL-C-87104 or MIL-T-81490.

Please contact us regarding your specific needs.

# PHASE ADJUSTABLE TRIMMERS

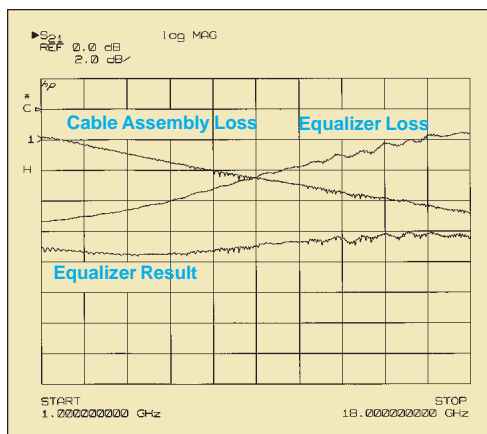
As high performance aircraft are upgraded with the latest technology EW and ESM systems, the need for phase matched cable assemblies is increasing. Phased array antennas often need multiple cable assemblies that require the cable assemblies to be phase matched after they are installed in the aircraft, some of which are routed through areas that subject the cables to multiple bends and twists, offer exceeding the capabilities of the most phase stable cables. *TIMES MICROWAVE SYSTEMS* has developed in-line phase trimmers qualified to MIL-T-81490 requirements that can be adjusted to compensate for phase changes that occur as the result of installation. Typical phase adjustment is +/-100 degrees at 18 GHz.

Please contact us regarding your specific needs.

# EQUALIZED CABLE ASSEMBLIES

For applications requiring a flat signal response as the frequency is swept, *TIMES MICROWAVE SYSTEMS* has developed cable assemblies with built-in signal equalizers. As most aerospace applications require commonality between “black boxes” for ease of maintenance and repair, a cable assembly with a built-in equalizer eliminates the need to incorporate the equalizer with the LRU. The equalizer is uniquely packaged to fit into the back end of the connector, with a minimal increase in the overall connector length. For existing cable assemblies, the equalizer can be packaged into a simple adapter that mates with the cable connector. *TIMES MICROWAVE SYSTEMS* can design an equalizer assembly that will maintain a flat signal response over a wide frequency range.

Please contact us regarding your specific needs.



# MILLIMETER WAVE CABLE ASSEMBLIES

*TIMES MICROWAVE SYSTEMS* millimeter wave coaxial cable assemblies are designed to meet MIL-T-81490 as applicable and provide a highly reliable and ruggedized answer to your difficult signal transmission problems. Available in two cable sizes, these cable assemblies deliver lower losses (down to 0.820 dB/ft. at 40 GHz) and improved flexibility while maintaining an amplitude change during flexure of less than 0.1 dB.

Our standard construction, designed for maximum flexibility, can replace 0.141"/3.58mm hard-line in many internal "black box" applications, eliminating costly tooling expenses and facilitating assembly and repair. Typical applications extend to equipment racks, test leads and low cost equipment interconnections as well. These highly reliable assemblies will survive high concentrated loads and flexure without degradation in electrical performance.

## Technical Data

|                                   | <b>MILTECH 130</b><br>0.130"/3.30mm Cable Assemblies                       | <b>MILTECH 175</b><br>0.175"/4.45 mm Cable Assemblies                       |
|-----------------------------------|--|---|
| <b>Electrical performance:</b>    |  |   |
| Maximum VSWR:2-12.4 GHz           | 1.30:1   | 1.30:1  |
| 12.4-40 GHz                       | 1.40:1   | 1.40:1  |
| Maximum insertion loss:           | 0.98dB per ft @ 40 GHz<br>0.78dB per ft @ 26 GHz<br>0.65dB per ft @ 18 GHz | 0.82dB per ft @ 40 GHz<br>0.66dB per ft @ 26 GHz<br>0.54 dB per ft @ 18 GHz |
| Shielding efficiency:             | Better than -90dB  | Better than -90dB   |
| <b>Mechanical performance:</b>    |  |   |
| Connector retention:              | 25 lbs.  | 35 lbs.   |
| Minimum bend radius:              | 0.650"   | 0.875"  |
| <b>Environmental performance:</b> |  |   |
| Temperature range:                | -65 to +200°C  | -65 to +200°C   |
| Moisture resistance:              | MIL-STD 202, Method 106  | MIL-STD 202, Method 106   |
| Vibration:                        | MIL-STD 202, Method 204, Cond. C   | MIL-STD 202, Method 204, Cond. C  |
| Shock:                            | MIL-E-5272, Para. 4.15.5.1   | MIL-E-5272, Para 4.15.5.1   |
| <b>Connectors:</b>                |  |   |
| Passivated stainless steel        | 2.9 mm, plug and jack (K)<br>2.4 mm, plug and jack                         | 2.9 mm, plug and jack (K)<br>2.4 mm, plug and jack                          |

Please contact us regarding your specific needs.

