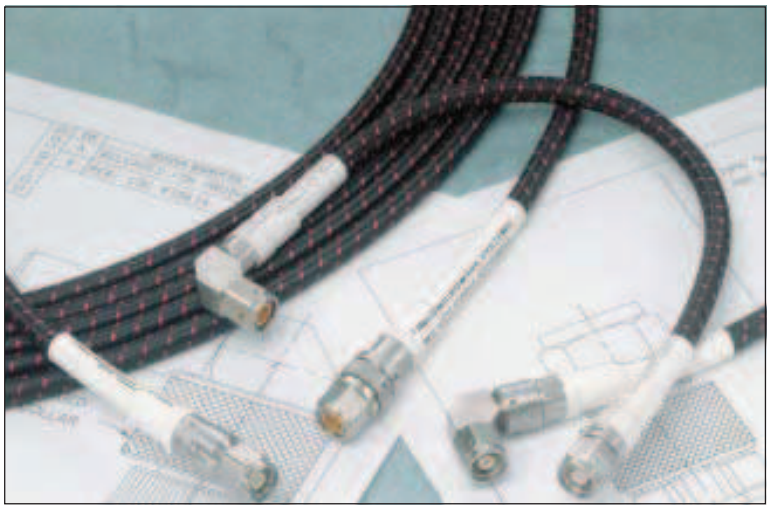
TIMES QUALIFIED MILTECH™ CABLE ASSEMBLIES



Starting on page 5

MILTECH Qualified Cable Assemblies

- Manufactured to the requirements of MIL-C-87104 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

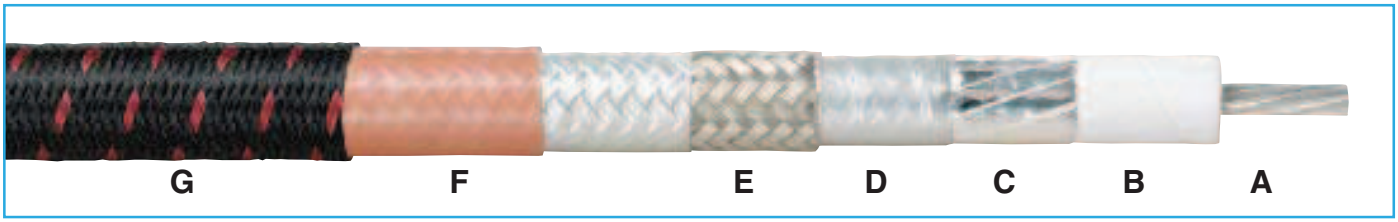
- Standard interface for the F-22
- 1.2:1 VSWR per mated pair through 20 GHz
- Available for flexible and semi-rigid cables from 0.086"/2.18 mm through 0.340"/8.64 mm OD
- Many sizes available
- Redundant gasket seals
- Qualified for high vibration environments
- Simple field replacement of individual 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 x 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
MILTECH 210	MS2919-4
MILTECH 230	MS2919-4
MILTECH 265	MS2919-5
MILTECH 340	MS2919-7
MILTECH 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
MILTECH™ 210	0.21/5.3	0.48	*MILTECH 210*	1.00/25.4	0.035lb/ft (52g/m)
MILTECH™ 230	0.23/5.8	0.38	*MILTECH 230*	1.15/29.2	0.045lb/ft (68g/m)
MILTECH™ 265	0.265/6.7	0.32	*MILTECH 265*	1.30/33.0	0.065lb/ft (97g/m)
MILTECH™ 340	0.34/8.6	0.22	*MILTECH 340*	1.90/48.3	0.105lb/ft (157g/m)
MILTECH™ 340XL	0.34/8.6	0.22	*MILTECH 340XL*	1.90/48.3	0.080lb/ft (120g/m)
MILTECH™ 340EL	0.34/8.6	0.22	*MILTECH 340EL*	1.90/48.3	0.070lb/ft (105g/m)
MILTECH™ 480	0.46/12.2	0.13 (@ 10 GHz)	*MILTECH 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 *MILTECH 480*)
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 *MILTECH* 210, 230, 265 80% Nom. For *MILTECH* 340/340XL 78% Nom. For *MILTECH* 480
Maximum operating voltage	2500 Volts (1000 Volts with SMA) 1000 Volts for *MILTECH 210 and 230*
RF leakage	-90 dB maximum per foot over tested 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 (*MILTECH 210, 230, 265)* 75 lbs. minimum (*MILTECH 340/340XL, 480)*
Vapor leakage	1 x 10^{-5} 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.

