# Elastic alloy

# Alloy 3J53

## Description

Alloy 3J53 is a precipitation-hardened Fe-Ni-Cr-Ti-Al constant-modulus precision alloy, equivalent to Ni-Span C 902 (UNS N09902). It was developed to solve the problem that ordinary elastic alloys suffer obvious elastic modulus drift and frequency shift when temperature changes, which caused precision instrument and resonant component errors.

Its core advantage is an extremely low temperature coefficient of elastic modulus within -40°C ~ +80°C. It maintains stable elasticity and resonant frequency over this temperature range. It also features high elastic limit, small hysteresis, good dimensional stability and moderate atmospheric corrosion resistance. It can be formed in solution-treated condition before final aging.

**Grade**: UNS N09902, Ni-Span C 902, Ni42CrTiAl, 42НХТЮ

## Chemical Composition (wt%)

| Ni | Cr | Ti | Al | C | Si | Mn | P | S | Fe |
|---|---|---|---|---|---|---|---|---|---|
| 41.50 – 43.00 | 5.20 – 5.80 | 2.30 – 2.70 | 0.50– 0.80 | ⩽ 0.05 | ⩽ 0.80 | ⩽ 0.80 | ⩽ 0.02 | ⩽ 0.02 | Balance |

East China Alloys

# ECA

*DATASHEET*

## Technical standards

| Technical Standard | Application |
|---|---|
| YB/T 5256 | 3J1 and 3J53 alloy for elastic component |
| YB/T 5254 | Constant elastic alloy 3J53 and 3J58 for frequency component |
| AMS 5225 | Iron-Nickel Alloy, Strip 49Fe-5.3Cr-42Ni-2.5Ti-0.55Al |

## Physical Properties

### Room-Temperature Constant Parameters

| Item | Value |
|---|---|
| Density | 8.05g/cm³ |
| Poisson's ratio | 0.28-0.32 |
| Relative magnetic permeability $\mu_r$ | < 1.01 |

### Coefficient of thermal expansion

| θ/℃ | α (×10⁻⁶ /℃) |
|---|---|
| 20–100 | 11.8 |
| 20–200 | 12.2 |
| 20–300 | 12.7 |
| 20–400 | 13.1 |
| 20–500 | 13.5 |
| 20–600 | 13.9 |

### Modulus of Elasticity

| θ/℃ | GPa |
|---|---|
| 20 | 190 |
| 100 | 188 |
| 200 | 185 |
| 300 | 181 |
| 400 | 176 |
| 500 | 170 |
| 600 | 163 |

### Shear Modulus

| θ/℃ | GPa |
|---|---|
| 20 | 73 |
| 100 | 72 |
| 200 | 71 |
| 300 | 70 |
| 400 | 68 |
| 500 | 65 |
| 600 | 63 |

Disclaimer: Data is typical for reference only.

## Frequency Temperature Coefficient

| Temperature Range /℃ | $\beta_f$(×10⁻⁶ /℃) |
|---|---|
| − 60 ~ +40 | − 10 ~ +10 |
| − 40 ~ +80 | − 8 ~ +8 |
| 0 ~ +100 | − 12 ~ +12 |

## Relative Magnetic Permeability

| θ / ℃ | $\mu_r$ (fully demagnetized, low magnetic field) |
|---|---|
| 20 | 1.009 |
| 100 | 1.014 |
| 160 | 1.019 |
| 190 | Curie transition |
| 220 | 1.002 |
| 250 | 1.001 |
| 400 | 1.0005 |