1b Selecting a strain gage based on operating environment and purpose

	Name/series designation		Materials: Resistive element	Materials: Base	Operating temperature ranges in combination with major adhesives after curing*1 (°C)	Self-temperature-compensation range (°C)	Applicable linear expansion coefficient (x10⁻⁶/°C)	Strain limit at room temp., approx.*2 (%)	Fatigue life at room temp., approx.*3 (times)	Page
For general stress measurement	General-purpose foil strain gages **KFG**	For general purpose	CuNi alloy foil	Polyimide	CC-33A: –196 to 120 EP-34B: –55 to 150 PC-6: –196 to 150	10 to 100	5, 11, 16, 23, 27	5.0	1.2×10^7	P32
		For sensing element of transducers			PC-6: –196 to 150 EP-34B: –55 to 150	10 to 100	11, 16, 23, 27	5.0	1.2×10^7	P55
		For concrete			CC-35: –30 to120 PC-12: –196 to 150	10 to 100	11	5.0	1.2×10^7	P87
		Concentrated stress measurement			CC-33A: –196 to 120 EP-34B: –55 to 150 PC-6: –196 to 150	10 to 100	11, 16, 23, 27	—	—	P51
		Residual stress measurement			CC-33A: –196 to 120 EP-34B: –55 to 150 PC-6: –196 to 150	10 to 100	11, 16, 23, 27	—	—	P66
		Bolt axial tension measurement			EP-18: Room temp. to 50 EP-34B: Room temp. to 50	10 to 100	11	—	—	P70
	Foil strain gages with temperature sensor **KFGT**		CuNi alloy foil	Polyimide	CC-33A: –10 to 120 EP-34B: –10 to 120 PC-6: –10 to 120	10 to 100	11, 16, 23	3	1×10^6	P71
	Foil strain gages **KFR**	Strain measurement at middle temperatures; for transducers	NiCr alloy foil	Polyimide	PC-6: –196 to 150 CC-33A: –196 to 120 EP-34B: –55 to 150	0 to 150	11, 16, 23	2.2	1×10^6	P72
		Concentrated stress measurement			PC-6: –196 to 150 CC-33A: –196 to 120 EP-34B: –55 to 150	0 to 150	11, 16, 23	—	—	P77
	Waterproof foil strain gages **KFW**		CuNi alloy foil	Paper base + phenol-epoxy	CC-33A: –10 to 80 EP-18: –10 to 80	10 to 80	11, 16, 23	2.8	3×10^4	P81
	Small-sized waterproof strain gages **KFWS**		CuNi alloy foil	Polyimide	CC-33A: –10 to 80 EP-18: –10 to 80	10 to 80	11, 16, 23	5.0	3×10^4	P85
	Weldable waterproof strain gages **KCW**		NiCr alloy foil	Stainless steel	(Spot welding) –20 to 100	10 to 90	11	0.5	$1 \times 10^{6*A}$	P86
	Wire strain gages **KC**		CuNi alloy foil	Paper base + phenol-epoxy	PC-12: –196 to 150 CC-35: –30 to 120	10 to 60	11	1.8	1.5×10^5	P90
	Embeddable strain gages **KM**		CuNi alloy	Acrylate	(Embedment) –10 to 70	0 to 50	11	0.3	—	P92
	Embeddable strain gages for concrete **KMC**		CuNi alloy wire	Silicone	(Embedment) Room temp. to 70	—	—	0.3	—	P93
For composite materials, plastics and rubber	Foil strain gages for composite materials **KFRP**		NiCr alloy foil	Polyimide	EP-34B: –55 to 200 CC-33A: –196 to 120	0 to 150	1, 3, 6, 9	2.2	1×10^6	P94
	Strain gages for printed boards **KFRS**		NiCr alloy foil	Polyimide	CC-33A: –196 to 120 PC-6: –196 to 150	–30 to 120	13	1.6	2×10^6	P99
	Foil strain gages for plastics **KFP**		CuNi alloy foil	Paper base + phenol-epoxy	EP-34B: –20 to 80 CC-33A: –20 to 80	10 to 80	65	3.0	1×10^6	P102
	Foil strain gages for low-elasticity materials **KFML**		CuNi alloy foil	Phenol-epoxy	EC-30: 0 to 60 CC-33A: 0 to 60	—	—	1.0	—	P105
For infinitesimal strain measurement	Semiconductor strain gages **KSP**	Micro-strain measurement	P type Si	Paper base + phenol-epoxy	PC-12: –50 to 150 CC-33A: –50 to 120	—	—	0.3	$2 \times 10^{8*A}$	P106
		For sening element of highly sensitive transducers	P type Si	Paper base + phenol-epoxy	PC-12: –50 to 150 CC-33A: –50 to 120	—	—	0.3	$2 \times 10^{8*A}$	P107
		Micro-strain meas; 2-element, temperature-compensation type	P type Si N type Si	Paper base + phenol-epoxy	PC-12: –50 to 150 CC-33A: –50 to 120	20 to 70	11	0.3	$2 \times 10^{8*A}$	P107
	Self-temperature-compensation semiconductor strain gages **KSN**		N type Si	Paper base + phenol-epoxy	PC-12: –50 to 150 CC-33A: –50 to 120 EP-17: –50 to 120(E5)	20 to 70	11, 16	0.3	$2 \times 10^{8*A}$	P108
	High-output semiconductor strain gages **KSPH**		P type Si	Paper base + phenol-epoxy	PC-12: –50 to 150 CC-33A: –50 to 120	—	—	0.3	$2 \times 10^{8*A}$	P110
	Ultralinear semiconductor strain gages **KSPL**		P type Si	Paper base + phenol-epoxy	PC-12: –50 to 150 CC-33A: –50 to 120	—	—	0.3	$2 \times 10^{8*A}$	P111