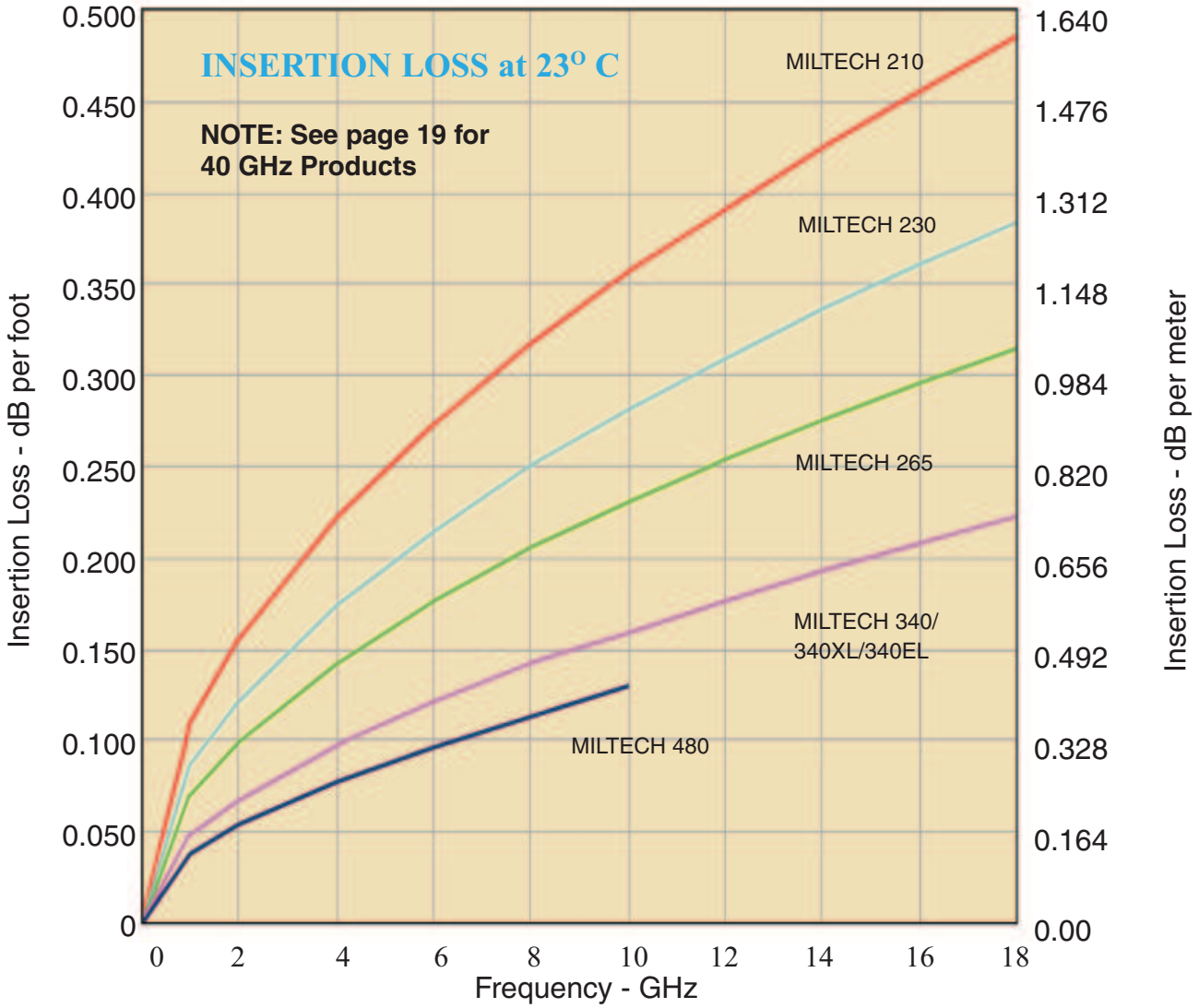
Insertion loss - Following is a graph of loss vs. frequency for *MILTECH* cables and equations to be used for calculating the loss at specific frequencies.

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:

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

or

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

(where FMHz is the frequency in MHz)

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

CONNECTOR LOSS

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

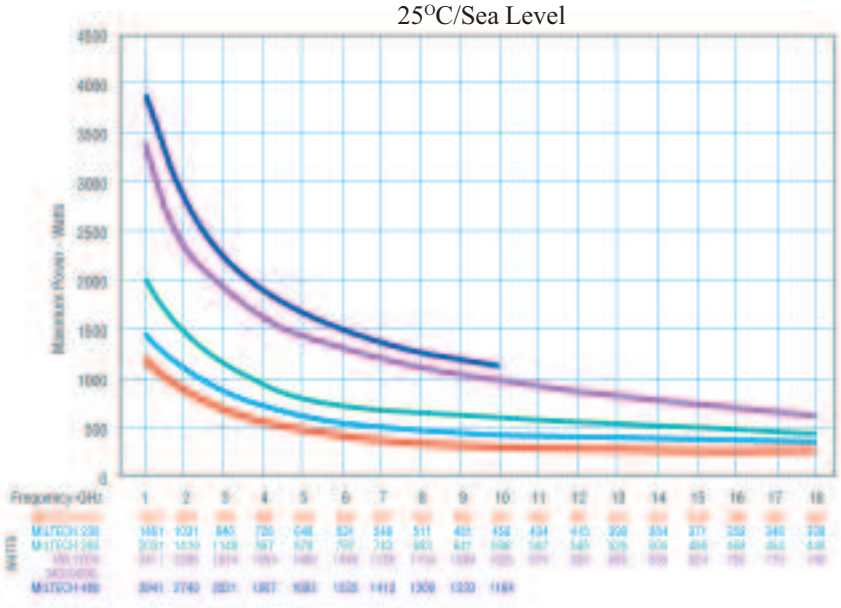


Fig. 2: MILTECH Maximum Power Handling Characteristics
100°C/70,000 ft. (21.34 km)

