

## Cable Assemblies

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## **RF & Microwave Assemblies:**

- Flexible, Conformable and Semi-Rigid Assemblies
- Cable Harnesses
- Delay Line Assemblies
- Phase Matched Assemblies
- Over Molded Cables

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## **Qualifications and Quality Standards:**

- UL Recognized (ZPFW2)
- J-STD-001 Soldering
- ISO 10012-1 Measuring Equipment

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## **Cable Operation Highlights:**

- Statistical Process Controls (SPC)
- 100% Hipot and Continuity On-Line Testing
- Connector Manufacturing
  - 1) Termination knowledge
  - 2) Cost Advantage
- Semi-Automated Equipment
- High Capacity in Excess of 100,000/week
- Pull Demand Manufacturing



# CABLE ASSEMBLY DESIGN SERVICE

Today's competitive marketplace has required systems manufacturers to shift design solutions of interconnect products to specialty suppliers. Cable assemblies are one product area where systems manufacturers have realized great success through the out-sourcing of this process. Services in design of the cable extend to the creation of new connectors to satisfy specific interconnect requirements such as those in non-magnetic applications. When these services are combined with the installation of cables into subassemblies to meet special requirements, as in the case of ESD, they can further add to a manufacturer's efficiency.

## **Manufacturing Capabilities**

To meet the needs of a successful out-sourcing program, a broad scope of capabilities are needed that place a very high focus on solution-oriented design, quality, and manufacturing techniques. The Phoenix Company meets these requirements through capabilities that center around a workcell approach to manufacturing and the use of in-process controls to ensure quality. All cable assembly products are manufactured in dedicated workcells designed to allow each phase of the manufacturing process to focus on quality. A typical coax cable assembly will have nine dimensions measured and controlled in-process through our statistical process control (SPC) program. Critical dimensions are further checked with the use of an on-line monitor that displays the upper and lower control limits.

As each measurement is taken and entered through the gauge, visual feedback is immediately provided to the operator to show the process is in control. Each cable is tested 100% for Hipot and continuity. SPC data is available to all customers upon request at no additional charge.

A pull-demand system controls the amount of work in process at each operation and streamlines the flow of material through the workcell. Line imbalances are visually identified and adjusted resulting in continuous refinements in throughput rates throughout the production of each assembly. Each workcell is designed for specific assemblies, and each team of operators is trained to support each specific type of cable assembly. Military contracts specifying Mil-Std-2000 soldering requirements can be fulfilled. Test capabilities support VSWR, insertion loss, phase, and delay measurements, as well as most standard mechanical and environmental tests.

Through the use of The Phoenix Company's design service, practical solutions can be found in applications ranging from a single cable to a complete chassis cable design. Expertise in high performance requirements can ensure the proper design and selection of components is achieved.



## Delay Lines

Custom delay line design and manufacturing capabilities are offered utilizing a variety of cable and connector styles. Delay line capabilities extend to a frequency range of 40 GHz and can be manufactured to a tolerance of  $\pm 10$  ps. A variety of propagation velocities are available through specific cables with distinct tolerances.

Engineering staff assistance in the electrical and mechanical design of individual delay requirements is available. Unique production methods support cost effective manufacturing of high density in standard packages as well as miniature custom designs. Delay lines are available in cable diameters from 0.034 to 0.250".

## Semi-Rigid Cables

Semi-rigid cable assemblies are available in diameters from 0.034 to 0.250" to meet a broad range of design requirements. Computer automated forming and processing equipment assures accuracy and minimizes variation from standard to complex designs. A design review service is available that aids in enhancing the manufacturability of your cable assembly. SPC is used throughout the assembly process to control all critical dimensions and VSWR data is available upon request.

## Cable Harnesses

A variety of cable functions can be incorporated into one cable harness by combining RF, logic, and power lines into one integrated assembly. Capabilities include building to customer specifications as well as the design of cable harnesses to fit unique chassis requirements. Mechanical operations, such as alignment or mounting functions, also can be built into harness designs.

Benefits such as minimal inventory, reduced inspection, and fewer cable installations can be realized through the integration of many cables into one harness. Each harness is built with in-process controls and tested for Hipot and continuity.

## Phase-Matching

The matching of electrical lengths of cable is available from DC to 40 GHz for both flexible and semi-rigid cable groups.

Phase-matched assemblies can be specified from among a variety of connectors and cables. An assortment of cable propagation velocities is available that will result in varying mechanical lengths per degree of phase. All phase data can be provided upon customer request.

