HSM Wire International, Inc

Ph: 330-244-8501 Fax: 330-244-8561

www.hsmwire.com

Kovar and Invar Alloy Comparison Chart

(For reference only)

Chemical Composition %

Chemical Element	Percentage	ASTM F15 Alloy Kovar	36 Alloy Invar
Iron	Nominal	Bal	Bal
Nickel	Nominal	29	35
Cobalt	Nominal	17	0.50
Manganese	Max.	0.50	0.60
Silicon	Max.	0.20	0.40
Carbon	Max.	0.04	0.05
Aluminum	Max.	0.10	0.10
Magnesium	Max.	0.10	0.10
Zirconium	Max.	0.10	0.10
Titanium	Max.	0.10	0.10
Copper	Max.	0.20	
Chromium	Max.	0.20	0.25
Molybdenum	Max.	0.20	
Phosphorus	Max.		0.15
Sulfur	Max.		0.15

Physical Properties

Property	Unit	ASTM F15 Alloy Kovar	36 Alloy Invar
Density	Lbs/in²	0.302	0.291
Specific Gravity		8.36	8.05
Specific Heat			0.123
Curie Temp.	°F	815	535
Melting Point	°F	2640	2600
Electrical Resisitivity	Ohm-cir mil/ft	294	495
Thermal Conductivity	BTU/In/ft²/hr/°F	120.00	72.60

Mechanical Properties (As annealed)

Property	Unit	ASTM F15 Alloy Kovar	36 Alloy Invar
Tensile Strength	PSI x 1000	75	65
Yield Strength	PSI x 1000	50	40
Elongation	% in 2"	30	35
Hardness	Rockwell B	80	80
Elastic Modulus	PSI x 10(-6)		20.5

Linear Coefficient of thermal expansion cm. per cm. per °C x 10

Temp. Range - °C	Kovar	Invar
30 - 100	~	0.8 - 1.6
30 - 200	~	1.3 - 2.1
30 - 350	~	6.2 - 7.0
30 - 400	4.6 - 5.2	~
30 - 450	5.1 - 5.5	8.5 - 9.2

***To be used as a guideline only

R1.9/10/14