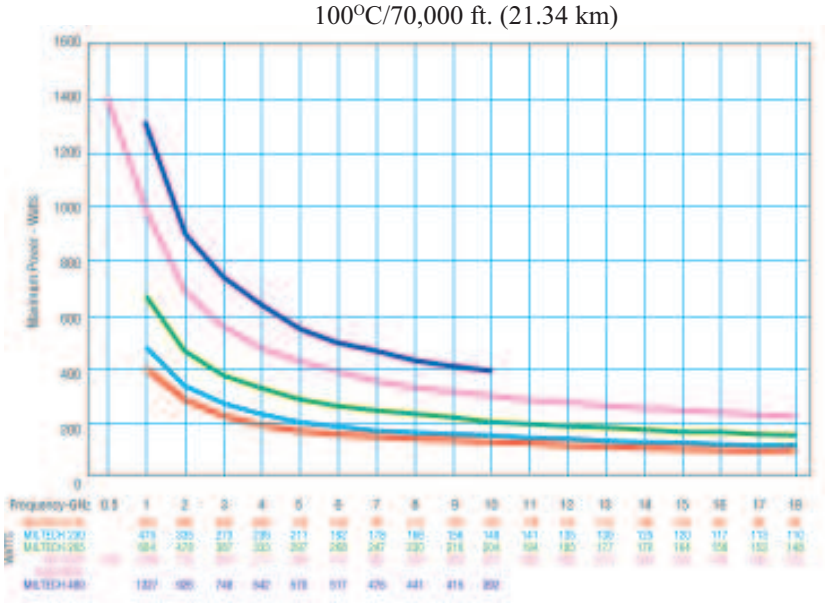


Table 1
Altitude Correction Factor

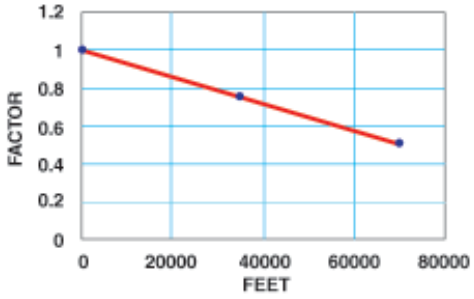
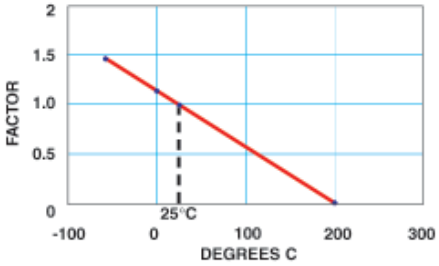


Table 2
Temperature Correction Factor



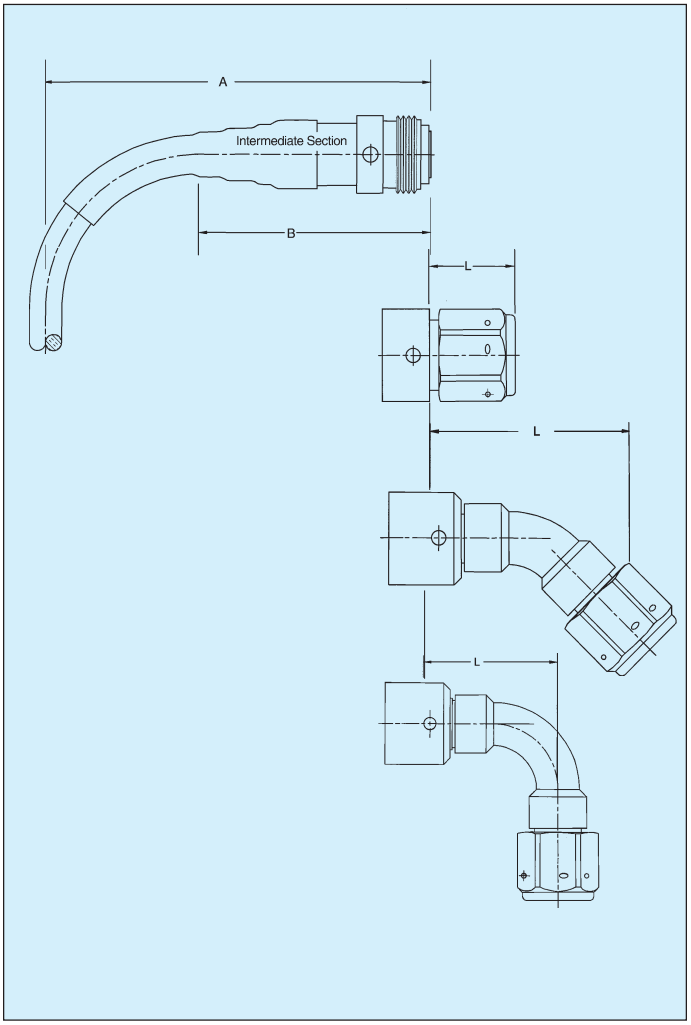
Apply straight line derating factors, as follows:
TEMPERATURE: Choose the applicable power level from the 25°C/sea level chart and multiply by the correction factor corresponding to the desired ambient temperature.
ALTITUDE: After obtaining the temperature adjusted power handling, multiply by the correction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

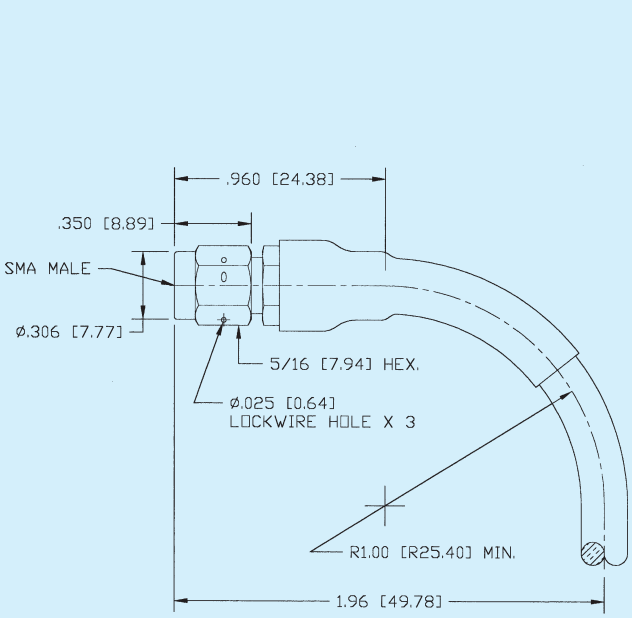
MILTECH™ Cable Assembly Connector Envelopes

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.

