



Strain Gages

Outline

Lead-wire cable

General

Waterproof

Concrete

Composite material  
PCB  
PlasticsUltra-small strain  
High temp.  
Low temp.

High elongation

Non-magnetoresistive

Hydrogen gas  
BendingWith protector  
Embedded

Crack

Adhesive  
Coating agent

Custom-designed

# Major Properties of Kyowa Strain Gages

	Models/ series designation	Materials		Operating temperature in combination with major adhesives after curing (°C) *1	Self- temperature- compensation (°C)	Applicable linear expansion coefficients ( $\times 10^{-6}/^{\circ}\text{C}$ ) *2	Strain limits at normal temp. (Approx.) *2	Fatigue lives at normal temp. (Times) *3	Pages
		Resistive elements	Bases						
For general stress measurement	General-purpose Foil Strain Gages KFGS	For general purpose	CuNi alloy foil	CC-33A CC-36 EP-340 PC-600	-196 to 120 -30 to 100 -55 to 150 -196 to 150	10 to 100	5, 11, 16, 23, 27	5.0%	1.2×10 <sup>7</sup> <b>1-18</b>
		For sensing element of transducers		PC-600 EP-340	-196 to 150 -55 to 150	10 to 100	11, 16, 23, 27	5.0%	1.2×10 <sup>7</sup> <b>1-24</b>
		For concrete		CC-35	-10 to 80	10 to 100	11	5.0%	1.2×10 <sup>7</sup> <b>1-31</b>
		Concentrated stress measurement		CC-33A CC-36 EP-340 PC-600	-196 to 120 -30 to 100 -55 to 150 -196 to 150	10 to 100	11, 16, 23, 27	—	— <b>1-22</b>
		Residual stress measurement		CC-33A CC-36 EP-340 PC-600	-196 to 120 -30 to 100 -55 to 150 -196 to 150	10 to 100	11, 16, 23, 27	—	— <b>1-25</b>
	Strain Gages for Measuring Axial Tension of Bolts KFB	CuNi alloy foil	Polyimide	EP-370	Normal temp. to 50	—	—	—	— <b>1-26</b>
	Foil Strain Gages with a Temperature Sensor KGFT	CuNi alloy foil	Polyimide	CC-33A CC-36 EP-340	-10 to 120 -10 to 100 -10 to 120	10 to 100	11, 16, 23, 27	3%	1×10 <sup>6</sup> <b>1-26</b>
	Foil Strain Gages KFRB	Strain measurement at mid tempera- ture, for transducers	NiCr alloy foil	PC-600 CC-33A EP-340	-196 to 150 -196 to 120 -55 to 150	0 to 150	11, 16, 23	2.2%	1×10 <sup>6</sup> <b>1-27</b>
		Concentrated stress measurement		PC-600 CC-33A EP-340	-196 to 150 -196 to 120 -55 to 150	0 to 150	11, 16, 23	—	— <b>1-28</b>
	Waterproof Foil Strain Gages KFWB	CuNi alloy foil	Polyimide	CC-33A CC-36 EP-340	-10 to 80 -10 to 80 -10 to 80	10 to 80	11, 16, 23	2.8%	3×10 <sup>4</sup> <b>1-29</b>
	Small-sized Waterproof Foil Strain Gages KFWS	CuNi alloy foil	Polyimide	CC-33A EP-340	-10 to 80 -10 to 80	10 to 80	11, 16, 23	5.0%	3×10 <sup>4</sup> <b>1-30</b>
	Weldable Waterproof Foil Strain Gages KCW	NiCr alloy foil	Stainless steel	(Spot welding) -20 to 100	10 to 90	11	—	—	— <b>1-30</b>
	Wire Strain Gages KC	CuNi alloy wire	Paper base + phenol-epoxy	CC-35	-30 to 120	10 to 60	11	1.8%	1.5×10 <sup>5</sup> <b>1-31</b>
	Embedded Strain Gages KM	CuNi alloy	Acrylate	(Embedment) -10 to 70	0 to 50	11	0.2%	—	— <b>1-32</b>
	Concrete-embedded Strain Gages KMC	CuNi alloy wire	Silicone	(Embedment) Normal temp. to 70	—	—	0.3%	—	— <b>1-32</b>
For composite materials, plastics and rubber	Foil Strain Gages for Composite Materials KFRPB	NiCr alloy foil	Polyimide	EP-34B CC-33A	-55 to 200 -196 to 120	0 to 150	1, 3, 6, 9	2.2%	1×10 <sup>6</sup> <b>1-33</b>
	Foil Strain Gages for Printed Boards KFRS	NiCr alloy foil	Polyimide	CC-33A PC-600	-196 to 120 -196 to 150	-30 to 120	13	1.6%	2×10 <sup>6</sup> <b>1-34</b>
	Foil Strain Gages for Plastics KFP	CuNi alloy foil	Polyimide	EP-34B CC-33A CC-36	-20 to 80 -20 to 80 -20 to 80	10 to 80	65	3.0%	1×10 <sup>6</sup> <b>1-35</b>
For ultrasmall strain measurement	Semiconductor Strain Gages KSPB	Ultra-small strain: for sensing element of highly sensitive transducers	P type Si	Polyimide	CC-33A EP-340	-50 to 120 -50 to 150	—	0.3%	*A $2\times 10^6$ <b>1-36</b>
		Ultra-small strain: 2- element, temperature- compensation type	P type Si N type Si	Polyimide	CC-33A EP-340	-50 to 120 -50 to 150	20 to 50	11	0.15% *A $2\times 10^6$ <b>1-36</b>
	Self-temperature-compensation Semiconductor Strain Gages KSNB	N type Si	Polyimide	EP-340 CC-33A CC-36	-50 to 150 -50 to 120 -30 to 100	20 to 50	11, 16	0.1% *A $2\times 10^6$ <b>1-36</b>	
	High-output Semiconductor Strain Gages KSPH	P type Si	Paper base + phenol-epoxy	CC-33A CC-36	-50 to 120 -30 to 100	—	—	0.3% *A $2\times 10^6$ <b>1-37</b>	
	Ultra Linear Semiconductor Strain Gages KSPLB	P type Si	Polyimide	CC-33A EP-340	-50 to 120 -50 to 150	—	—	0.15% *A $2\times 10^6$ <b>1-37</b>	
Notes	<p>*1. Underlined adhesives are those used for strain limit tests and fatigue life tests at normal temperature.</p> <p>*2. Typical values with uniaxial gages. The strain limit is the mechanical strain when the difference between the strain reading and mechanical strain upon applying a simple tension load to the test piece is greater than ±10% of the mechanical strain or when the strain gage is disconnected or detached. *1% = 10000 <math>\mu\text{m/m}</math></p> <p>*3. Typical values with uniaxial gages. Strain level: ±1500 <math>\mu\text{m/m}</math>; *A: ±1000 <math>\mu\text{m/m}</math>; *B: ±500 <math>\mu\text{m/m}</math></p>								

