ALLOY 46

UNS K94600

Fe–Ni controlled-expansion alloy

Intermediate expansion alloy for electronic, glass and ceramic sealing applications.

01 PRODUCT INTRODUCTION

Alloy 46 is an iron-nickel controlled-expansion alloy selected where the expansion coefficient must be matched to a specific glass or ceramic. It occupies an intermediate nickel range between low-expansion Invar grades and higher-expansion sealing alloys. Applications include lead frames, hermetic headers, feedthroughs and precision electronic packages. Expansion data must be evaluated over the complete temperature cycle rather than at a single reference point. Final selection should consider the complete expansion curve, mating material, surface preparation, sealing temperature and service environment.

02 ENGINEERING POSITION

Core advantage	Intermediate controlled expansion; verify against mating glass or ceramic
Applications	Electronic headers · feedthroughs · glass seals · precision packages
Material class	Fe–Ni controlled-expansion alloy

03 COMMON INDUSTRY USE

Industry focus	Electronic headers · feedthroughs · glass seals · precision packages
Design note	Specify thermal expansion range, mating material and sealing cycle.

Composition & Physical Data

04 CHEMICAL COMPOSITION

Ni	45–47%	**Fe**	**Balance**
C	Specification limit	**Mn**	**Specification limit**
Si	Specification limit	**Cr**	**Specification limit**
P	Specification limit	**S**	**Specification limit**

05 PHYSICAL PROPERTIES

Density	Approx. 8.20 g/cm³
Thermal expansion	Intermediate controlled expansion; verify against mating glass or ceramic
Data status	Typical reference; specification controls acceptance

06 MATERIAL IDENTITY

Common name	ALLOY 46
UNS	K94600
Alloy family	Fe–Ni controlled-expansion alloy
Application focus	Electronic headers · feedthroughs · glass seals · precision packages

Mechanical & Thermal Performance

07 DIMENSIONAL STABILITY

Expansion basis	The coefficient varies with temperature, heat treatment, rolling direction and condition.
Design data	Use measured expansion curves over the complete operating and joining range.

08 SERVICE PERFORMANCE

Primary service	Glass / ceramic matching and precision dimensional control
Joining	Review sealing atmosphere, oxidation, wetting and interfacial reaction.
Thermal cycling	Assess mismatch stress, joint geometry and repeated temperature excursions.
Mechanical loads	Use product-form-specific tensile, yield and fatigue data.

09 APPLICATIONS

Typical use	Electronic headers · feedthroughs · glass seals · precision packages
Critical review	Confirm mating material, surface finish, joint design and quality criteria.

Fabrication, Sealing & Heat Treatment

10 FORMING & MACHINING

Forming	Use controlled forming practice and account for work hardening.
Machining	Use sharp tools, stable setup and suitable coolant.

11 JOINING GUIDANCE

Cleaning	Remove oil, sulfur, oxides and iron contamination before sealing.
Sealing	Control atmosphere, pre-oxidation, wetting and thermal cycle.
Heat input	Avoid unnecessary reheating and local distortion.
Inspection	Check dimensions, leak rate, seal integrity and surface condition.

12 HEAT TREATMENT

Heat treatment and stress relief must follow the specific product and sealing specification. Controlled annealing is used to stabilize dimensions and restore ductility after forming.

Quality control	Confirm process qualification, leak testing, dimensional inspection and traceability.

Product Forms, Standards & Procurement

13 PRODUCT FORMS

Forms	Sheet · strip · bar · wire · tube · lead frames · headers · custom parts
Condition	Annealed or stress relieved according to product and sealing route

14 RFQ INFORMATION

Material	ALLOY 46 · K94600 · controlled-expansion specification
Dimensions	Form, thickness, tolerances, length and quantity
Joining	Mating glass / ceramic, sealing temperature, atmosphere and leak rate
Documents	MTR, expansion curve, heat traceability and compliance certificates

15 TECHNICAL DISCLAIMER

Expansion values are temperature- and condition-dependent. They do not replace measured curves, joint qualification, applicable sealing standards or the certified material test report.

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