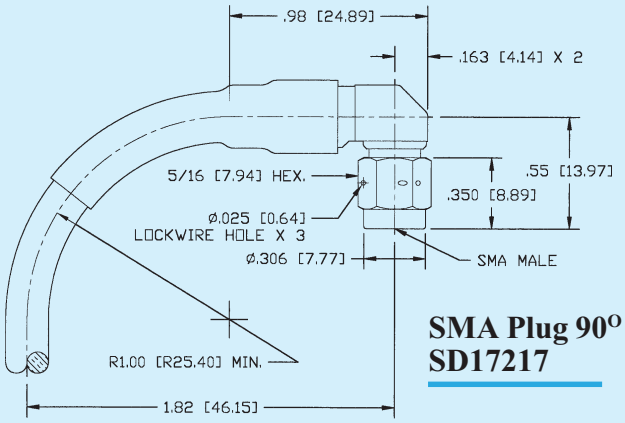


MILTECH™ 210 ENVELOPE DIMENSIONS

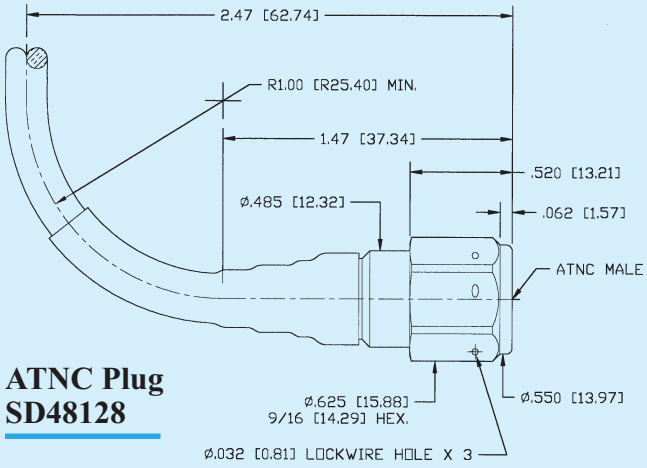
Non-replaceable Connectors



SMA Plug
SD17218

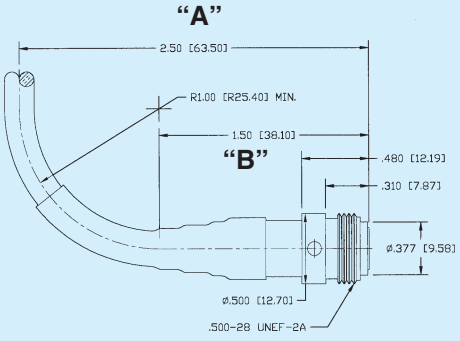


SMA Plug 90°
SD17217



ATNC Plug
SD48128

Replaceable Connectors

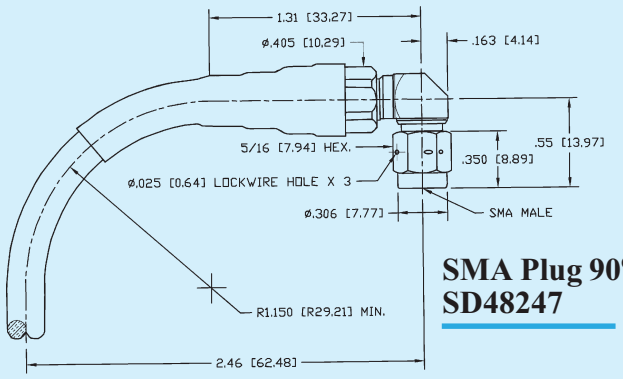


Connector Type	Part Number	Weight (oz/g)	Tool P/N
N Plug	SD48721	0.97/28	TN550-688
SMA Plug	SD48530	0.62/18	TN550-625
TNC Plug	SD48555	0.62/18	TN550-625
TNC Jack BKHD	SD48590	0.79/23	TN550-625
TNC Plug 90°	SD48572	1.41/40	TN550-625
TNC Plug 45°	SD48576	1.32/38	TN550-625
TK Plug	SD48554	0.73/21	TN550-625
Intermediate Section	SD17966	1.28/37	TN550-500

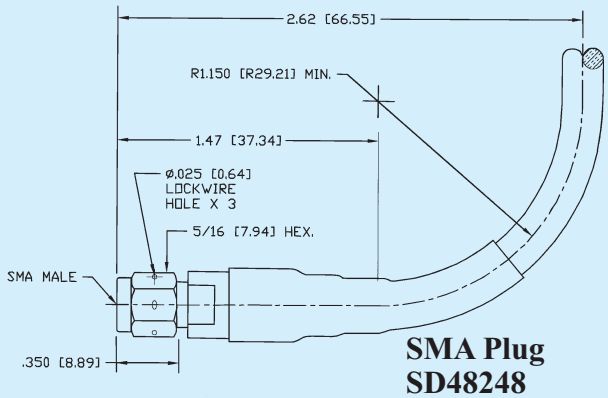
Dimensions for all replaceable connectors may be found on pages 14-17.