## MILLIMETER WAVE CABLE ASSEMBLIES

- Operation to 40 GHz • MIL-T-81490 features
- Stainless steel connectors
- 2 sizes for low insertion loss
- Operation to 200°C

### Insertion loss at intermediate frequencies can be calculated as follows:

$$IL = K_1 \times \text{SqRt}(\text{FMHz}) + 0.000146 \times (\text{FMHz}) \text{ dB per 100 feet}$$

or

$$IL = K_2 \times \text{SqRt}(\text{FMHz}) + 0.000480 \times (\text{FMHz}) \text{ dB per 100 meters}$$

(where FMHz is the frequency in MHz)

| Cable    | K <sub>1</sub> , dB/100 ft. | K <sub>2</sub> , dB/100 meters. |
|----------|-----------------------------|---------------------------------|
| MM 0.130 | 0.4622                      | 1.5160                          |
| MM 0.175 | 0.3822                      | 1.2536                          |



# TESTMATE MICROWAVE TEST LEADS

*TIMES MICROWAVE SYSTEMS* Testmate cables have the flexibility, durability and reliability required for laboratory, manufacturing and field testing applications. A variety of *MILTECH* male and female replaceable interfaces are available, allowing a single cable to be customized by the end used for multiple interconnect solutions without degrading the low loss and VSWR of the cable assembly. For general purpose testing requirements up to 18 GHz, *TIMES MICROWAVE SYSTEMS* offers 2 cable sizes. Using the same construction techniques as the military qualified *MILTECH* cable described elsewhere in the catalog, these cables provide the flexibility and low loss required for testing applications. Our ¼" cable offers the lowest loss and best flexibility for its size. For test applications requiring long cable lengths, our ½" cable offers the lowest loss up to 18 GHz, while still providing excellent flexibility.



## 18 GHz Test leads

- Customer replaceable *MILTECH* connector front ends
- Excellent electrical characteristics
- Heavy wall polyurethane jacket provides excellent abrasion resistance
- 2 sizes for low insertion loss

Additional Testmate literature is available at: [www.timesmicrowave.com](http://www.timesmicrowave.com)

## Technical Data

|   | Testmate – 230 test leads  | Testmate – 340 test leads   |
|---|--|---|
| <b>Electrical performance:</b>  |  |   |
| Maximum VSWR: 0.5–18 GHz  | 1.35:1   | 1.35:1  |
| Maximum insertion loss:   | 0.43 dB per ft @ 18 GHz  | 0.26 dB per ft. @ 18 GHz  |
| Shielding efficiency  | Better than –90 dB   | Better than –90 dB  |
| <b>Mechanical performance:</b>  |  |   |
| Outside diameter:   | ¼"/6.4 mm  | ½"/12.7 mm  |
| Connector retention:  | 75 lbs.  | 150 lbs.  |
| Minimum bend radius:  | 1.25"/31.8 mm  | 2.00"/50.8 mm   |
| <b>Environmental performance:</b>   |  |   |
| Operating temperature:  | –65 to +90°C   | –65 to +90°C  |
| Moisture resistance:  | MIL-STD 202, Method 106  | MIL-STD 202, Method 106   |
| Vibration   | MIL-STD 202, Method 204, Cond.C                                      | MIL-STD 202, Method 204, Cond.C                                     |
| Shock:  | MIL-E-5272, Para. 4.15.5.1   | MIL-E-5272, Para 4.15.5.1   |
| <b>Connectors:</b>  |  |   |
| Passivated stainless steel - (works with all <i>MILTECH</i> replaceable front ends) | SMA, plug and jack<br>TNC, plug and jack<br>N, plug and jack<br>7 mm | SMA, plug and jack<br>TNC, plug and jack<br>N, plug and jack<br>7mm |

Please contact us regarding your specific needs. See pages 14 and 15 for part numbers for additional connectors.

# TEST ADAPTERS

*TIMES MICROWAVE SYSTEMS* provides test adapters and between series test adapters for test labs and systems use. These durable, precision coaxial test adapters provide superior electrical performance and reliable service as test interfaces. Used as “connector savers”, they also can protect panel connectors from wear.