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		Resistive elements	Bases						
For high temperature	Encapsulated Gages KHCX	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) -196 to 950	25 to 950	11, 13	—	—	1-38
	Encapsulated Gages KHCV	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) 25 to 800	—	— (Dynamic measurement)	—	—	1-38
	Encapsulated Gages KHCR	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) 25 to 750	25 to 750	11, 13, 16	—	—	1-38
	Encapsulated Gages KHCS	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) -196 to 750	25 to 750	11, 13, 16	—	—	1-38
	Encapsulated Gages KHCM	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) -196 to 650	25 to 650	11, 13, 16	—	—	1-38
	Encapsulated Gages KHC	NiCr alloy wire	Heat-resistant metal	(Spot welding) -196 to 550	Normal temp. to 500	11, 13, 16	—	—	1-38
	High-temperature Foil Strain Gages KFU	NiCr alloy foil	Polyimide	PI-32 -30 to 350	10 to 300	11, 16, 23	1.9%	*A 1.5×10 <sup>5</sup> (300°C)	1-39
	High-temperature Foil Strain Gages KH	NiCr alloy foil	Stainless steel	(Spot welding) -50 to 350	10 to 300	11, 16	0.5%	*B 1×10 <sup>7</sup>	1-39
	High-temperature Foil Strain Gages KFHB	NiCr alloy foil	Polyimide	PC-600 EP-34B PI-32 -196 to 250 -55 to 200 -196 to 250	10 to 250	11, 16, 23	2.1%	—	1-40
For low temp.	Low-temperature Foil Strain Gages KFLB	NiCr alloy foil	Polyimide	PC-600 EP-270 CC-33A -269 to 150 -269 to 30 -196 to 120	-196 to 50	5, 11, 16, 23	2.2%	1×10 <sup>6</sup>	1-41
For large strain measurement	Ultrahigh-elongation Foil Strain Gages KFEM	CuNi alloy foil	Polyimide	CC-36 -20 to 80	—	—	20% to 30%	—	1-42
	High-elongation Foil Strain Gages KFEL	CuNi alloy foil	Polyimide	CC-36 -10 to 80	—	—	15%	1×10 <sup>6</sup>	1-42
For antimagnetic applications	Non-inductive Foil Strain Gages KFNB	NiCr alloy foil	Polyimide	PC-600 CC-33A -196 to 150 -196 to 120	0 to 150	11, 16, 23	1%	1×10 <sup>4</sup>	1-43
	Shielded Foil Strain Gages KFSB	CuNi alloy foil (120 Ω) NiCr alloy foil (350 Ω)	Polyimide	CC-33A EP-340 -196 to 120 -55 to 120	10 to 100	11, 16, 23	0.5%	1×10 <sup>4</sup>	1-43
For hydrogen gas environments	Foil Strain Gage for Hydrogen Gas Environment KFV	Special alloy foil	Polyimide	PC-600 -30 to 80	—	—	—	—	1-44
Internal strain	Foil Strain Gages for Bending Strain Measurement KFF	CuNi alloy foil	Acrylate	CC-33A EP-340 -50 to 80 -50 to 80	20 to 60	11, 16, 23	0.2%	*B 4×10 <sup>6</sup>	1-44
With protector	Foil Strain Gages with a Protector KCH	CuNi alloy foil	Polyimide	Protector: Stud bolt Strain gage EP-340, CC-33A -40 to 100	—	11	1%	*A 1.2×10 <sup>6</sup>	1-45
Embedded	Embedded Gage KMP		Aluminum	—	20 to 120	—	—	—	1-45
Crack	Crack Gages KV	CuNi alloy foil	Paper base+phenol-epoxy	CC-33A CC-36 PC-600	—	—	—	—	1-46
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