MILTECH™ 230 ENVELOPE DIMENSIONS

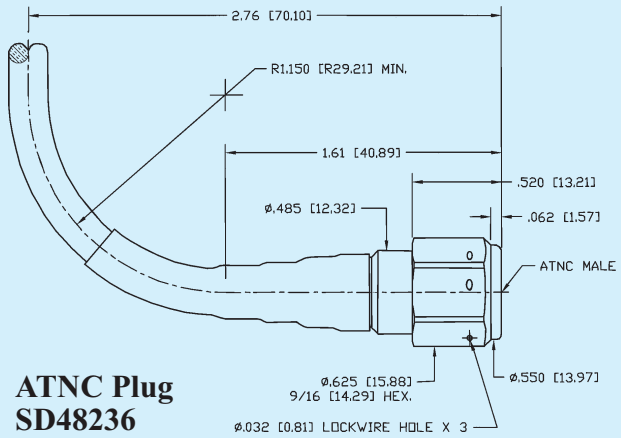
Non-replaceable Connectors



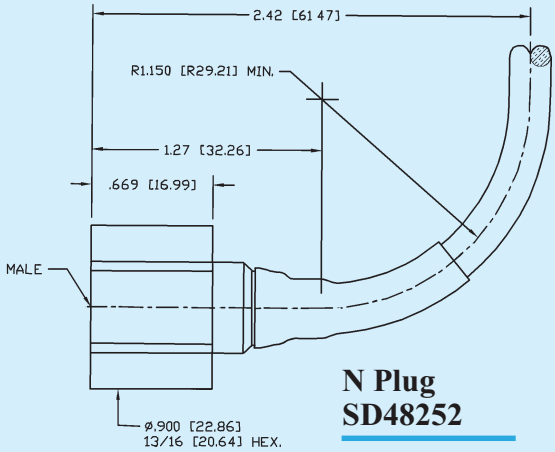
SMA Plug 90°
SD48247



SMA Plug
SD48248

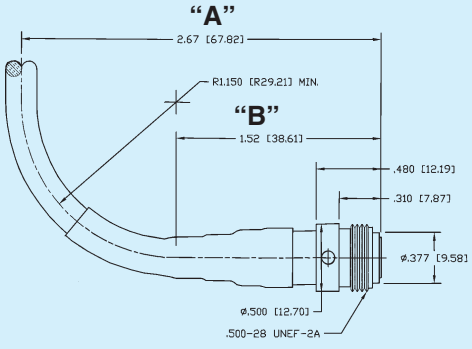


ATNC Plug
SD48236



N Plug
SD48252

Replaceable Connectors

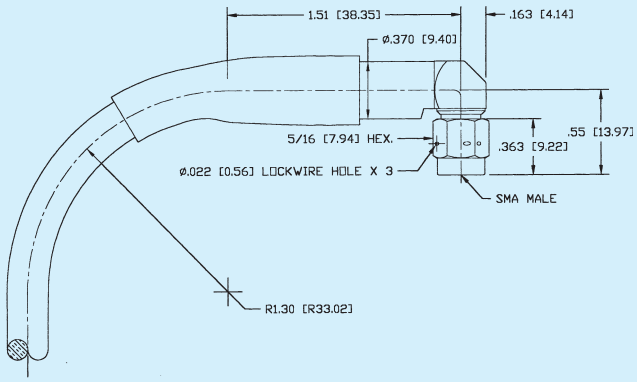


Connector Type	Part Number	Weight (oz/g)	Tool P/N
N Plug	SD48721	0.97/28	TN550-688
SMA Plug	SD48530	0.62/18	TN550-625
TNC Plug	SD48555	0.62/18	TN550-625
TNC Jack BKHD	SD48590	0.79/23	TN550-625
TNC Plug 90°	SD48572	1.41/40	TN550-625
TNC Plug 45°	SD48576	1.32/38	TN550-625
TK Plug	SD48554	0.73/21	TN550-625
Intermediate Section	SD17966	1.28/37	TN550-500

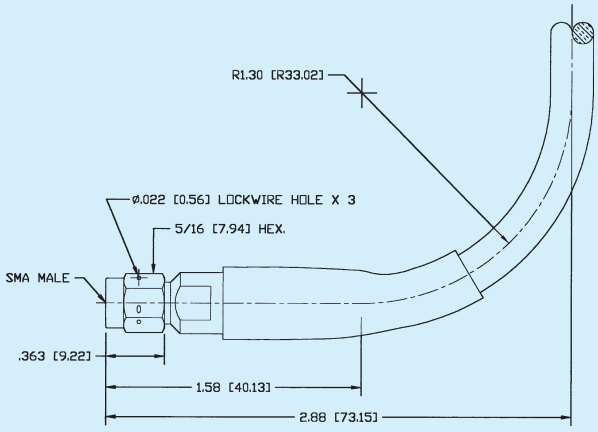
Dimensions for all replaceable connectors may be found on pages 14-17.

MILTECH™ 265 ENVELOPE DIMENSIONS

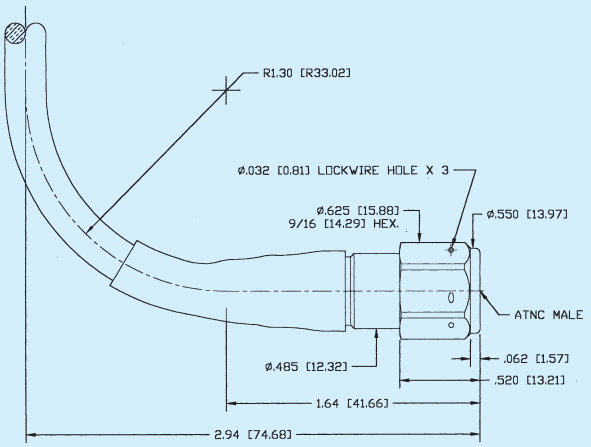
Non-replaceable Connectors



SMA Plug 90°
SD48217

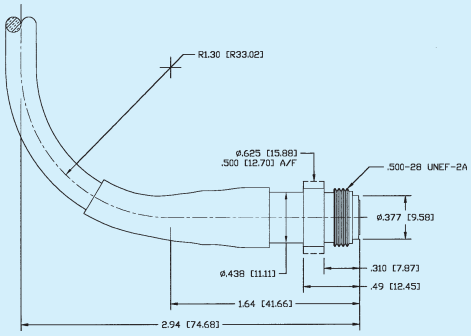


SMA Plug
SD48214



ATNC Plug
SD48190

Replaceable Connectors



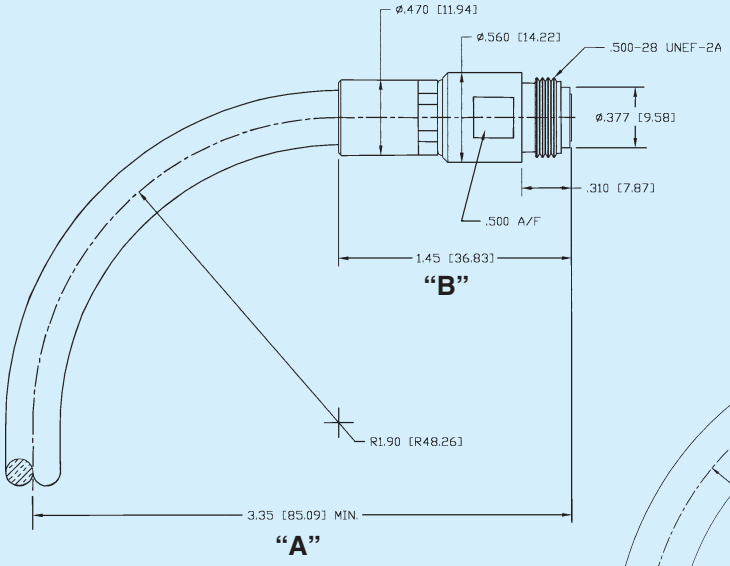
Connector Type	Part Number	Weight (oz/g)	Tool P/N
N Plug	SD48721	0.97/28	TN550-688
SMA Plug	SD48530	0.62/18	TN550-625
TNC Plug	SD48555	0.62/18	TN550-625
TNC Jack BKHD	SD48590	0.79/23	TN550-625
TNC Plug 90°	SD48572	1.41/40	TN550-625
TNC Plug 45°	SD48576	1.32/38	TN550-625
TK Plug	SD48554	0.73/21	TN550-625
Intermediate Section	SD17945	1.128/32	1/2” Open End

