High Volume Low Cost Stamped Spring Probe Development

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Overview

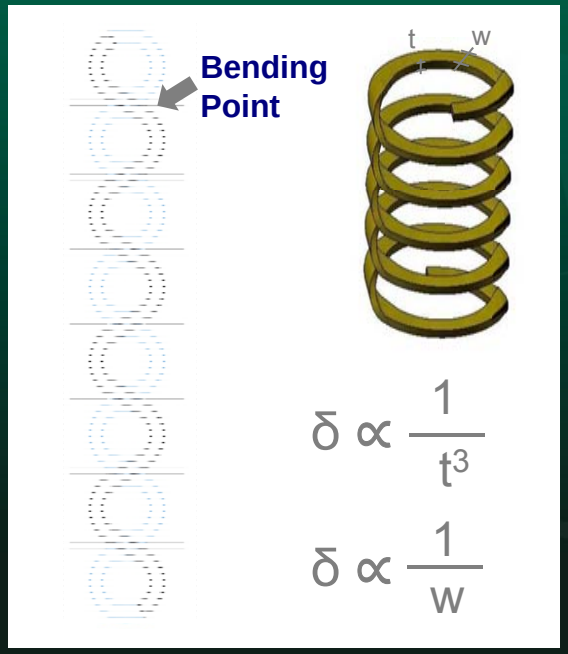
- Why trials on stamped spring probe pin
- How to make coil spring by stamping
- One piece spring probe pin by stamping
- Three piece spring probe pin by stamping
- Electrical and mechanical performance & requirements
- Importance of material selection
- Lessons learned and next step

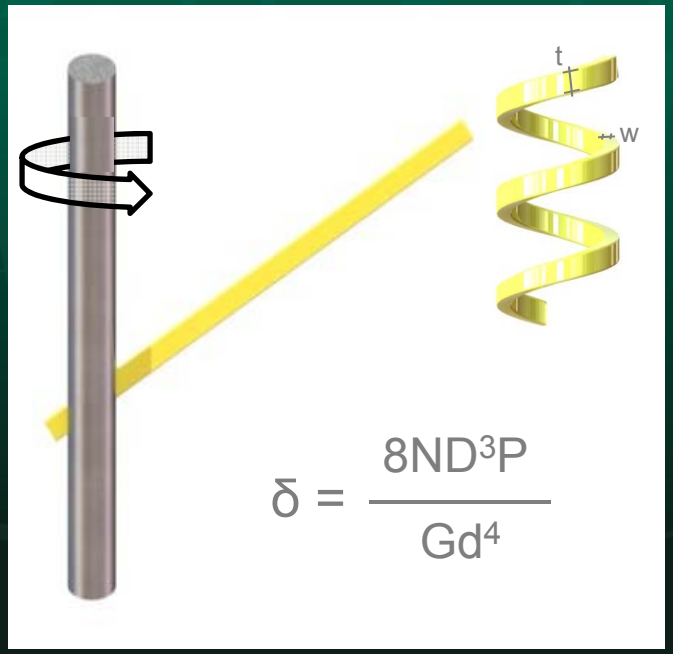
Why Trials on Stamped Spring Probe?

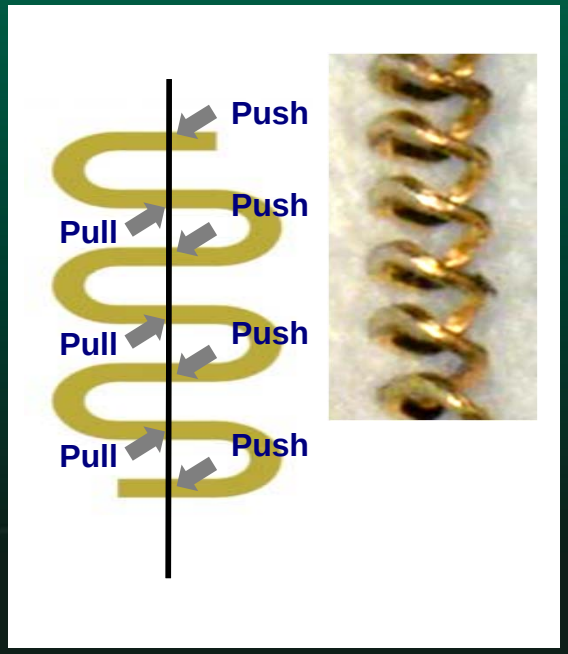
- Cost management
- Easy for mass production and quality management
- Lead time management
- Finer pitch
- High performance with short pin length

