



**ED FAGAN INC.**

# Invar 36<sup>1</sup> Controlled Expansion Alloys

769 Susquehanna Avenue, Franklin Lakes, NJ 07417 • **phone 201.891.4003**  
10537 Humbolt Street, Los Alamitos, CA 90720 • **phone 562.431.2568**

## DESCRIPTION

A low expansion alloy, consisting of 36% Nickel, balance Iron. This alloy exhibits extremely low expansion around ambient temperatures and is often used where minimum expansion is required.

## APPLICATIONS

Optoelectronics, optical and laser benches, electronics, and scientific instruments.

AKA: Invar 36<sup>1</sup>, Pernifer 36<sup>2</sup>, NILO 36<sup>4</sup>, Invar<sup>3</sup>

Footnotes: 1. Trademark Carpenter Technology Corp., Reading PA; 2. Trademark ThyssenKrupp-VDM, Germany; 3. Trademark Imphy Alloys, France; 4. Trademark Special Metals Corporation, USA



## PHYSICAL PROPERTIES

<b>Density</b>	<b>lb/cu in</b>	0.291
<b>Specific Gravity</b>		8.05
<b>Curie Temp</b>	<b>°F</b>	535
	<b>°C</b>	279
<b>Melting Point</b>	<b>°F</b>	2600
	<b>°C</b>	1427
<b>Electrical Resistivity</b>	<b>micro-ohm-cm</b>	84
	<b>ohm-cir mil/ft</b>	495
<b>Thermal Conductivity</b>	<b>W/cm °C</b>	0.10
	<b>BTU-in/sq. ft-hr-°F</b>	72.6
<b>Specific Heat</b>	<b>Cal/g-°C</b>	0.123
	<b>BTU-lbm-°F</b>	0.123
<b>Thermal Expansion</b>	<b>ppm/°F(75°F to 842°F)</b>	4.9
	<b>ppm/°C(25°C to 450°C)</b>	8.9

## MECHANICAL PROPERTIES

<b>Tensile Strength</b>	<b>ksi</b>	75
	<b>MPa</b>	518
<b>Yield Strength</b>	<b>ksi</b>	40
	<b>MPa</b>	276
<b>Elongation</b>	<b>% in 2 in.</b>	34
<b>Typical Hardness Ann.</b>	<b>Rockwell</b>	HRB 80
<b>Modulus of Elasticity</b>	<b>Mpsi</b>	20.5
	<b>kMPa</b>	141

## CHEMISTRY - maximum % unless noted

<b>Iron</b>	Bal	<b>Silicon</b>	0.40
<b>Nominal Nickel</b>	36	<b>Sulfur</b>	0.015
<b>Nominal Cobalt</b>	0.5	<b>Chromium</b>	0.25
<b>Carbon</b>	0.05		

## SPECIFICATIONS

<b>ASTM</b>	F-1684
<b>MIL</b>	I-23011 Cl 7
<b>AMS</b>	I-23011 Cl 7



## LINEAR COEFFICIENT OF THERMAL EXPANSION - (ppm per °C) Deg. °C Class 1

<b>30-100</b>	<b>0.8-1.6</b>	<b>30-375</b>	-	<b>30-550</b>	-
<b>30-150</b>	-	<b>30-400</b>	<b>7.8</b>	<b>30-600</b>	<b>11.4</b>
<b>30-200</b>	<b>1.3-2.1</b>	<b>30-425</b>	-	<b>30-700</b>	<b>12.7</b>
<b>30-250</b>	-	<b>30-450</b>	<b>8.5-9.2</b>	<b>30-800</b>	<b>13.5</b>
<b>30-300</b>	<b>4.92</b>	<b>30-475</b>	-	<b>30-900</b>	<b>13.9</b>
<b>30-325</b>	-	<b>30-500</b>	<b>9.7</b>	<b>30-1000</b>	-
<b>30-350</b>	<b>6.2-7.0</b>	<b>30-525</b>	-		

## FORMS AVAILABLE

<b>Rod</b>	0.125" - 6"	<b>Coil/Strip*</b>
<b>Sheet</b>	0.030" - 0.125"	<b>Photo-Etch*</b>
<b>Plate</b>	0.187" - 4"	

\*Though not a standard stock item, we may be able to supply you with the exact size, shape & quantities you require. Please call.



Ed Fagan Inc also specializes in locating exotic materials. So, if you can't locate that hard-to-find material you need... Put EFI's material locator service to work for you!

[www.material-locator.com](http://www.material-locator.com)

**THE MATERIALS YOU NEED,  
WHEN YOU NEED THEM**



toll free 800.348.6268  
[www.edfagan.com](http://www.edfagan.com)  
[sales@edfagan.com](mailto:sales@edfagan.com)  
international sales  
+44 (0) 1548 858 770

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## Glass Sealing/ Controlled Expansion Alloys

EFI provides the highest quality materials including materials from Carpenter Technology Corp.

### ASTM F15 Alloy:

aka Kovar & Pernifer 2918  
Coil/Strip, Sheet, Plate,  
Bar, Wire

### Invar 36:

Bar, Sheet, Plate

### 42/46/48/52 Alloy:

Coil/Strip, Sheet, Plate, Bar

### Electronic Nickel

### 200/201/233/270:

Coil/Strip, Rod, Sheet, Plate

## Soft Magnetic Alloys/ EMI Shielding & Laminations

EFI is a distributor of magnetic shielding alloys for the world's leading producer of these alloys – ThyssenKrupp VDM.

### EFI Alloy 79:

aka Magnifer 7904,  
Moly-Permalloy & HyMu 80  
Sheet, Coil/Strip

### EFI 50:

aka Magnifer 50 & High Perm 49  
Bar, Coil/Strip

### Carpenter VimVar Core Iron:

Rod, Bar

### Carpenter Hipercor 50:

Coil/Strip, Billet

## Refractory Metals/Alloys

EFI is a stocking distributor of Molybdenum & Tungsten products, as well as many other refractory metals and alloys, providing the highest quality materials available.

### Molybdenum:

Bar, Sheet, Plate, Coil/Strip

### TZM Molybdenum Alloy:

Sheet, Bar

### Tungsten:

Bar, Coil/Strip, Sheet

**Tantalum:** Sheet, Tubing

**Niobium:** Strip

**Tungsten Alloy:** Rod, Shapes

## Hard-to-Find Special Purpose Metals, Alloys and Materials

Are you spending too much of your valuable time trying to locate suppliers of specialty metals and materials? Use EFI's Material Locator (see below) to source it for you so you can get back to doing what you do best.

- Coil/Strip
- Sheet
- Plate
- Rod
- Tube
- Pipe
- Wire

## JUST IN TIME DELIVERY

All standard stock items can be **shipped within 24 hours** – and are often **shipped the same day**. All materials are certified with shipment.

## METALS WE DISTRIBUTE

Titanium  
Zirconium

High Temperature Alloys  
Corrosion Resistant Alloys  
Stainless Steel

Copper – OFE, OFHC  
Brass & Bronze  
Beryllium Copper

## SERVICES WE OFFER

Slitting, Shearing, Saw Cutting, Centerless Grinding, Water-jet Cutting, Laser Cutting,  
Custom Stocking Programs • Consignment Programs



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WHEN YOU NEED THEM**



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[sales@edfagan.com](mailto:sales@edfagan.com)  
international sales  
+44 (0) 1548 858 770

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