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

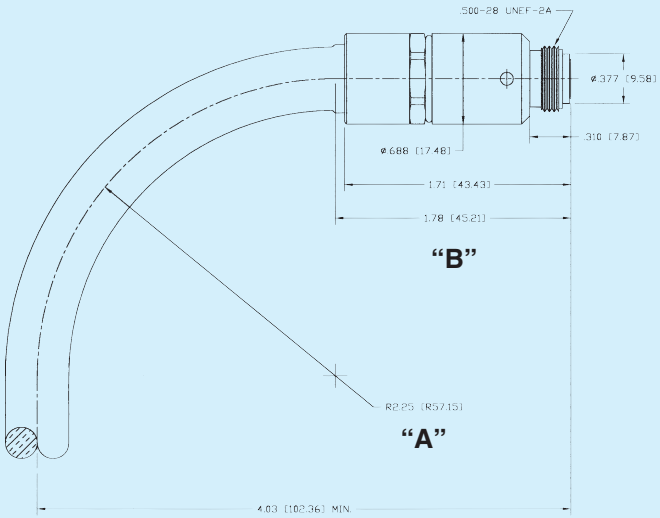
MILTECH™ ENVELOPE DIMENSIONS

MILTECH 340/340XL and MILTECH 480

MILTECH 340/340XL/EL



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	½" Open End
MILTECH 480 Int. Sec.	SD17935	1.60/46	TN550-688

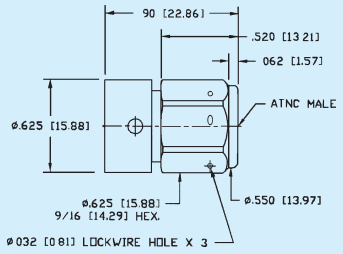
Self-Locking Replaceable Connectors

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

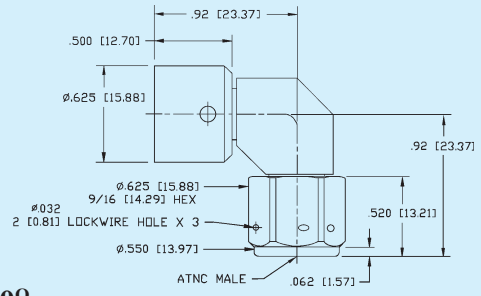
Dimensions for all replaceable connectors may be found on pages 14-17

MILTECH™ REPLACEABLE FRONT END CONNECTORS



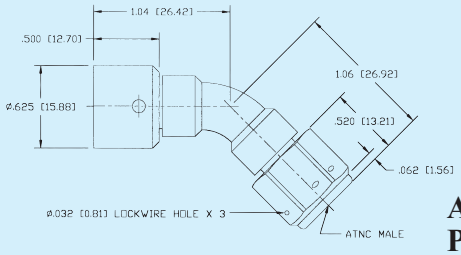
L = 0.605 (15.37)

ATNC Plug SD48555



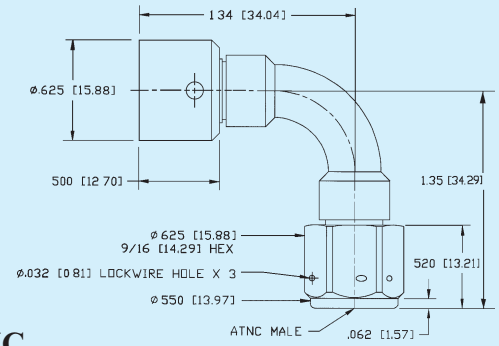
ATNC Plug 90° SD48573

L = 0.640 (16.26)



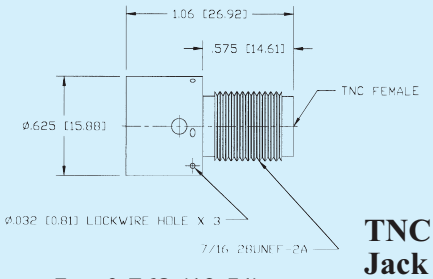
L = 1.505 (38.23)

ATNC Plug 45° SD48576



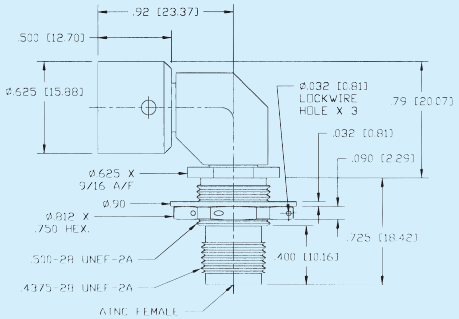
ATNC Plug 90° SD48572

L = 1.05 (26.67)



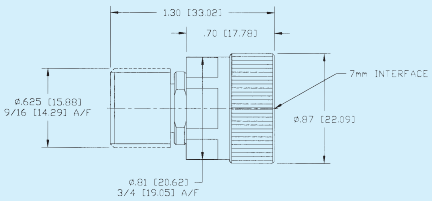
L = 0.768 (19.51)

TNC Jack SD48621-1



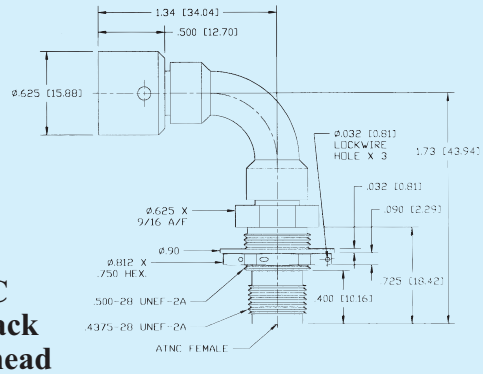
ATNC 90° Jack Bulkhead SD48609

L = 0.640 (16.26)



