

Metal Foil Ultra-Precision Resistors

Wilbrecht Series WA and Series WB



FEATURES

- Temperature Coefficient of Resistance (TCR): ± 2.5 ppm/ $^{\circ}$ C available
- Selected TCR Tracking: to 0.5 ppm/ $^{\circ}$ C (matched sets)
- Shelf Life Stability: ± 25 ppm maximum for 1 year
- Power Rating: 0.3 Watts at 125 $^{\circ}$ C
- Load Life Stability: ± 150 ppm Maximum ΔR (2000 hours at rated power)
- Resistance Tolerance: $\pm 0.005\%$ to $\pm 1.0\%$
- Resistance range: 2.99 Ohms to 200K Ohms
- Current Noise: 0.010 μ V (RMS)/ Volt of Applied Voltage
- Thermal EMF: 0.1 μ V/ $^{\circ}$ C Maximum; 0.05 μ V/ $^{\circ}$ C Typical; 1 μ V/Watt
- Rise/Decay Time: 1.0 nanosecond @ 1K Ohms

Manufactured in our Huron, SD factory, the WA and WB series metal foil ultra-precision resistors are designed for the most stringent temperature and drift stability requirements. Demanding applications such as oil field data-logging, commercial flight navigation systems, and automated IC test equipment routinely use our metal foil resistors.

Ultra-Precision Resistors

Series WA and Series WB

Composition of Series Number

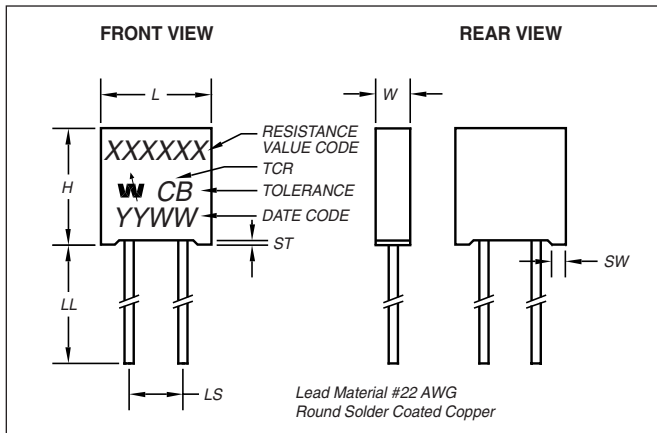
Example:

WA C 10K000 A

Tolerance
Resistance Value
TCR: C = ± 5.0 ppm/ $^{\circ}$ C; K = ± 2.5 ppm/ $^{\circ}$ C
Series: WA WB

Resistance value, in ohms, is expressed by a series of 6 characters. 5 of which represent significant digits while the 6th - R or K - is a dual purpose letter that designates both the value range (R for ohmic; K for kilo-ohm) and the location of decimal point.

Configuration

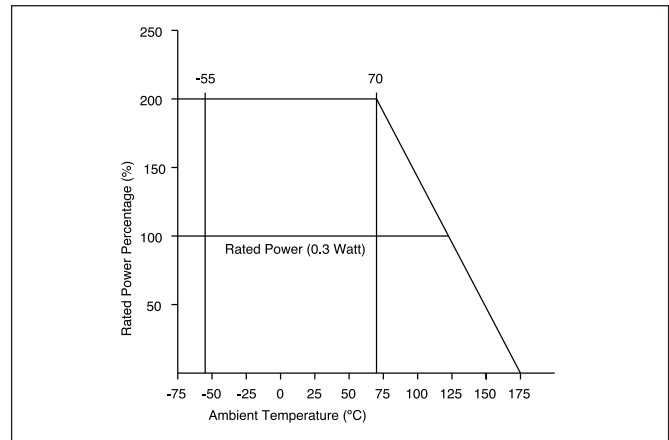


Series	Dimensions	mm	Inches
WA WB	L	7.9 \pm 0.2	0.311 \pm 0.008
	SW	1.0 max	.039 max
	H	8.3 \pm 0.2	0.327 \pm 0.008
	ST	0.3 max	0.012 max
	LL	25 \pm 5	1.0 \pm 0.2
WA	W	2.8 \pm 0.2	0.110 \pm 0.008
	LS	3.81 \pm 0.25	0.150 \pm 0.010
WB	W	2.3 \pm 0.2	0.091 \pm 0.008
	LS	5.08 \pm 0.25	0.200 \pm 0.010

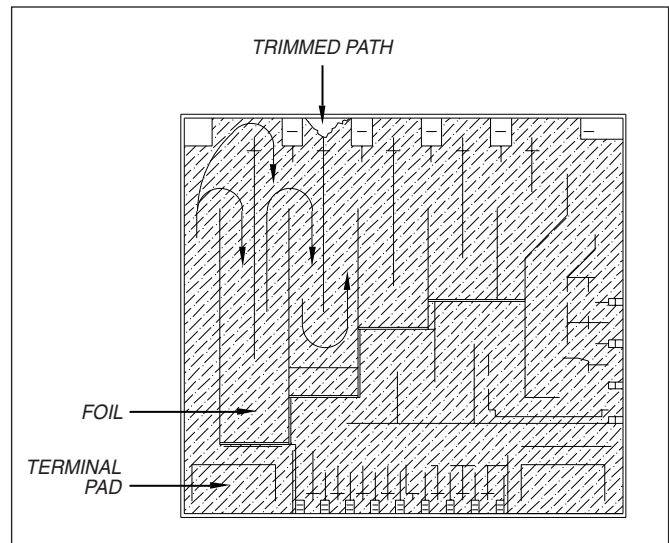
TCR, Resistance Range, Tolerance, Rated Power

