



**Nickel-Iron-Cobalt Alloy**

*Kovar, ASTM F15, DP1, 1.3891*

Our Kovar is produced with expansion properties similar to glass and ceramics to enable good glass-to-metal bonding. This alloy retains good formability over a wide temperature range.

**Heat Treatment**

Because of its effect on the actual structure of the material, there is a distinction made between heat treating the material to facilitate fabrication and heat treating the material to ensure optimum conditions for glass sealing, plating or brazing.

**Stress Relief Annealing**

To relieve stress and work hardening of parts at intermediate stages of fabrication, it is intended particularly for drawing, forming and spinning operations.

1. Wash and degrease parts
2. Anneal in atmosphere controlled furnace. Atmosphere may be wet or dry hydrogen, dissociated ammonia, cracked glass or similar neutral atmosphere.
3. Annealing temperature is not critical; however, high temperatures (greater than 900°C) or extended time periods (longer than 60 minutes) should be avoided because such treatments promotes grain growth.  
Typical cycle 850°C for 30 minutes.
4. Parts should be held at temperature for the indicated time and then furnace cooled to less than 175°C to avoid oxidation and/or thermal shock (which may cause distortion)

Nominal Chemical Composition		
54% Fe	29% Ni	17% Co

Mechanical Properties				
Tensile	Yield	Elongation	Modulus of Elasticity	Poisson's Ratio
525N/mm <sup>2</sup>	345N/mm <sup>2</sup>	30%	140GPa	0.317

Physical Properties		
Density	Curie Temperature	Melting Point
8.36 - 8.50 gcm <sup>-3</sup>	435°C	1450°C

Thermal Properties							
Coefficient of Expansion							
Temperature Range			x10K <sup>-1</sup>	Temperature Range			x10K <sup>-1</sup>
30°C	to	200°C	5.5	30°C	to	600°C	7.9
30°C	to	300°C	5.1	30°C	to	700°C	9.3
30°C	to	400°C	4.9	30°C	to	800°C	10.4
30°C	to	450°C	5.3	30°C	to	900°C	11.5
30°C	to	500°C	6.2				

Electrical Properties		Thermal Conductivity	
Electrical Resistivity	48.9 uOhm cm		21 Wm <sup>-1</sup> K <sup>-1</sup>

Glass Matches
Kimble: EN-1 (Owens-Corning), K650, K704
Corning: 7052 or 7050, 7055, 7056 7062 & others

