BH DÖVME METAL SANAYİ ve TİCARET LTD. ŞTİ.
Hatip Mah. Viawest 5 Sanayi Sitesi
Gündüz Sefası Sok. No:8/11, İç Kapı: E-11
Çorlu/Tekirdağ
info@bhmetal.com.tr
www.bhmetal.com.tr

Grade	W. Nr.	UNS	Nickel Alloys
Invar 36 / Alloy 36	1.3912	K93600 / K93603	

Nickel Alloy Properties

Invar 36 / Alloy 36 is a special low-expansion alloy developed for applications where dimensional stability under temperature changes is critical. Its main advantage is minimizing dimensional change, particularly at low and moderate temperature ranges. Good ductility, formability and weldability make it suitable for precision-tolerance components. However, **Invar 36 / Alloy 36** is not selected primarily for high corrosion resistance or high-temperature strength; it is mainly preferred for dimensional stability and low thermal expansion.

Chemical Analysis (Invar 36 / Alloy 36)

Ni %	Fe %	C %	S %	Mn %	Si %	Cr %	Co %	P %
35.00 - 37.00	Bal.	0.05 max.	0.015 max.	0.60 max.	0.40 max.	0.25 max.	0.50 max.	0.015 max.

Mechanical Properties (Soft Annealed)

Product form	Rp0.2, MPa	Rm, MPa	Elongation, %	Hardness	Density, g/cm³
Round bar	270	490	40	≤150 HV / ≤80 HRB	8.1
Plate	270	490	40	≤150 HV / ≤80 HRB	8.1

Note: Mechanical values are typical room-temperature values and may vary depending on product form, section size, annealing condition and order specification.

Application Areas

Sector / Application Area	Products
Aerospace and composite manufacturing	Carbon fiber composite molds, autoclave tooling plates, precision tooling/fixture components
Cryogenic systems and LNG	LNG tank/membrane components, liquefied gas handling equipment, low-temperature connection and support components
Electronics and semiconductor	Semiconductor equipment parts, electronic device carriers, OLED/display production components
Optical and laser systems	Laser system housings, optical support platforms, precision adjustment/connection components
Measurement, control and precision engineering	Gauges, measuring device components, reference plates requiring dimensional stability
Thermostat and bimetal applications	Bimetal thermostat strips, thermostat rods, temperature regulator rod/tube components
Space and defense	Satellite electronic carrier frames, precision mounting plates, low-expansion support elements

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Industrial tooling and special machinery	Precision machining plates, mold blocks, machine components that should not be affected by temperature changes

Description

Invar 36 / Alloy 36 service temperature should not be treated as a fixed maximum value, because this grade is selected for low thermal expansion and dimensional stability rather than high-temperature strength. Its low-expansion behavior is most pronounced at approximately -250 °C to +200 °C. It retains useful toughness and strength at cryogenic temperatures, which makes it suitable for low-temperature applications such as liquefied gases/LNG. Its Curie temperature is around 230 °C; above this range, the alloy's thermal expansion behavior starts to change. Therefore, it should not be considered a high-temperature service alloy. Weldability is generally good; however, to preserve the low-expansion characteristic, clean surfaces, controlled heat input, suitable filler metal and a controlled welding procedure should be used.

Specification

Invar 36, Alloy 36, NILO 36, Pernifer 36, Fe-Ni36, Ni36, 1.3912, UNS K93600, UNS K93603

Standards

Product form	ASTM	AMS
Round bar	ASTM F1684	AMS-I-23011 Class 7*
Plate	ASTM F1684 / ASTM B753	AMS-I-23011 Class 7*
Pressure vessel plate	ASTM A658 / ASME SA-658	—

**Note: AMS-I-23011 is a noncurrent SAE specification for iron-nickel alloys used for glass/ceramic sealing. For general commercial bar and plate orders, ASTM F1684 should be treated as the main reference unless AMS-I-23011 is specifically required by the customer specification.*

Alternative Grades

1. Invar 42

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