To make Coil Spring by stamping

- A few ways to make a coil spring
- Characteristic of springs from different ways of make

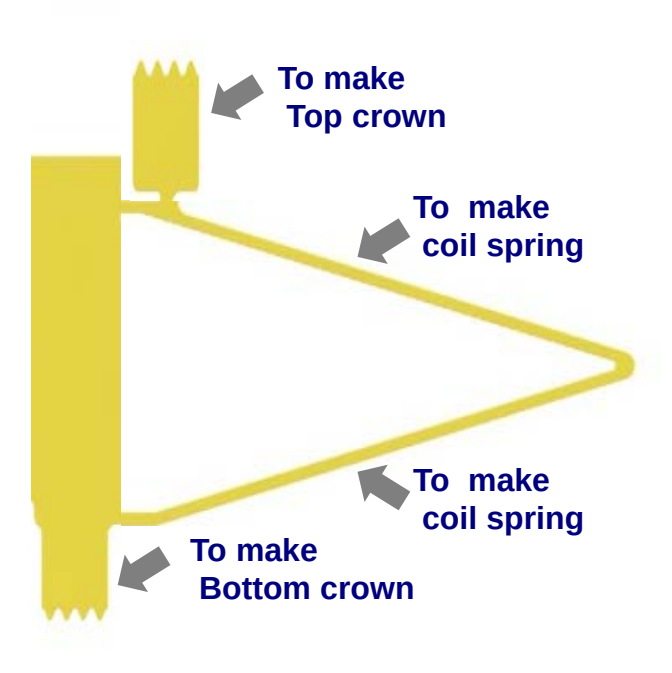


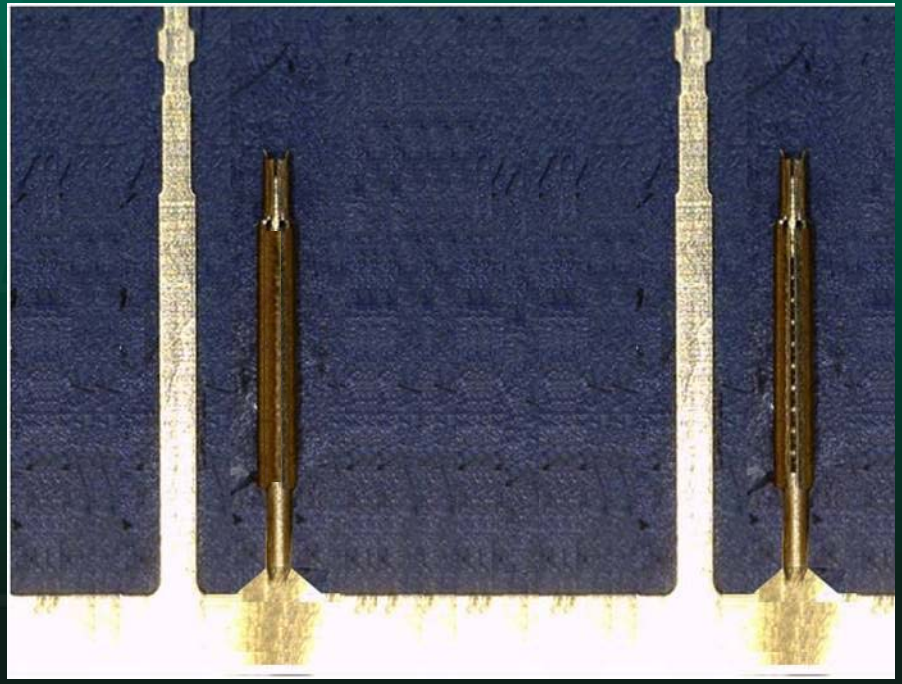




One Piece Spring Probe Pin by Stamping.