Constructed from gold-plated beryllium copper and stainless steel, these 50 ohm adapters operate from DC to 18 GHz. Typical electrical specifications are 0.15 dB insertion loss and 1.40:1VSWR at 18 GHz. The mating interfaces conform to MIL-PRF-39012.

| Type                | Part Number |
|---------------------|-------------|
| N jack – TNC jack   | OE5062-1    |
| N plug – TNC jack   | OE5062-2    |
| N jack – TNC plug   | OE5062-3    |
| N jack– TK jack     | OE5062-4    |
| N plug – TK jack    | OE5062-5    |
| N jack – TK plug    | OE5062-6    |
| N plug– TK plug     | OE5063-7    |
| TK plug – TK plug   | OE6063-8    |
| TNC plug – TNC plug | OE5063-9    |

Please contact us regarding your specific needs

| Type                  | Part Number |
|-----------------------|-------------|
| N plug – N plug       | OE5108-7    |
| N plug – N jack       | OE5108-9    |
| N plug – PTNC plug    | OE5108-11   |
| N plug –SMA jack      | OE5108-13   |
| N jack – SMA plug     | OE5108-16   |
| N jack – SMA jack     | OE5108-17   |
| PTNC jack – PTNC jack | OE5108-31   |
| N plug – HN jack      | OE5108-35   |
| N plug – HN plug      | OE5108-36   |
| N plug – PTNC jack    | OE5109-10   |
| N plug - PTNC plug    | OE5109-11   |
| N plug – SMA jack     | OE5109-13   |
| N jack – PTNC jack    | OE5109-15   |
| N jack – SMA jack     | OE5109-17   |
| PTNC plug – PTNC plug | OE5109-30   |
| PTNC jack – PTNC plug | OE5109-32   |
| SMA jack – SMA jack   | OE5109-33   |
| SMA plug – SMA plug   | OE5109-34   |
| SMA plug – PTMC plug  | OE5109-35   |

Please contact us regarding your specific needs



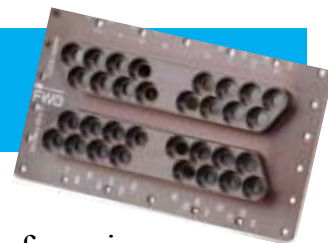
## Tools

- Sold separately or in kits
- Can be customized to meet individual requirements
- Corrosion free stainless steel

## TOOLS, SPANNER WRENCHES, & TORQUE WRENCHES

*TIMES MICROWAVE SYSTEMS* can provide the necessary tooling to facilitate the removal and replacement of replaceable connector interfaces for our cable assemblies. Most applications require only a simple open end or spanner wrench to complete the process. The correct tools are specified along with the replaceable connectors shown elsewhere in this catalog, however, custom tool and connector kits can be supplied for unique applications. Please contact us for your specific needs.

# M8 MULTI-PORT INTERCONNECTION SYSTEM



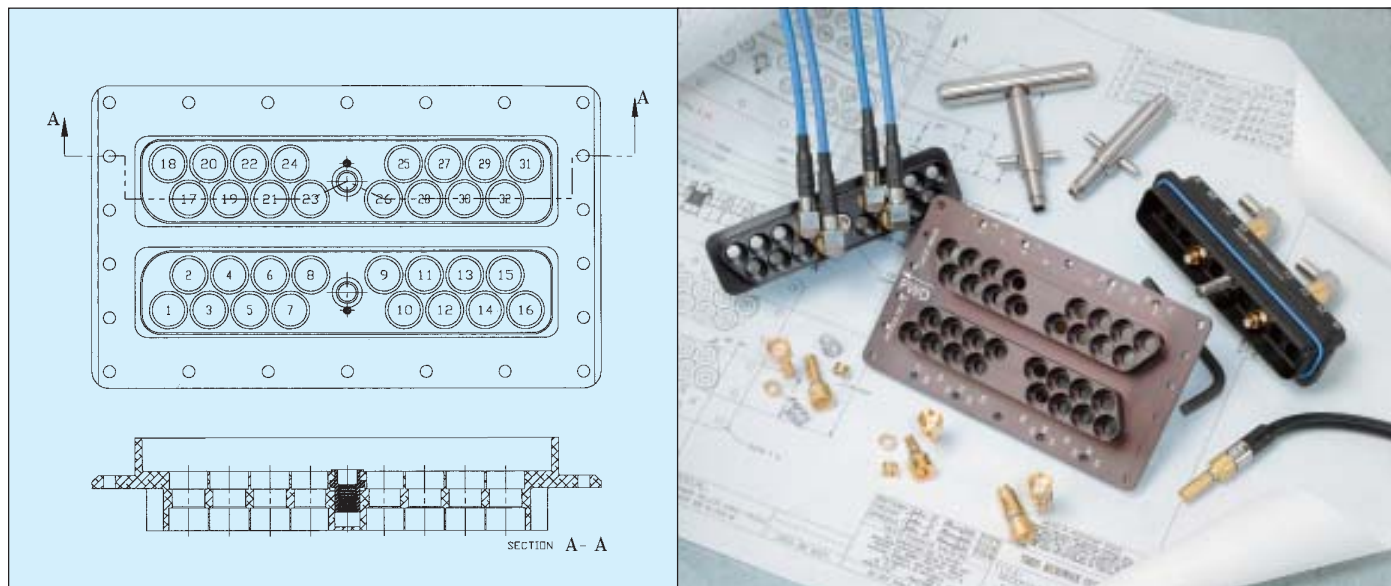
The *TIMES MICROWAVE SYSTEMS* M8 Multi-Port Connector family was specially designed and developed to mate multiple coaxial cable interfaces in a high performance environment not previously achievable with other multi-port connectors. The *TIMES MICROWAVE SYSTEMS* housings and contacts have been tested and qualified to such demanding transmission line assembly specifications as MIL-T-81490 and MIL-C-87104 and feature excellent phase stability with low VSWR and insertion loss up to 20 GHz. The M8 interconnection system easily survives harsh environments where high vibration, shock, temperature and humidity could cause serious cable and system performance degradation where other multi-port connection systems have been used. The *TIMESMICROWAVE SYSTEMS* M8 Multi-port interconnect system is presently used on a number of airborne applications.