## Over Molded Cables

Molding capabilities include standard D-subminiature connectors and cylindrical connectors to meet standard or custom mold designs. Microprocessor based molding equipment allows for fast setup and tight control over each phase of the mold cycle. Cycle time efficiency is maximized through multiple position, rotary based molding stations. Critical dimensions are ensured by using in-process controls.

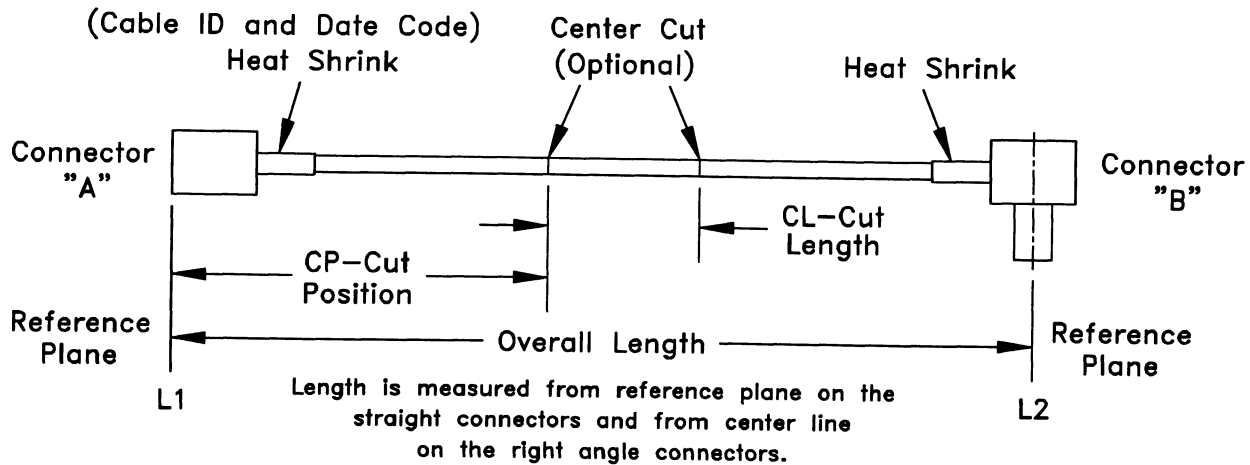
Solutions to a variety of requirements involving quality, inventory, design, and installation can be achieved through the use of The Phoenix Company's cable design service.



# FLEXIBLE CABLE ASSEMBLIES

## How To Specify Flexible Cable Assemblies

When specifying the mechanical and electrical requirements of a standard flexible cable assembly, please use the diagram below to define the following information.



Connector A _____	Connector B _____
Cable Type _____	Length, Tolerance _____
VSWR _____	Frequency Range _____
Insertion Loss _____	Cable ID and Date Code _____