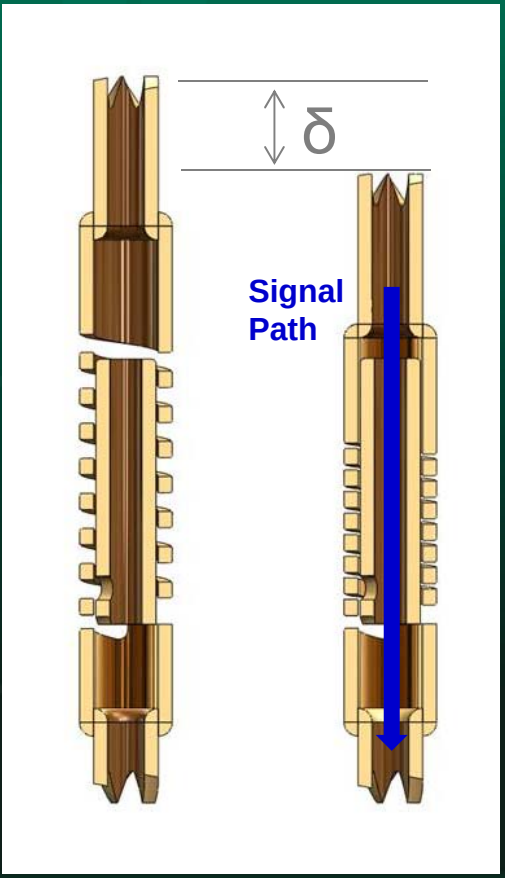
- Example 1.





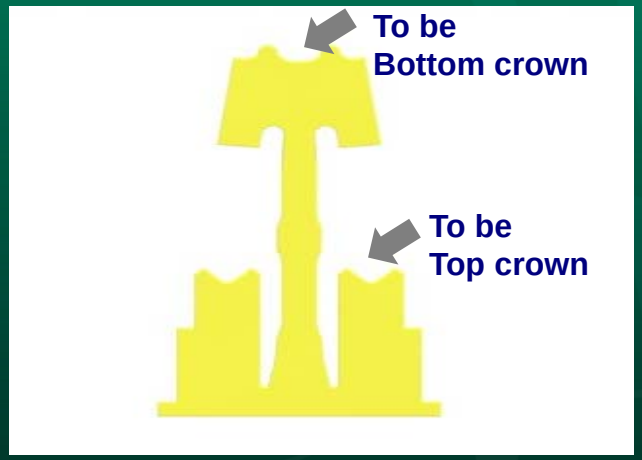
One Piece Spring Probe Pin by Stamping.

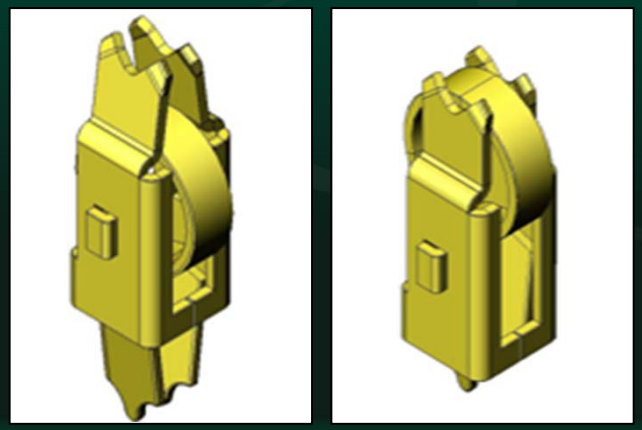
- Example 2.

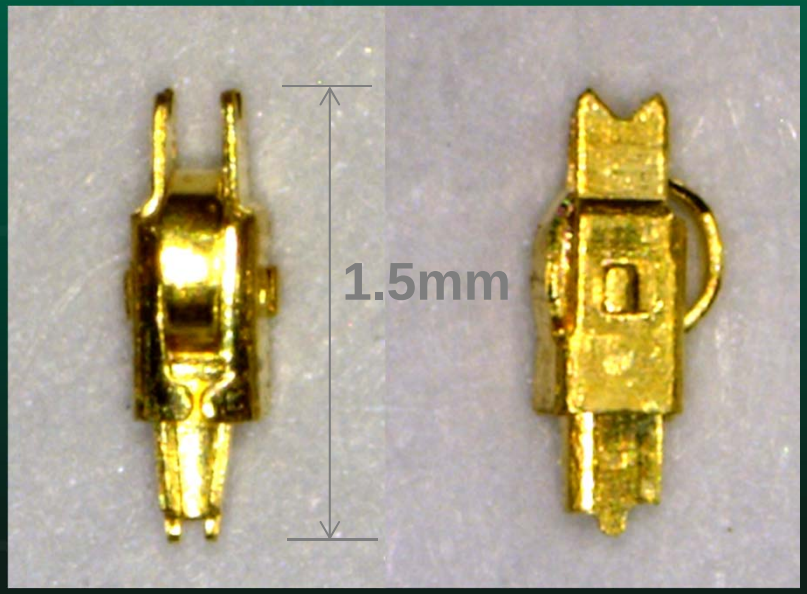


One Piece Spring Probe Pin by Stamping.

