



26

Fe
55.845

Iron

28 **27**

Ni **Co**
58.6934 58.933194
Nickel Cobalt

Kovar® | ASTM F15

Controlled Expansion Alloys

DESCRIPTION

Kovar® | ASTM F15 is a vacuum melted, iron-nickel, low expansion alloy consisting of 29% Nickel, 17% Cobalt and balance Iron. Kovar's coefficient of thermal expansion characteristics match both borosilicate (Pyrex®) glasses and alumina ceramics making this alloy a desirable choice for sealing metal to glass parts. It is one of the most popular of the controlled expansion alloys for hermetic sealing and is also known as Pernifer® 2918, Dilver® P1, NILO® K.

APPLICATIONS

Power tubes, microwave tubes, transistors, diodes and hybrid packages.

TYPICAL PHYSICAL PROPERTIES

Density	lb/cu in	0.302
Specific Gravity		8.36
Curie Temp	°F	815
	°C	435
Melting Point	°F	2640
	°C	1450
Electrical Resistivity (70°F)	ohm-cir mil/ft	294
	microhm-cm	49
Thermal Conductivity	BTU-in/sq.ft-hr°F	120
	W/cm °C	0.17
Specific Heat	Cal/gm°C	0.11
	BTU-lbm-°F	0.11

Source: CarTech® Kovar Alloy Data Sheet v.10/90. | ASTM F15

FORMS | SIZES AVAILABLE

Round Bar Rod	0.040" - 7.25"
Photo-Etch Strip Coil	0.010" - 0.015"
Plate	0.187" - 1.50"
Sheet	0.010" - 0.125"
Strip Coil	0.005" - 0.060"

Listed above are our standard stock items. Our inventory fluctuates based on market demands. If you do not see the size or form you require, please call us.

TYPICAL MECHANICAL PROPERTIES

*Tensile Strength	ksi (MPa)	75 (517)
**Sheet + Strip	ksi (MPa)	82 (570) max
**Rod + Wire	ksi (MPa)	85 (585) max
*Yield Strength	ksi (MPa)	50 (345)
*Elongation	% in 2"	30
*Typical Hardness Ann.	Rockwell B	68
Modulus of Elasticity	ksi (GPa)	20,000 (138)
Poisson's Ratio		0.317

*Kovar strip tested parallel to the direction of rolling. Material annealed 1830 °F (999°C) for 30 minutes, then furnace cooled. ** Per ASTM F15, Temper A, Annealed

Source: CarTech® Kovar Alloy Data Sheet v.10/90. | ASTM F15

MEAN COEFFICIENT OF THERMAL EXPANSION AS ANNEALED

Temp Range 77 °F to	Coefficient 10 ⁻⁶ /°F	Temp Range 25 °C to	Coefficient 10 ⁻⁶ /°C	ASTM F15 CTE *
				30 °C to μm/m · °C
212 °F	3.25	100 °C	5.86	
392 °F	2.89	200 °C	5.20	
572 °F	2.85	300 °C	5.13	
662 °F	2.72	350 °C	4.89	
752 °F	2.81	400 °C	5.06	400 °C 4.60 to 5.20
842 °F	2.92	450 °C	5.25	450 °C 5.10 to 5.50
932 °F	3.41	500 °C	6.15	
1112 °F	4.34	600 °C	7.80	
1292 °F	5.06	700 °C	9.12	
1472 °F	5.73	800 °C	10.31	
1652 °F	6.25	900 °C	11.26	

Average coefficient of expansion properties after annealing in hydrogen for one hour at 1650 °F (900 °C) at 15 minutes 2010 °F (1099 °C) and cooled to room temperature within one hour.

Source: CarTech® Kovar Alloy Data Sheet v.10/90. ASTM F15 Table 4

CHEMISTRY %

Nominal Nickel 29, Nominal Cobalt 17, Nominal Iron 53

SPECIFICATIONS

ASTM F15 UNS K94610 AMS I-23011 CL1 MIL I-23011 CL1



Special Purpose Alloys & Metals From Stock

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Controlled Expansion | Glass Sealing

Ed Fagan Inc. supplies the highest quality metals and alloys including materials from Carpenter Technology Corp.

Kovar® | ASTM F15 Alloy

Forms: Plate, Round Bar, Sheet, Strip/Coil, Wire
Trade Names: Kovar®, Pernifer® 2918, NILO K®, DilverP1®

Alloy 42/46/48/52

Forms: Plate, Round Bar, Sheet, Strip/Coil, Wire
Trade Names: Pernifer®40, 46, 48, 50; NILO® 42, 46, 48, 50; Glass Seal 42, 46, 48, 50

Free-Cut Invar "36"® Alloy

Forms: Round Bar, Wire

Invar "36"® Alloy

Forms: Plate, Sheet
Trade Names: Pernifer® 36, NILO® 36, Invar

Super Invar 32-5®

Forms: Plate, Round Bar, Sheet

Refractory Metals and Alloys

Ed Fagan Inc. is your leading source for quality refractory metals and alloys. We stock Tungsten, Molybdenum and its alloys in various forms and sizes manufactured from Plansee Group.

Molybdenum

Forms: Plate, Precision Cut Wire, Round Bar, Sheet/Strip, Spooled Wire, Threaded Rod/Nuts

Molybdenum Lanthanum Oxide (ML)

Forms: Sheet – Stress Relieved, Recrystallized

Molybdenum TZM

Forms: Plate, Round Bar

Niobium

Forms: Plate, Round Bar, Sheet, Strip/Coil, Wire

Rhenium

Forms: Plate, Round Bar, Sheet, Strip/Coil

Tantalum

Forms: Round Bar, Sheet

Tungsten

Forms: Parts (To Specification), Plate, Precision Cut Wire, Round Bar, Sheet

Tungsten Alloy

Blank Forms: Flats, Parts, Plate/Sheet, Rod, Shapes

Soft Magnetic Alloys | EMI Shielding & Laminations

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Forms: Round Bar, Square Bar, Strip/Coil, Wire
Trade Names: Alloy 4750, High Permeability 49®, Magnifer® 50

EFI Alloy 79

Forms: Rectangular Bar, Round Bar, Sheet, Strip/Coil, Wire
Trade Names: Hipernom, HyMu80®, Magnifer® 7904, Molypermalloy, Permalloy 80®

Hiperco® 50, Hiperco® 50A, Hiperco® 50 HS

Forms: Plate, Round Bar, Strip/Coil

Carpenter VimVar Core Iron

Forms: Plate, Round Bar

Electrical & Electronic Nickels

Ed Fagan Inc. supplies select, commercially pure grades of Nickel in various forms and sizes.

Electronic Nickels

200/201/205/233/270

Forms: Round Bar, Sheet, Strip/Coil, Wire

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