

Controlled Expansion: Glass Sealing Alloys

Wire • Bar • Strip • Ribbon

These are nickel-iron based alloys that are required for applications where a hermetic seal is required between metal and glass or ceramic. They are also used for applications where a certain thermal expansion is required over a given temperature range. Examples of such applications are light bulbs, vacuum tubes, optoelectronics, etc.

Alloy 36 – This grade exhibits near zero coefficient of thermal expansion from room temperature to 100 °C. It is used for applications that cannot tolerate any dimensional changes due to temperature changes. It finds use in precision laser measurement equipment, electronic devices, instrumentation, thermostats, and in antenna/aerial technologies. Another common usage is for making the low expansion part of bimetallic thermostats.

Alloy 42 has a constant low rate of thermal expansion up to temperatures approaching 350 °C. The thermal coefficient of expansion of this alloy matches that of soft glass. As a result, it is used for glass-sealing applications in microelectronic components and vacuum devices. Alloy 42 is also used as the core of Dumet wire, which forms the glass-sealing component of the lead-in-wires used in electric light bulbs. This alloy is also used for thermostats and thermo switches.

Alloy 48 has a thermal expansion coefficient which matches that of soda-lime glass. It is used for electric wiring in glass-to-metal connections. It is also used in thermostats for industrial applications up to 450 °C.

Alloys 52 & 54 are also glass-to-metal sealing alloys that are used in compact fluorescent lamps & other electronic applications.

Specifications & Nominal Chemical Composition (%)					
Alloy	Werkstoff Nr	UNS designation	ASTM	Ni	Fe
Alloy 36	1.3912	K93600/K93603	B753	36	Balance
Alloy 42	1.3917	K94100	F29	42	Balance
Alloy 48	1.3922	K98000	F30	48	Balance
Alloy 52	2.4478	N14052	F30	52	Balance
Alloy 54	2.4475	-	-	54	Balance

Mean Coefficient of Thermal Expansion in Annealed Condition ($\mu\text{m}/\text{m}\cdot^\circ\text{C}$)					
Alloy	Temperature Range ($^\circ\text{C}$)				
	20-100	20-200	20-300	20-400	20-500
Alloy 36	1.5	2.6	5.5	8.4	10.1
Alloy 42	5.3	5.3	5.3	6.2	8.0
Alloy 48	8.5	8.6	8.7	8.8	9.1
Alloy 52	10.3	10.2	10.2	10.1	9.9
Alloy 54	10.3	10.3	10.2	10.1	10.2