- Example 3. Spring probe pin with a plate spring

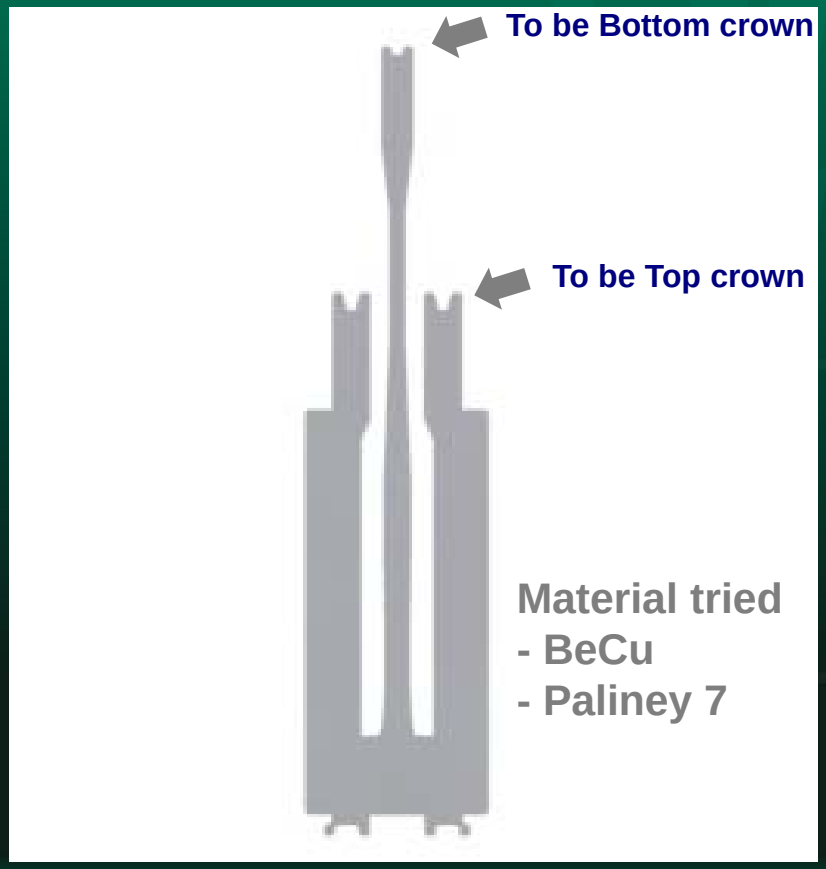


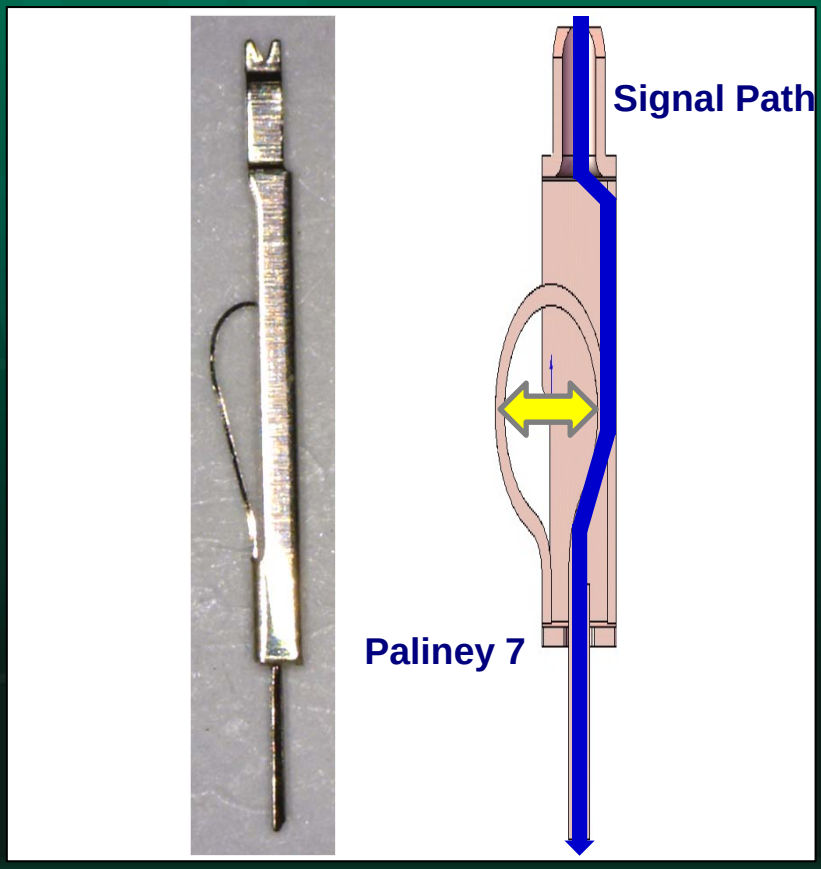