### Cable Options

Phase Matching, Phase Tracking, Delay Requirements

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Other \_\_\_\_\_

## How to Specify (Center Cut) Flexible Cable Assemblies

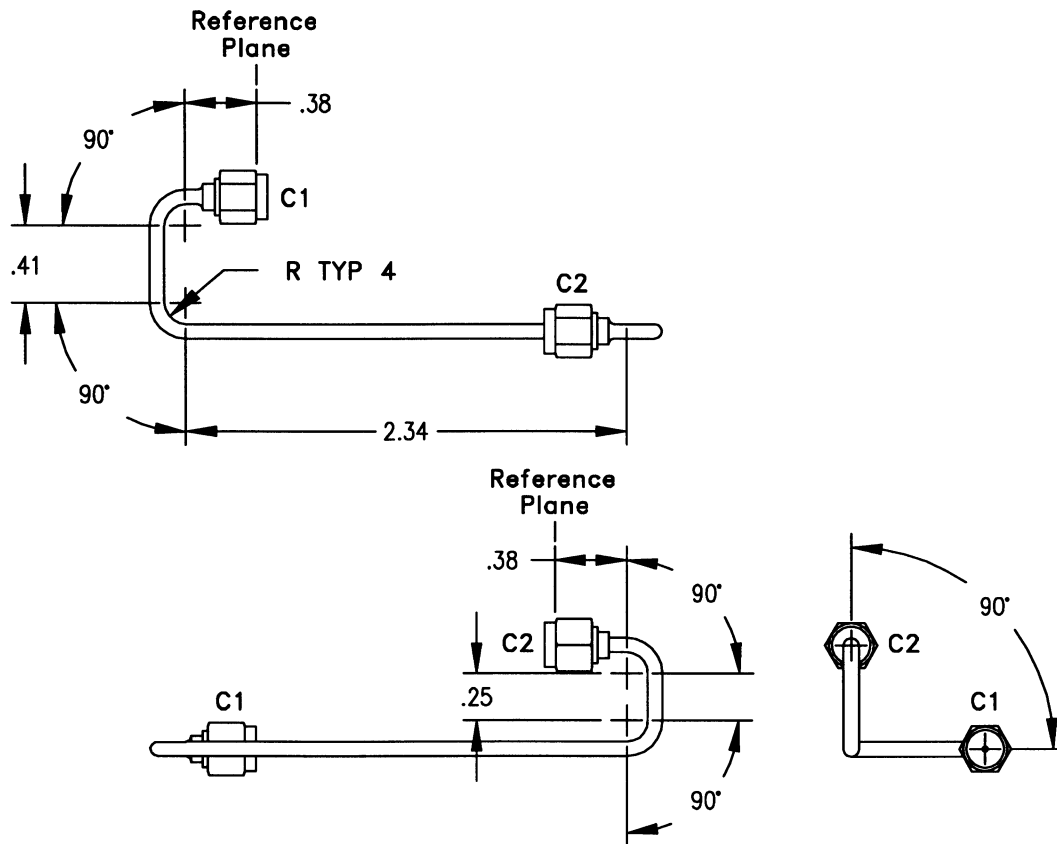
The additional information below will need to be completed when specifying a (center cut) flexible cable assembly.

L1 to L2 _____ (Overall Length)	CP-Cut Position _____	CL- Cut Length _____ Center Cut Tolerance _____
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## How To Specify Semi-Rigid Cable Assemblies

When specifying the mechanical requirements of a semi-rigid cable assembly, the diagram below can be used as an example of the preferred method for defining dimensions. Complete electrical requirements should also be listed on the drawing to assure an accurate and timely response. For cost effective assemblies, keep all inside bend radii the same.



Connector Type (C1) \_\_\_\_\_

VSWR \_\_\_\_\_  
(Optional)

Connector Type (C2) \_\_\_\_\_

Frequency Range \_\_\_\_\_  
(Optional)

Cable Type \_\_\_\_\_

Return Loss \_\_\_\_\_  
(Optional)

Cable Marker \_\_\_\_\_

Insertion Loss \_\_\_\_\_  
(Optional)

Delay Required \_\_\_\_\_  
(Optional)

Other \_\_\_\_\_

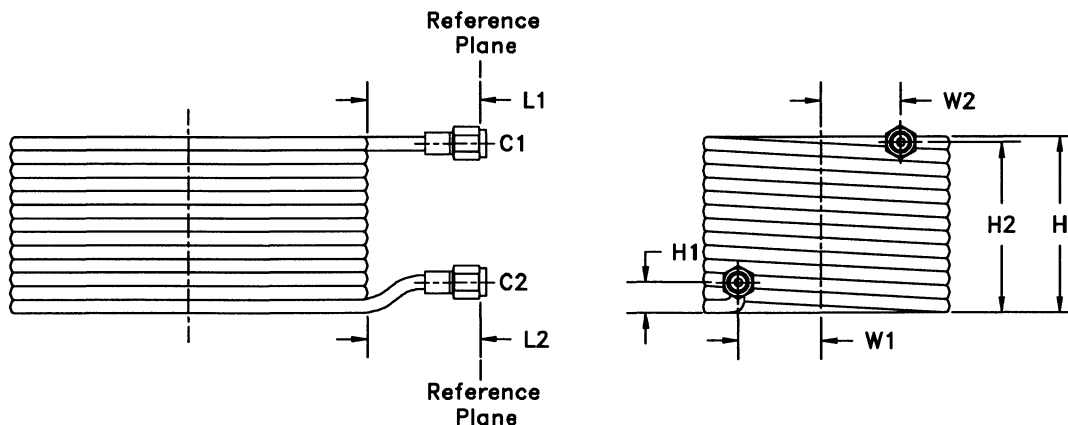
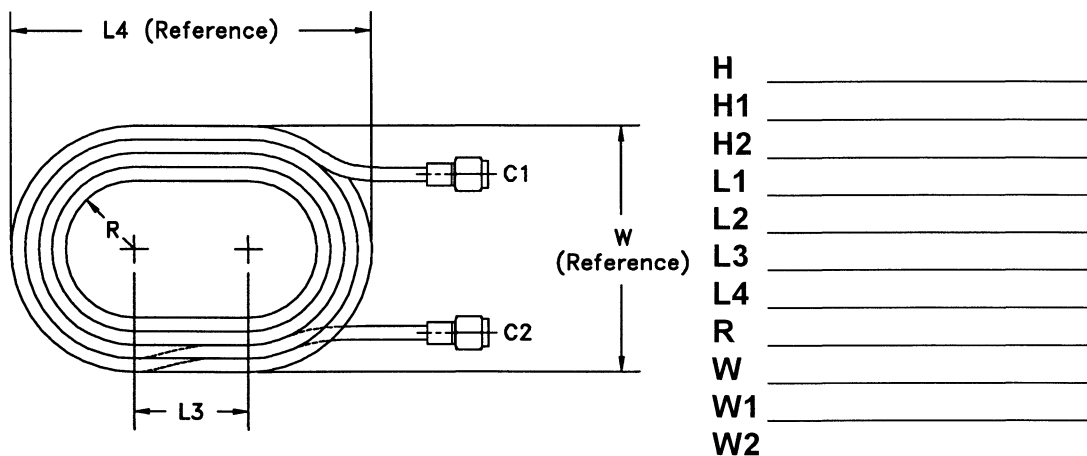
Tolerance of Delay \_\_\_\_\_  
(Optional)