To enhance the versatility of the multi-port interconnection system, the following features have been incorporated:

- The connector housing and each cable assembly is individually sealed.
- The M8 interface design includes spring loading to guarantee full mating under all conditions, providing reliable VSWR performance.
- Individual cable assemblies are inserted and removed easily from the rear of the connector housing using a simple hand tool.
- A single housing can accept all *MILTECH* cables as well as transmission lines of different sizes, including flexible and semi-rigid types from 0.086"/2.18mm to 0.480"/12.2mm OD.
- M8 Multi-Port housings are available in several configurations.
- Rack and panel or jackscrew mounts are available.

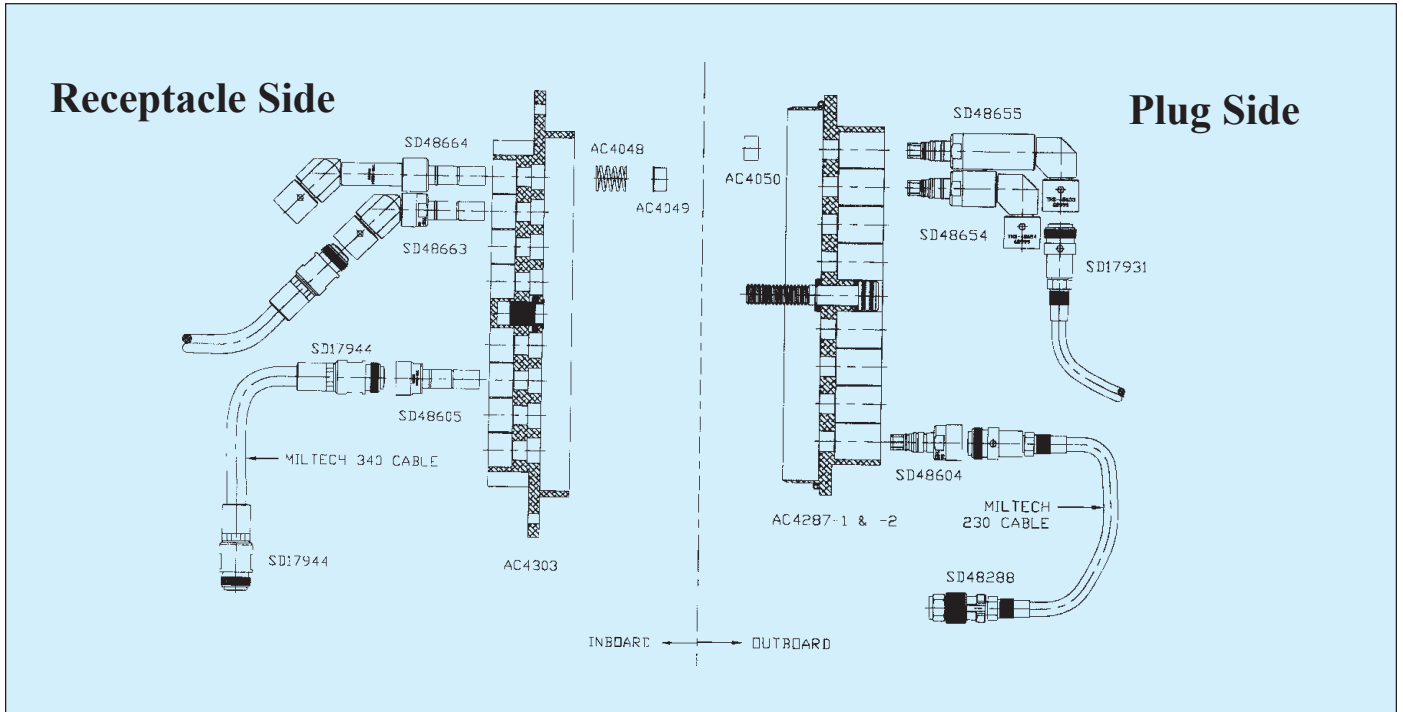
## Electrical Specifications

Insertion Loss and VSWR per *MILTECH* Cable and Connector Specifications.