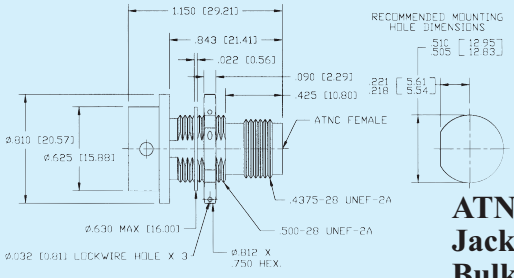
L = 1.050 (26.67)

7MM SD48703



ATNC 90° Jack Bulkhead SD48569

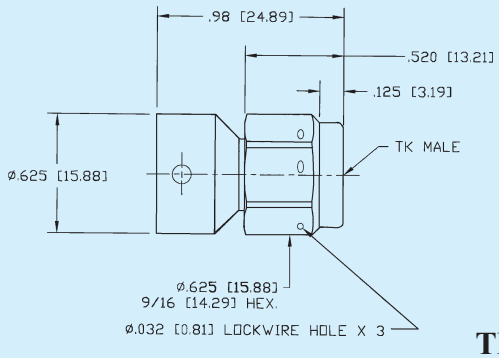
L = 1.05 (26.67)



L = 0.863 (21.92)

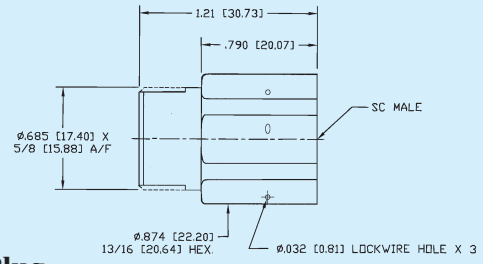
ATNC Jack Bulkhead SD48590

MILTECH™ REPLACEABLE FRONT END CONNECTORS



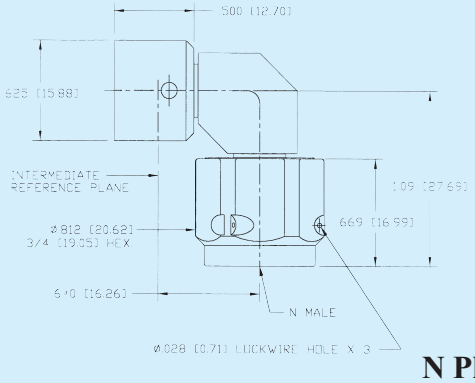
TK Plug
SD48554

L = 0.690 (17.53)



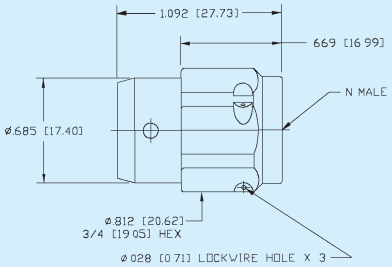
SC Plug
SD48642

L = 0.915 (23.24)



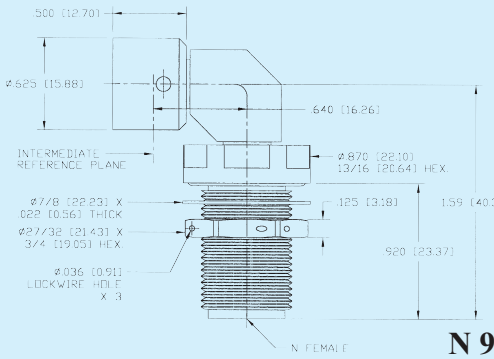
N Plug 90°
SD48628-1

L = 0.640 (16.26)



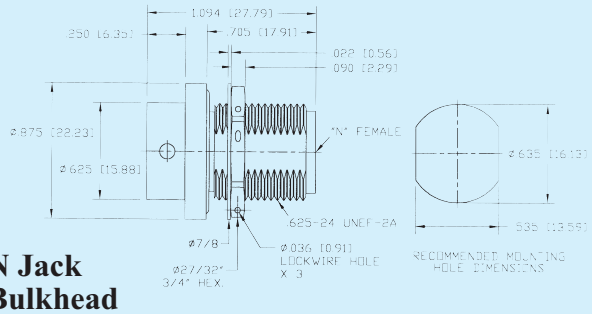
N Plug
SD48721

L = 0.802 (20.37)



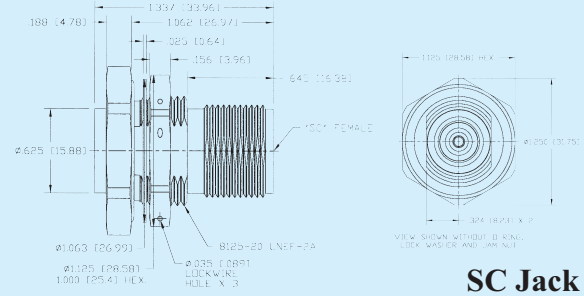
N 90° Jack
Bulkhead
SD48629

L = 0.640 (16.26)



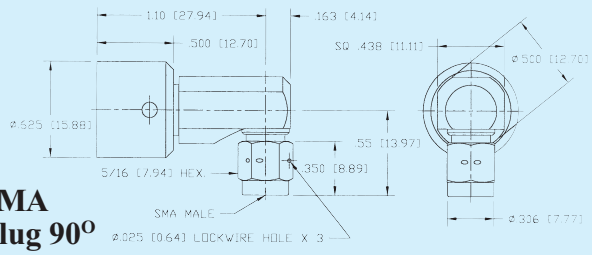
N Jack
Bulkhead
SD48667

L = 0.805 (20.45)



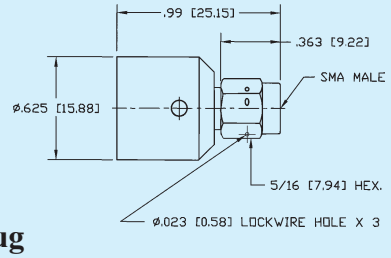
SC Jack
Bulkhead
SD48680

L = 1.047 (26.59)



SMA
Plug 90°
SD48608

L = 0.815 (20.70)



SMA Plug
SD48530

L = 0.700 (17.78)

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-PRF-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.