# DELAY LINE ASSEMBLIES

## How to Specify Delay Line Assemblies

When specifying the mechanical requirements of a delay line assembly, the diagram below can be used as an example of the preferred method of defining dimensions. Unique dimensional shapes can also be accommodated to meet customer drawings. Complete electrical requirements should also be listed on the drawing to assure an accurate and timely response.



Connector Type (C1) \_\_\_\_\_

VSWR \_\_\_\_\_

Connector Type (C2) \_\_\_\_\_

Frequency Range \_\_\_\_\_

Cable Type \_\_\_\_\_

Return Loss \_\_\_\_\_

Cable Marker \_\_\_\_\_

Insertion Loss \_\_\_\_\_

Delay Required \_\_\_\_\_

Other \_\_\_\_\_

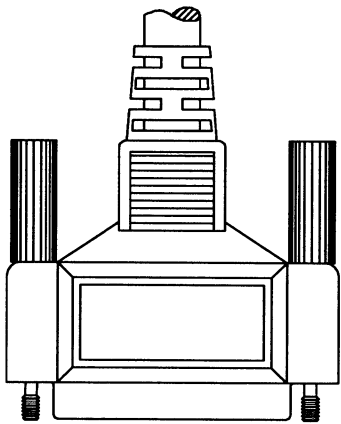
Tolerance of Delay \_\_\_\_\_

In the absence of a specification, engineering staff assistance in the electrical and mechanical design of delay lines is available.

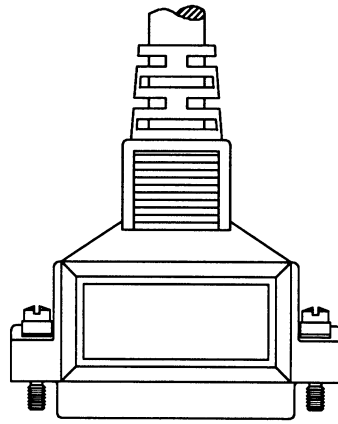


# OVER MOLDED CABLES

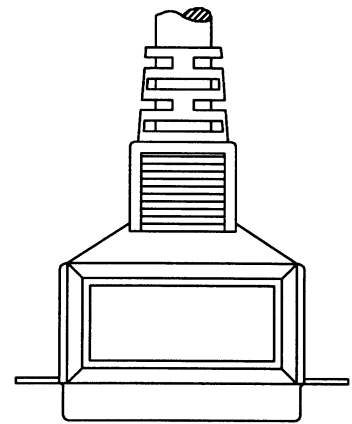
Molding capabilities include standard D-subminiature connectors and cylindrical connectors to offer standard or custom mold designs. Microprocessor-based molding equipment allows for fast set up and tight control over each phase of the mold cycle. Cycle time efficiency is maximized through multiple position, rotary based molding stations. Critical dimensions are ensured through the use of in-process controls. Solutions to a variety of requirements involving unique designs can be achieved through the use of the Phoenix Company's cable design service.



OVER MOLD WITH  
THUMBSCREWS



OVER MOLD WITH  
SADDLE WASHERS



OVER MOLD WITH  
EXPOSED FLANGES

