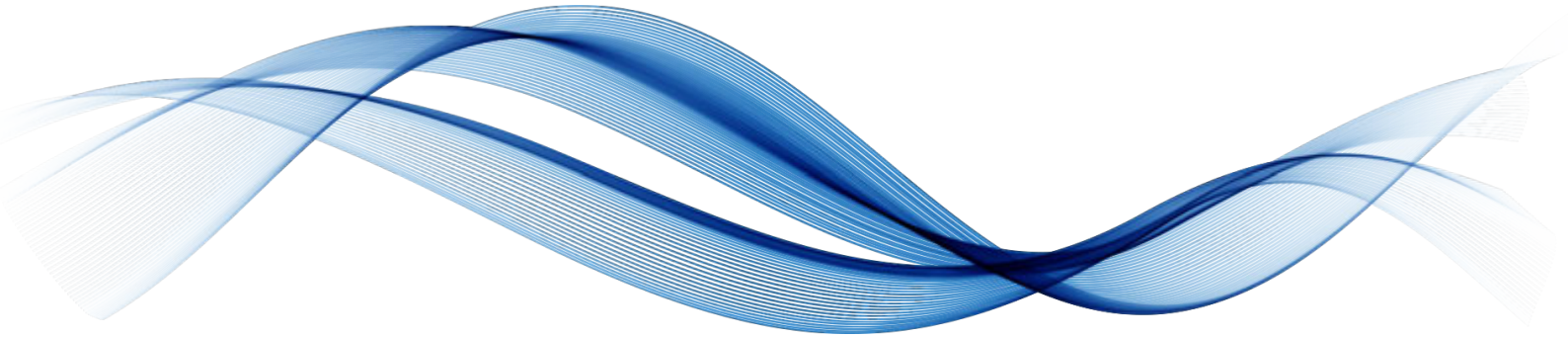
technetix



Inner Spring Design

White Paper

Technetix Group Limited
e: sales@technetix.com w: www.technetix.com

Inner Spring Design

Delivering network performance through high quality connections

Well designed inner spring connectors help:

- Prevent intermittent connections
- Reduce intermodulation distortion
- Decrease common path distortion (CPD)

Introduction

The mechanical design and resilience of the inner spring in a connector is vitally important to the optimum operation of a network.

Poorly designed inner springs can deform during connection, or fail to retain their elasticity and so not provide effective clamping force when varying thicknesses of inner conductor are connected in succession. If this happens, the result can be intermittent connections, intermodulation distortion, and common path distortion (CPD), all of which are likely to result in an increase in subscriber complaints and truck rolls.

There are three main factors that affect the quality of a connector:

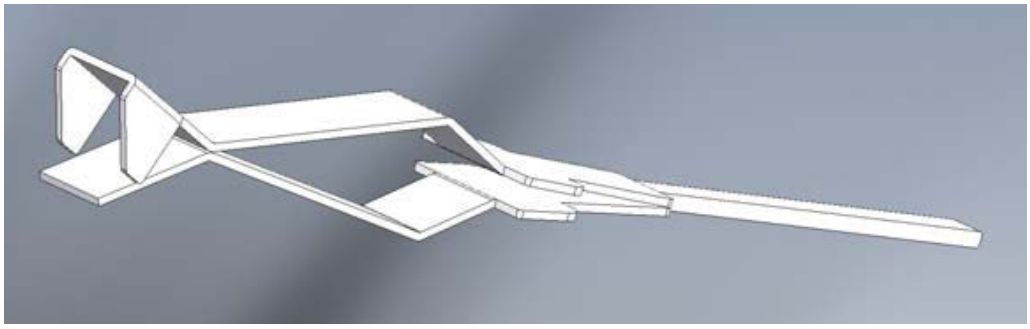
1. The mechanical design of the inner spring