Figure 1

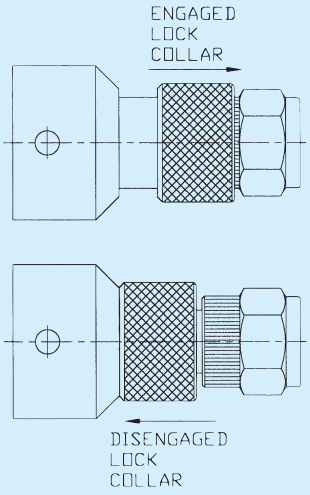
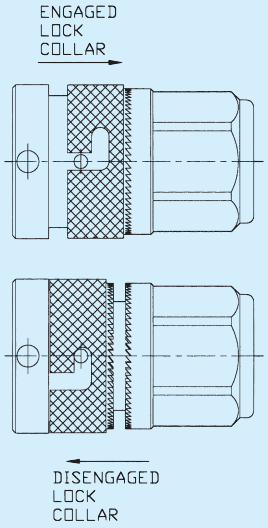
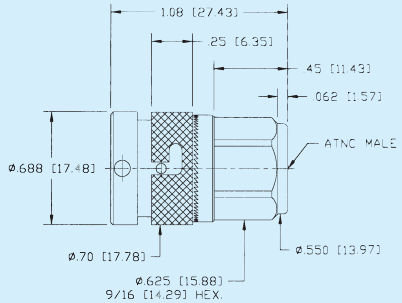


Figure 2

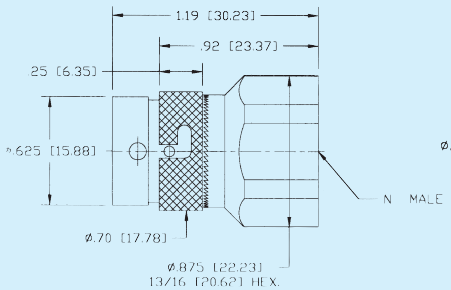


MILTECH™ REPLACEABLE FRONT END SELF-LOCKING CONNECTORS



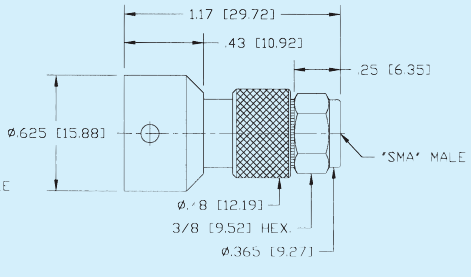
L = 0.788 (20.02)

ATNC Plug
SD48606



L = 0.905 (22.99)

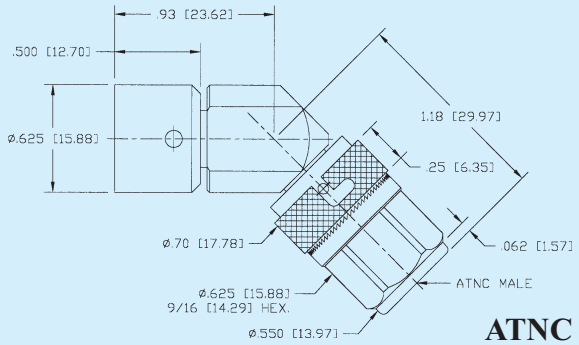
N Plug
SD48669



L = 0.878 (22.30)

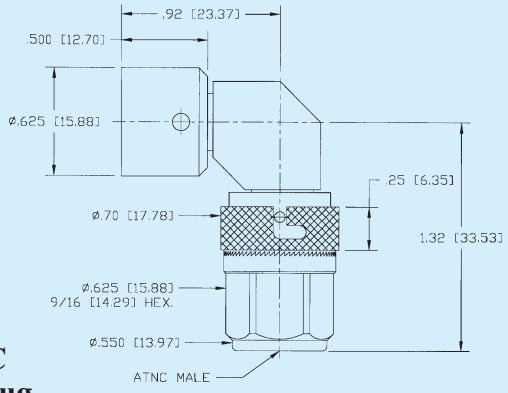
SMA Plug
SD48689

MILTECH™ REPLACEABLE FRONT END SELF-LOCKING CONNECTORS



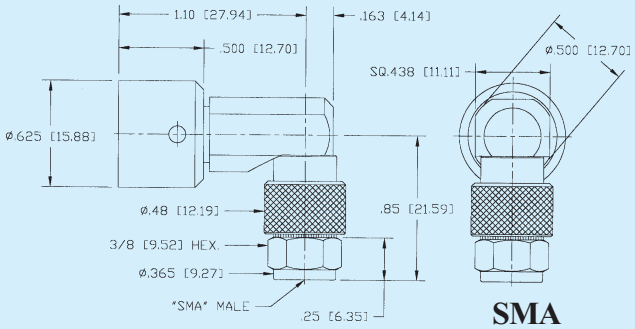
ATNC
45° Plug
SD48674

L = 1.475 (37.47)



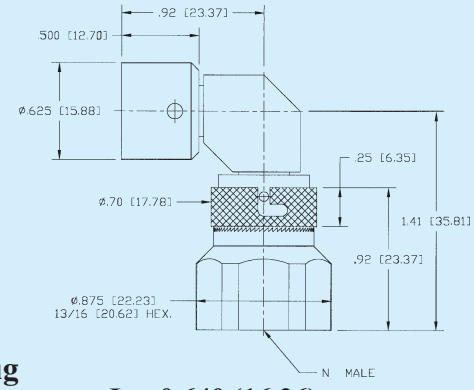
ATNC
90° Plug
SD48645

L = 0.640 (16.26)



SMA
Plug 90°
SD48688

L = 0.815 (20.70)



N
90° Plug
SD48647

L = 0.640 (16.26)

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.