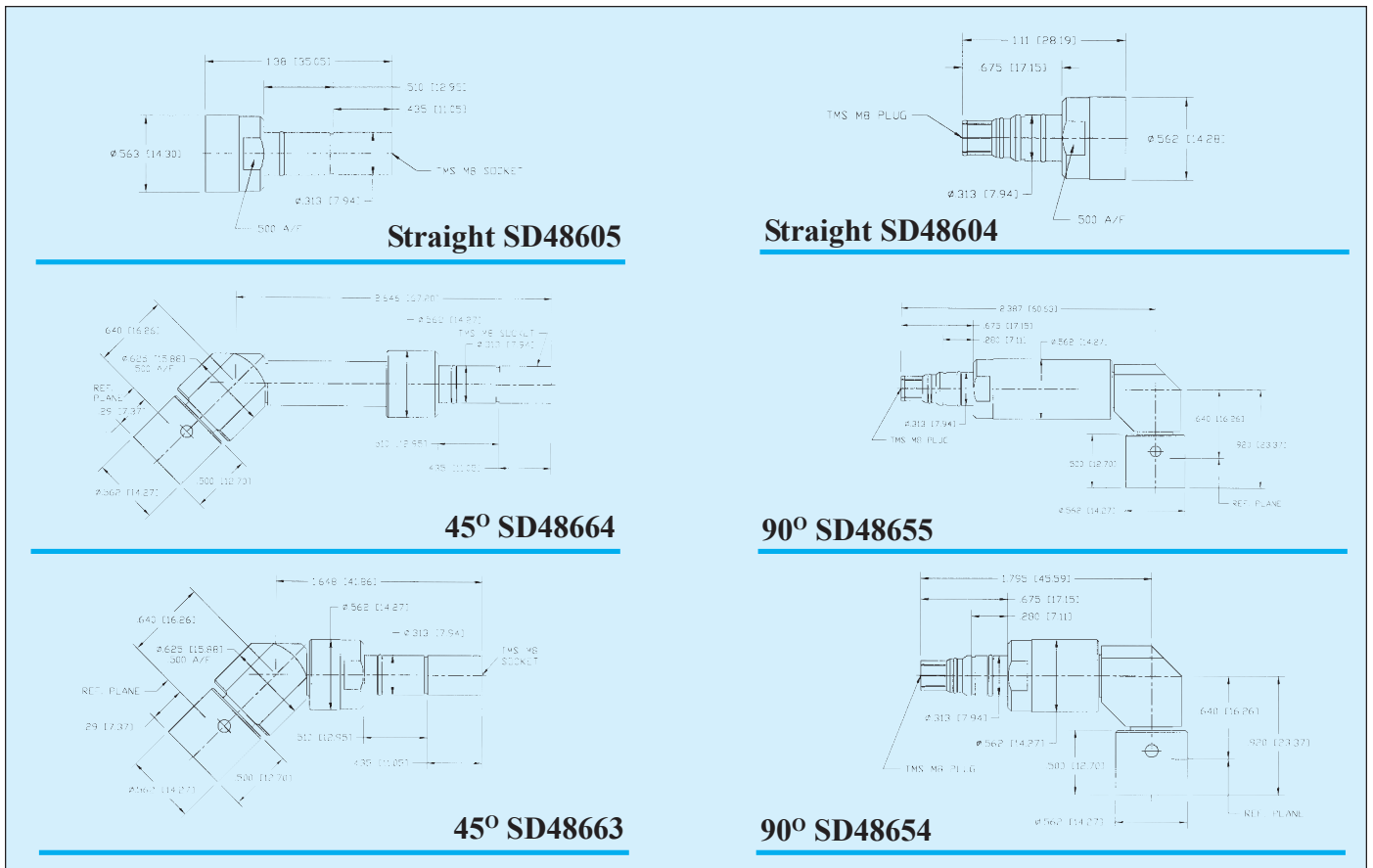


# M8 MULTI-PORT INTERCONNECTION SYSTEM

## Typical System Interface



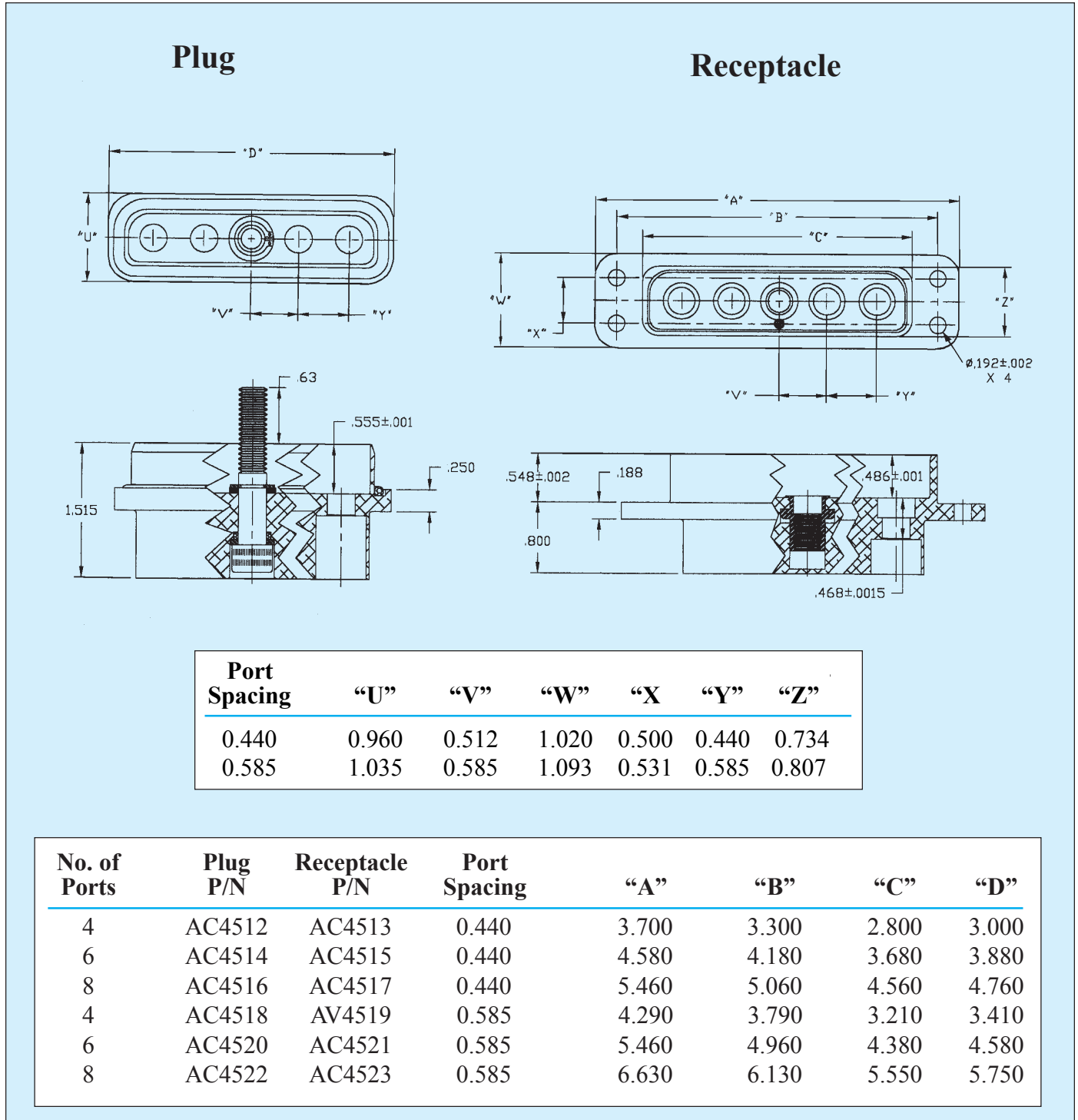
## Standard Connectors



# MS MULTI-PORT INTERCONNECTION SYSTEM

## Dimensions vs. Number of Ports

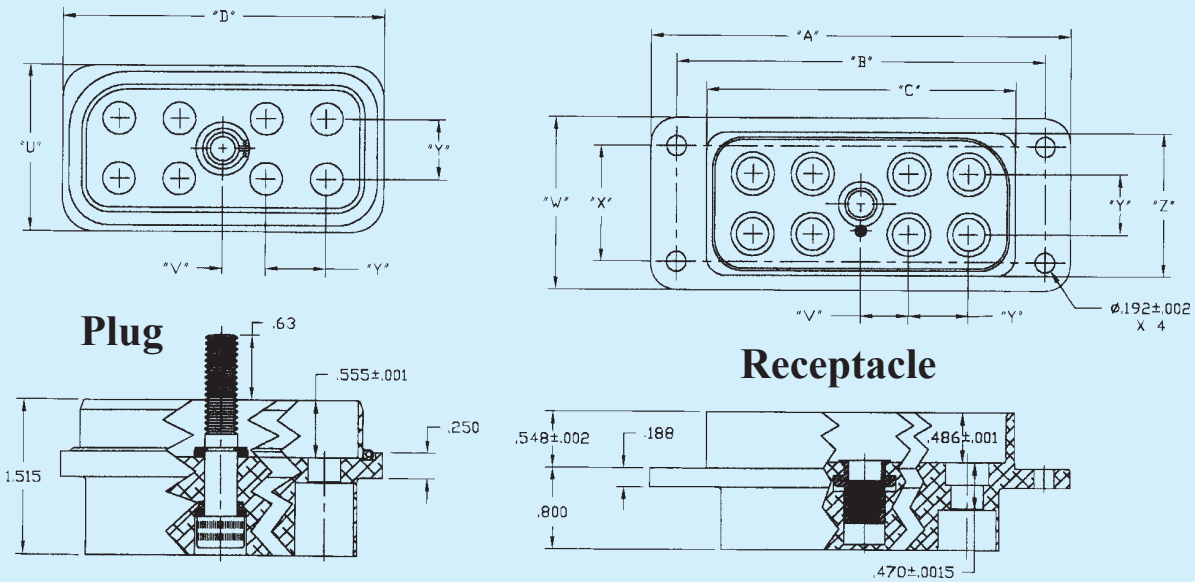
The *TIMES MICROWAVE SYSTEMS* M8 Multi-Port connector is available with