One Piece Spring Probe Pin by Stamping.

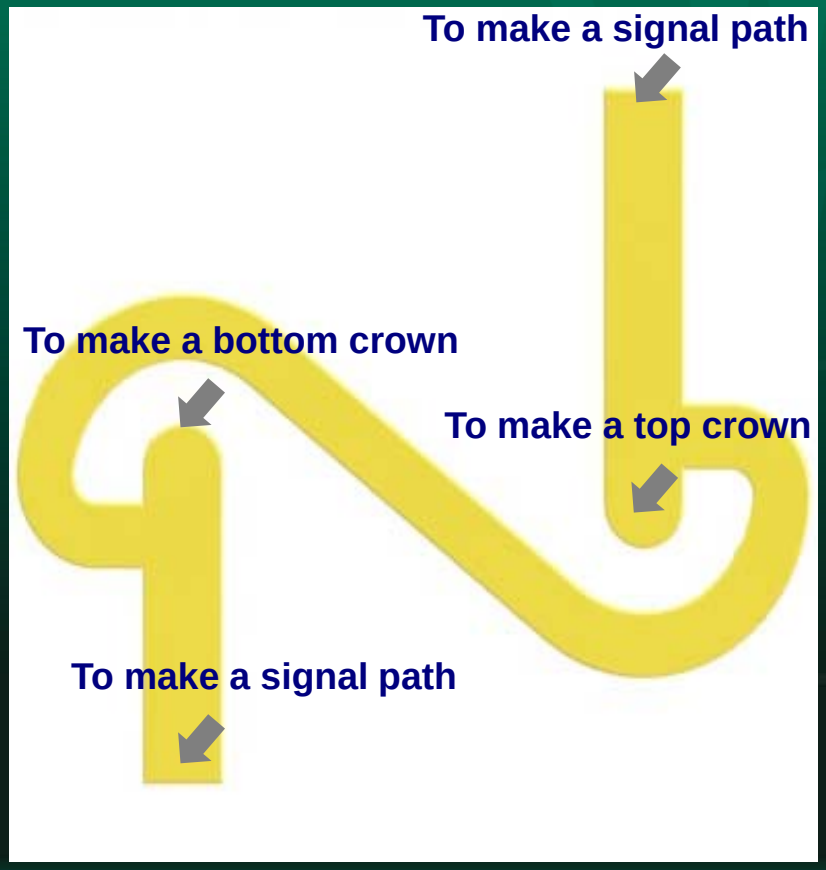
- Example 4. Spring probe pin with a plate spring

