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**Fe**  
55.845

# Kovar® | ASTM F15

## Controlled Expansion Alloys

Iron

**Ni**  
58.6934

**Co**  
58.933194

### 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 <sup>-6</sup> /°F	Temp Range 25 °C to	Coefficient 10 <sup>-6</sup> /°C	ASTM F15 CTE *
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

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PH: 562.431.2568 | Toll Free: 800.782.9657

# Special Purpose Alloys & Metals From Stock

## 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/Rod, Sheet, Strip/Coil  
Trade Names: Kovar®, Pernifer® 2918, NILO K®, DilverP1®

### Alloy 42/46/48/52

Forms: Plate, Round Bar/Rod, Sheet, Strip/Coil  
Trade Names: Pernifer®40, 46, 48, 50; NILO® 42, 46, 48, 50; Glass Sealing 42, 46, 48, 52

### Free-Cut Invar "36"® Alloy

Forms: Round Bar/Rod

### Invar "36"® Alloy

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

### Super Invar 32-5®

Forms: Plate, Round Bar/Rod, Sheet

## Refractory Metals and Alloys

Ed Fagan Inc. is your leading source for quality refractory metals & alloys. We stock DFARS Molybdenum, ML/MLS/MLR, Molybdenum TZM, Tantalum & Tungsten manufactured from Plansee.

### Molybdenum

Forms: Plate, Round Bar/Rod, Sheet/Coiled Sheet, Threaded Rod/Nuts, Wire

### Molybdenum Lanthanum Oxide (ML)

Forms: Sheet – Stress Relieved, Recrystallized

### Molybdenum TZM

Forms: Plate, Round Bar/Rod, Sheet

### Niobium

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

### Rhenium

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

### Tantalum

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

### Tungsten

Forms: Plate, Precision Cut Wire, Round Bar/Rod, Sheet

### Tungsten Alloys

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

## Soft Magnetic Alloys | EMI Shielding & Laminations

Ed Fagan Inc. is a distributor of "EMI shielding alloys" for VDM Metals GmbH the world's leading producer of these alloys.

### EFI Alloy 50

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

### EFI Alloy 79

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

### Hiperco® 50

Forms: Strip/Coil

### Hiperco® 50A

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

### Hiperco® 50 HS

Forms: Strip/Coil

### Carpenter VimVar Core Iron

Forms: Round Bar/Rod

## 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/Rod, Sheet, Strip/Coil, Wire

## Alloys and Metals We Distribute

Corrosion Resistant Alloys • High-Temperature Alloys • Stainless Steel  
• Titanium – CP, 6 Al-4V

## Ed Fagan Inc. Services

Slitting, Shearing, Saw Cutting, Grinding, Water Jet Cutting, Laser Cutting,  
Custom Stocking and Consignment Programs

**JUST-IN-TIME DELIVERY:** All of our **standard stock** items can be **shipped within 24-hours** of your order confirmation and most are **shipped the same day**. All materials certified with shipment. For special orders and non-stock materials, contact our sales team for our competitive pricing and delivery lead times.