replaceable or non-replaceable cables/contacts. The non-replaceable version, with 0.440"/11.18mm contact spacing, can accept cable diameters up to 0.31"/7.88mm. The replaceable version, with 0.585"/14.86mm contact spacing, can accept cable diameters up to 0.48"/12.19mm. Either version will accept flexible or a combination of flexible and semi-rigid cable.





# MS MULTI-PORT INTERCONNECTION SYSTEM

## Dimensions vs. Number of Ports

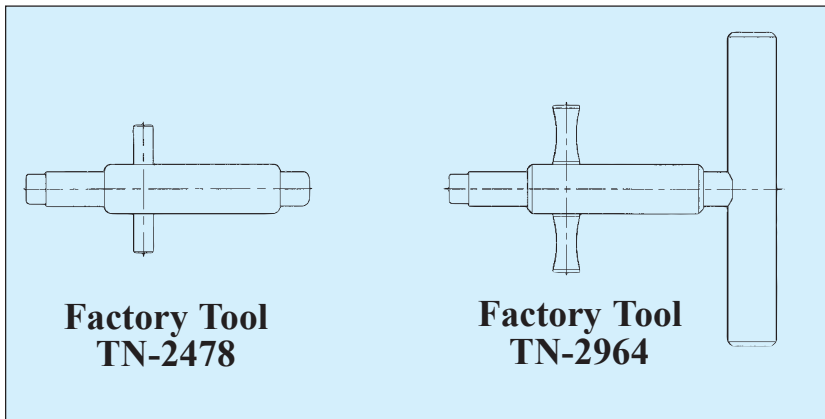


| Port Spacing | "U"   | "V"   | "W"   | "X"   | "Y"   | "Z"   |
|--------------|-------|-------|-------|-------|-------|-------|
| 0.440        | 1.400 | 0.504 | 1.460 | 0.875 | 0.440 | 1.174 |
| 0.585        | 1.620 | 0.507 | 1.678 | 1.125 | 0.585 | 1.392 |