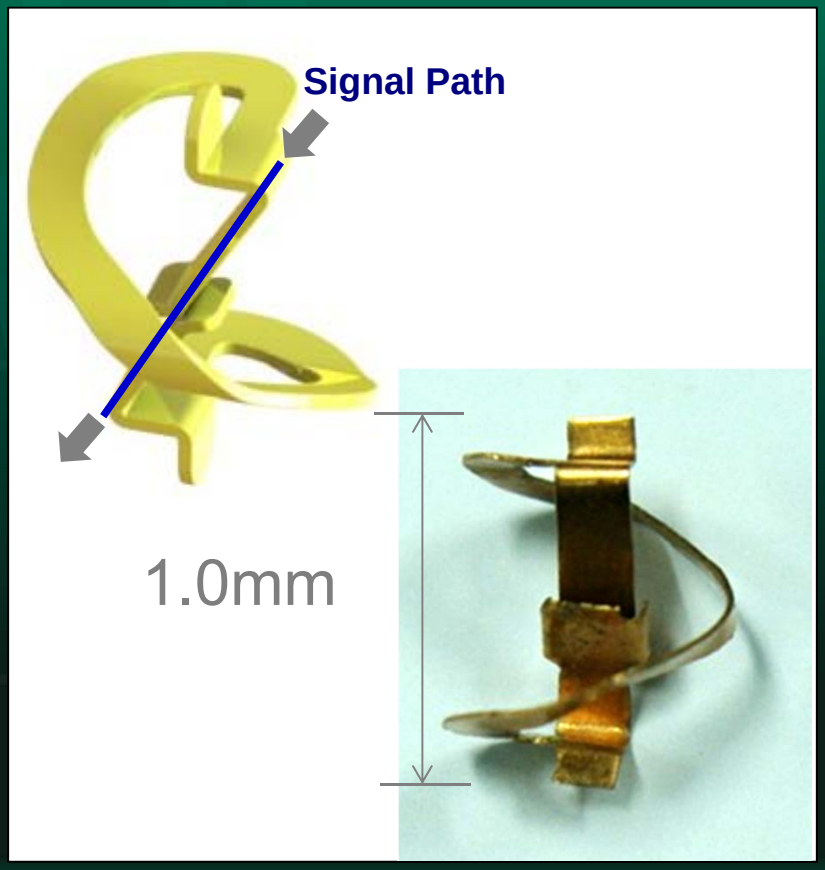




One Piece Spring Probe Pin by Stamping.