2. The material used to manufacture the inner spring

3. The plating added to it

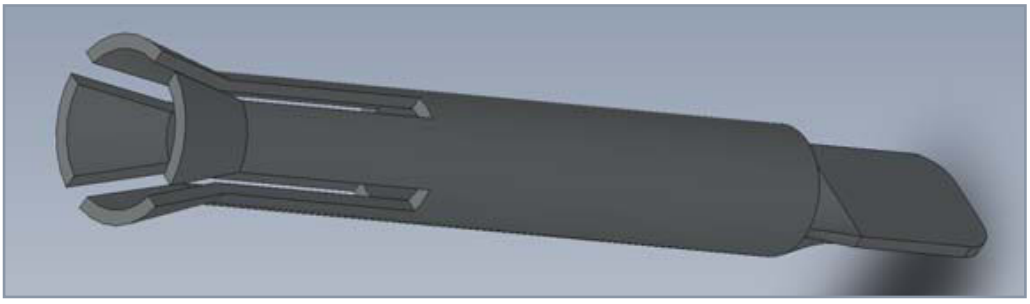
1) The two main mechanical designs

C-strap connectors



C-strap (or duck bill) connectors are extremely adaptable. Depending on the flexibility and thickness of the material used in their manufacture, they can accept a wide range of inner stingers, from thin to thick.

Tulip connectors



Tulip connectors are constructed to make contact with the inner stinger of a male connector in four places. Their shape results in good contact but for a smaller range of inner stinger diameters. For example, a tulip inner spring created to accept a 1 mm stinger will continue to give good contact if used for a connector from 0.8 mm to 1 mm, but not 0.6 mm or 1.3 mm. The 0.6 mm stinger would be too small to make contact with all four points of the tulip connector (so the connection would be poor) and the 1.3 mm stinger will overload the tulip connector, forcing it open and making it unusable for smaller diameter stingers from that point onwards.

2) Inner spring material

Inner springs are manufactured from beryllium copper (BeCu) or phosphor bronze. Both materials are able to withstand as much variation in stinger diameter as steel springs while retaining their elasticity and effective clamping force. However, beryllium copper is more resilient than phosphor bronze, and so is the best choice where stingers with a large variation of diameters are likely to be inserted into the connector.

3) Inner spring plating

It is the plating on inner springs that makes contact with the stinger of a male connector. To prevent galvanic corrosion, this plating should emit the lowest electrical current possible. Ideally the plating would be of the same material as the stinger of the male connector but this material can differ depending on the type of connector and the manufacturer. Therefore, best practice is to use a plating material that is as neutral as possible to the materials most commonly used in the manufacture of stingers.

Electromechanical potentials	Gold	Silver	Nickel	Copper alloy	Copper	Alu – bronze Brass 30% ZN	Brass 50% ZN	Bronze	Tin	Aluminium	Zinc
Gold	0	220	300	320	440	470	570	640	670	960	1270
Silver	220	0	80	100	220	250	350	420	450	740	1050
Nickel	300	80	0	20	140	170	270	340	370	650	970
Copper alloy	320	100	20	0	120	150	250	320	350	640	950
Copper	440	220	140	120	0	30	130	200	230	520	830
Alu - bronze Brass (30% ZN)	470	250	170	150	30	0	100	170	200	490	800
Brass (50% ZN)	570	350	270	250	130	100	0	70	100	390	700
Bronze	640	420	340	320	200	170	70	0	30	320	630
Tin	670	450	370	350	230	200	100	30	0	290	600
Aluminium	960	740	650	640	520	490	390	320	290	0	310
Zinc	1270	1050	970	950	830	800	700	630	600	310	0

Figure 1: Overview of the electromechanical potential between metals

Copper and nickel are the metals used most frequently for inner stingers, so the following metals can be used for the plating:

- Silver
- Nickel
- Copper alloy
- Brass (30%ZN)

Conclusion

The following table cross references and rates the various combinations of inner spring mechanical design, material and plating:

		Shape		Material		Plating	
		C-strap	Tulip	Beryllium copper	Phosphor bronze	Nickel plating	Silver plating
Shape	C-strap			++++	++	++	++++
	Tulip			+++	+	++	++++
Material	Beryllium copper	++++	+++			++	++++
	Phosphor bronze	++	+			++	++++
Plating	Nickel plating	++	++	++	++		
	Silver plating	++++	++++	++++	++++		

Figure 2: Comparison of the various combinations of inner spring attributes

Based on the results of this comparison, Technetix F-connectors use c-strap connectors with inner springs manufactured from beryllium copper and plated with silver.

For more information on Technetix Solutions, email us on sales@technetix.com or call one of our team on 01444 251 200.

About Technetix

Technetix leads the market when it comes to the enhancement of broadband cable network performance. That's why we're the tried, tested and trusted supplier to 1,100 customers in 55 countries.

We're the major European provider of products used in the final mile of broadband cable networks and our headend and access network products enable us to offer solutions end to end.