| No. of Ports | Plug P/N | Receptacle P/N | Port Spacing | "A"   | "B"   | "C"   | "D"   |
|--------------|----------|----------------|--------------|-------|-------|-------|-------|
| 4            | AC4524   | AC4525         | 0.440        | 2.720 | 2.320 | 1.820 | 2.020 |
| 8            | AC4526   | AC4527         | 0.440        | 3.600 | 3.200 | 2.700 | 2.900 |
| 12           | AC4528   | AC4529         | 0.440        | 4.480 | 4.080 | 3.580 | 3.780 |
| 16           | AC4530   | AC4531         | 0.440        | 5.360 | 4.960 | 4.460 | 4.660 |
| 4            | AC4532   | AC4533         | 0.585        | 2.910 | 2.410 | 1.830 | 2.030 |
| 8            | AC4534   | AC4535         | 0.585        | 4.080 | 3.580 | 3.000 | 3.200 |
| 12           | AC4536   | AC4537         | 0.585        | 5.250 | 4.750 | 4.170 | 4.370 |
| 16           | AC4538   | AC4539         | 0.585        | 6.420 | 5.920 | 5.340 | 5.540 |

## Insertion/Extraction Tools

The insertion and extraction of M8 Multi-Port contacts from the M8 shell is a simple process that uses an easily operated insertion/extraction hand tool. Both field and factory tool styles are available. The field tool will conveniently fit into a technician's pocket or toolbox and was designed for routine insertion or extraction of the M8 contacts. The factory tool was designed for production line applications, however, both are interchangeable.



## CUSTOM PRODUCTS

*TIMES MICROWAVE SYSTEMS* also manufactures coaxial products for a broad range of unique applications in addition to the cable and connector products described elsewhere in this catalog. To date, we have designed more than 10,000 different flexible and semirigid cables and connectors to meet customer requirements. We will design and manufacture coaxial cables, connectors, adapters, test kits and tools to meet any specialized customer requirements. Prior applications include wave guide to coax adapters, impedance transforming cable assemblies, broadband delay lines, high shielding effectiveness assemblies, antenna extender assemblies, high pressure fuel resistant assemblies, high vibration assemblies, and low smoke/zero halogen cable assemblies. Please contact us regarding your specific needs.



# SPECIAL APPLICATION WORKSHEET

Copy and fax this form to Times Microwave Systems Applications Engineering, or contact a TMS application engineering manager directly at (203) 949-8400. You may also fax this form or call the the sales manager for your area at the offices listed on the back cover.

FAX TO: (203) 949-8423

From: \_\_\_\_\_

Phone: \_\_\_\_\_

E-mail \_\_\_\_\_

Company \_\_\_\_\_

City: \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

## APPLICATION

1. Ground, airborne, shipboard or submarine, etc: \_\_\_\_\_
2. System name: \_\_\_\_\_
3. Platform: \_\_\_\_\_
4. Use (receive, transmit): \_\_\_\_\_
5. Number of this assembly per system: \_\_\_\_\_
6. Cable type (flex, rigid, semi-rigid): \_\_\_\_\_

## DESIGN

### Electrical

1. Frequency band: \_\_\_\_\_
2. Insertion loss: \_\_\_\_\_
3. VSWR (over frequency): \_\_\_\_\_
4. Power (rms, CW, or peak): \_\_\_\_\_

### Mechanical

1. Length and tolerance: \_\_\_\_\_
2. Sealing requirements: \_\_\_\_\_
3. Connector requirements: \_\_\_\_\_
4. Cable diameter: \_\_\_\_\_
5. Crush resistance: \_\_\_\_\_
6. Impact shock: \_\_\_\_\_
7. Vibration levels: \_\_\_\_\_
8. Marking: \_\_\_\_\_

### Environmental

1. Temperature (operating and non-operating): \_\_\_\_\_
2. Altitude: \_\_\_\_\_
3. Pressure: \_\_\_\_\_
4. Severe environments (salt fog, humidity, fuel, hydraulic fluid, solvents, etc): \_\_\_\_\_

SPECIAL CONSIDERATIONS: \_\_\_\_\_

## Mockup Assistance

*TIMES MICROWAVE SYSTEMS* applications and engineering personnel are available to discuss customer requirements, to make recommendations for the best use of our products and to assist with mockup services as customer facilities. Such services generally include determining the cable types to be used, including cable lengths and routing, as well as connector configurations. Mockup assistance may also include installation procedures, specifications and testing procedures, as required.

## SIMPLIFIED ORDERING

We have included cable and connector part numbers throughout this catalog as much as practicable. Please fill out the simplified ordering guide below and we will be happy to prepare a quotation.

|                    |                              |                    |
|--------------------|------------------------------|--------------------|
| <b>Connector A</b> | <b>Cable Type and Length</b> | <b>Connector B</b> |
|                    |                              |                    |

*Field-tested, high performance  
coaxial cable assemblies  
Pioneering a wide range of coaxial cable  
and connector developments*



*Let our experience,  
innovation and support  
work for you!*



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