- Example 5. Spring probe pin with a plate spring





Three Piece Spring Probe Pin by Stamping

- Example 1.
  Hair pin shape spring probe with cylindrical crown

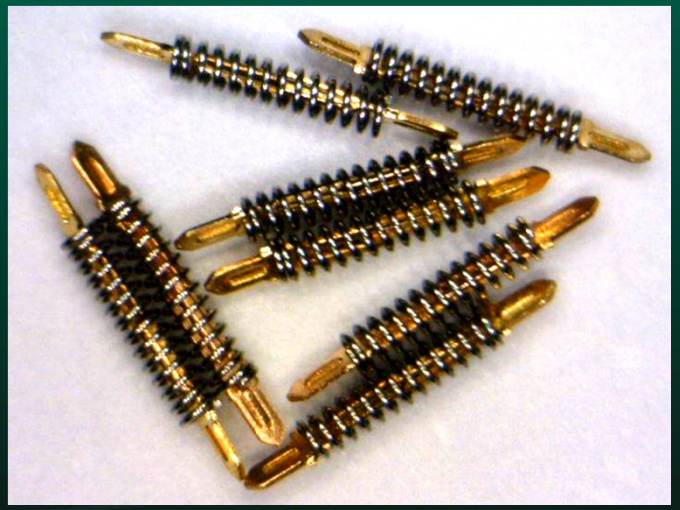
Front view

Side view

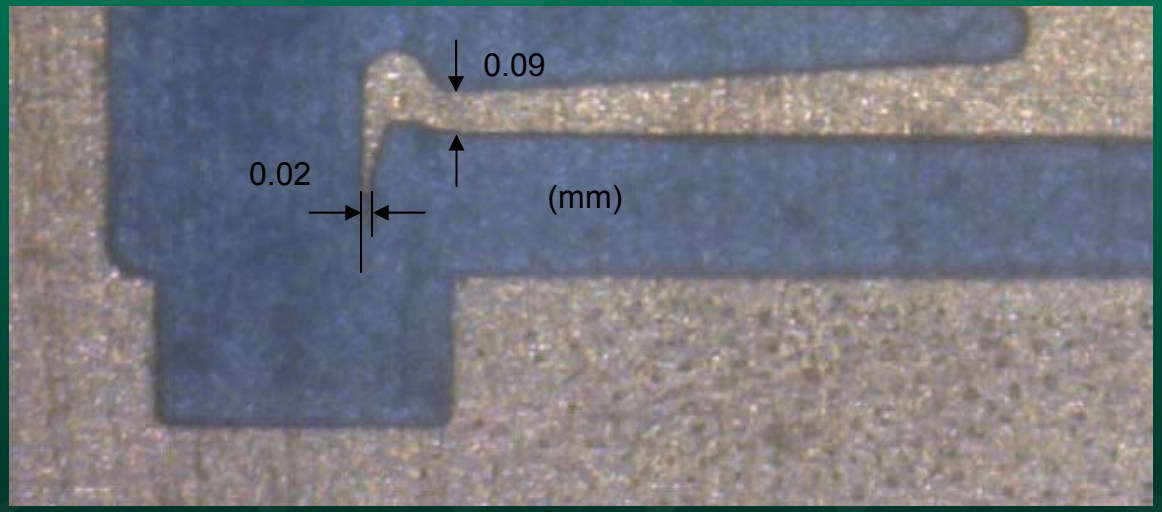
- Can choose material as needed for plunger, bridge and spring
- Long stroke for short pin is possible
- Small outer diameter is possible

Three Piece Spring Probe Pin by Stamping

- Example 2. Spring probe pin with three bridges



Example #1 Stamped Probe



Electrical and Mechanical Performance Requirements

- To provide required stroke, spring force and life.
- Thickness of metal strip
- Diameter of spring probe pin.

Material Selection (Typical High Performance Alloys Used in BiTS Applications)

- Alloy 25 (C17200)
  - Be 1.8 to 2.00%
  - Co + Ni 0.20% min
- Alloy 390 (C17460)
  - Be 0.15 to 0.50%
  - Ni 1.0 to 1.4%
- Alloy 390E (C17500)
  - Be 0.40 to 0.70%
  - Co 2.4 to 2.7%
- Alloy 3 (C17510)
  - Be 1.8 to 2.00%
  - Co + Ni 0.20% min
- Alloy 360 (NO3360)
  - Be 1.85 to 2.05%
  - Ti 0.4 to 0.6%

Material Selection (Why use Alloy 25)

PHYSICAL PROPERTIES*

Elastic Modulus	Melting Point (Solidus)	Electrical Conductivity/ resistivity	Density**	Thermal Expansion Coefficient	Thermal Conductivity (25 °C)
19,000 ksi 131 GPa	1600°F 870 °C	22-28% IACS 6.2-7.8 μΩ-cm	0.302 lb/in^3 8.36 g/cm^3	9.7x10^{-6} in/in °F 17.0x10^{-6} m/m °C	60 BTU/ft hr °F 105 W/ m K

MECHANICAL PROPERTIES*

Temper**	0.2% Offset Yield Strength		Ultimate Tensile Strength		Elon-gation ***	Hard-ness	Formability (Minimum Bend Radius to Thickness Ratio for a 90° Bend)****	
	ksi	MPa	ksi	MPa	Percent	DPH	Longitudinal	Transverse
A (TB00)	30-55	190-380	60-78	410-540	35-65	90-144	0.0	0.0
¼ H (TD01)	60-80	410-560	75-88	510-660	20-45	121-185	0.0	0.0
½ H (TD02)	75-95	510-660	85-100	580-690	12-30	176-216	0.5	1.0
H (TD04)	90-115	620-800	100-120	680-830	2-18	216-287	1.0	2.9
AT (TF00)	140-175	960-1210	165-195	1130-1350	3-15	353-413	-	-
¼ HT (TH01)	150-185	1030-1300	175-205	1190-1420	3-10	353-424	-	-
½ HT (TH02)	160-195	1100-1350	185-215	1270-1490	1-8	373-435	-	-
HT (TH04)	165-205	1130-1420	190-220	1310-1520	1-6	373-446	-	-

Lessons Learned From Trials

- Importance of material selection
- Design for easier accuracy control for stamping yield
- Design for application, outside diameter, working temperature, stroke, numbers of insertion
- Paliney7 does not require gold plating, but high material cost

Next Steps

- To serve finer pitch; Out diameter should be 0.2mm and less
- To serve high speed application; 0.55mm in length with 0.25mm stroke
- To reduce initial cost; Stamping tool design enabling various kinds of pin from one tool