Series	TCR (ppm/ $^{\circ}$ C) -55 $^{\circ}$ C to +125 $^{\circ}$ C	Resistance Range (Ω)	Resistance Tolerance (%)	Rated Power (W) at 125 $^{\circ}$ C
WA WB	C(± 5.0) K(± 2.5)	5 - 30 Ω	± 0.1 (B) ± 0.5 (B) ± 1 (F)	0.3 up to 100K Ω 0.2 over 100K Ω
	C(± 5.0)	30 - 150K Ω	± 0.005 (V) ± 0.01 (T) ± 0.02 (Q) ± 0.05 (A)	
	K(± 2.5)	30 - 100K Ω	± 0.1 (B) ± 0.5 (D) ± 1 (F)	

Power Derating Curve

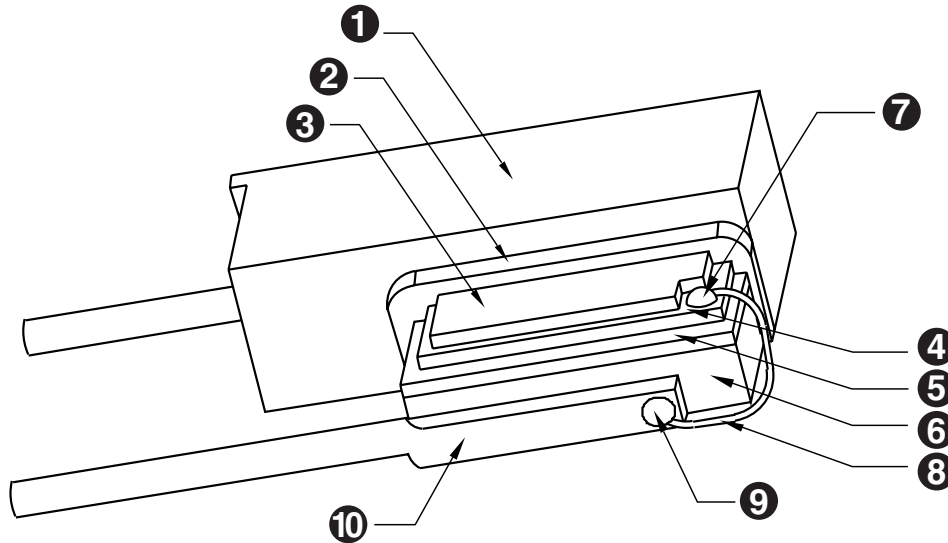


Adjustment of Resistance Value



Low TCR nichrome foil, bonded to an alumina substrate, is photoetched to create a resistance pattern. Sections of the resistance pattern can be trimmed to provide overall resistance tolerances as tight as $\pm 0.005\%$. The resulting current path (arrows in diagram) is stable and will not generate electrical noise over time.

WA
WB



- 1** TRANSFER MOLDED EPOXY
- 2** MOISTURE BARRIER / BUFFER COATING
- 3** PROTECTIVE COATING
- 4** NiCr FOIL (ETCHED RESISTIVE ELEMENT)
- 5** BONDING LAYER
- 6** ALUMINA SUBSTRATE
- 7** EXPOY STRENGTHENED WELD JOINT
- 8** SECONDARY LEAD (FOR MECHANICAL STRESS RELIEF)
- 9** HIGH TEMPERATURE SOLDER
- 10** THROUGH HOLE LEAD

Stability	
Load Life at 2,000 hours	±0.015% Max. ΔR @ 0.3W/+125°C
Load Life at 10,000 hours	±0.005% Max. ΔR @ 0.1W/+70°C ±0.05% Max. ΔR @ 0.3 W/+125°C ±0.01% Max. ΔR @ 0.05 W/+125°C
Shelf Life Stability	±0.0025% Max. ΔR after 1 year ±0.005% Max. ΔR after 3 years
Current Noise	0.010μV(RMS)/Volt of applied voltage (-40dB)
High Frequency Operation	
Rise/Decay Time	1.0ns at 1KΩ
Inductance (L)	0.1μH max.; 0.08μH typical
Capacitance (C)	1.0pF max.; 0.5pF typical
Voltage Coefficient	< 0.1ppm/V
Thermal EMF	0.1μV/°C max.; 0.05μV/°C typical 1μV/Watt ("C" TCR)

Rugged Molded Construction Minimizes Lead Stress

The nichrome foil resistance element is protected by a moisture barrier and sealed in a molded epoxy housing. Internal secondary leads provide the strain relief necessary to protect the resistor lead terminations from outside shock and vibration.

TCR Specifications

"C" TCR	Nominal TCR	+0.6ppm/°C (0°C to +25°C) -0.6ppm/°C (+25°C to +60°C) +2.2ppm/°C (-55°C to +25°C) -1.8ppm/°C (+25°C to +125°C)
	Maximum TCR Spread from Nominal	±2.5ppm/°C (+0°C to +25°C and +25°C to +60°C) ±2.3ppm/°C (-55°C to +25°C and +25°C to +125°C)
"K" TCR	Nominal TCR	-0.3ppm/°C (0°C to +25°C) +0.3ppm/°C (+25°C to +60°C) -1.0ppm/°C (-55°C to +25°C) ±1.0ppm/°C (+25°C to +125°C)
	Maximum TCR	±2.5ppm/°C (+0°C to +25°C and +25°C to +60°C) ±2.5ppm/°C (-55°C to +25°C and +25°C to +125°C)