Notes

*1. Underlined adhesives are those used for strain limit tests at room temperature and for fatigue tests at room temperature.
*2. Typical values with uniaxial gages. Strain limit is the mechanical limit where a difference between the strain reading and mechanical strain initiated by applying tension load exceeds 10%
*3. Typical values with uniaxial gages. Strain level: ±1500 με; *A: ±1000 με; *B: ±500 με, *C: ±100 με

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	Name/series designation	Materials		Operating temperature ranges in combination with major adhesives after curing*1 (°C)	Self-temperature-compensation range (°C)	Applicable linear expansion coefficient (x10⁻⁶/°C)	Strain limit at room temp., approx.*2 (%)	Fatigue life at room temp., approx.*3 (times)	Page
		Resistive element	Base						
For high-temperature applications	Encapsulated strain gages **KHCX**	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) –196 to 950	25 to 950	11, 13	1.0 (950°C)	1 x 10⁶*C (950°C)	P113
	Encapsulated strain gages **KHCD**	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) Room temp. to 800	—	—	1.0 (800°C)	1 x 10⁶*B (800°C)	P114
	Encapsulated strain gages **KHCS**	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) –196 to 750	25 to 750	11, 13, 16	1.0 (750°C)	1 x 10⁶*B (750°C)	P115
	Encapsulated strain gages **KHCM**	Heat-resistant special alloy wire	Heat-resistant metal	(Spot welding) –196 to 650	25 to 650	11, 13, 16	1.0 (650°C)	1 x 10⁶*B (650°C)	P116
	Encapsulated strain gages **KHC 20 type**	NiCr alloy wire	Heat-resistant metal	(Spot welding) –196 to 550	Room temp. to 500	11, 16	0.8	4 x 10⁵*A	P117
	Encapsulated strain gages **KHC 10 type**						0.5	4 x 10⁵*A	
	Encapsulated strain gages **KHC 5 type**						0.5	2 x 10⁵*A	
	High-temperature foil strain gages **KFU**	NiCr alloy foil	Polyimide	PI-32: –196 to 300	10 to 300	11, 16, 23	1.9	1.5 x 10⁵*A (300°C)	P121
	High-temperature foil strain gages **KH-G4**	NiCr alloy foil	Stainless steel	(Spot welding) –50 to 350	10 to 300	11, 16	0.5	1 x 10⁷*B	P126
	High-temperature foil strain gages **KFH**	NiCr alloy foil	Polyimide	PC-6: –196 to 250 EP-34B: –55 to 200 PI-32: –196 to 250	10 to 250	11, 16, 23	2.1	2 x 10⁵	P127
For low temp.	Low-temperature foil strain gages **KFL**	NiCr alloy foil	Polyimide	PC-6: –269 to 150 CC-33A: –196 to 120 UC-26: –196 to 50	–196 to 50	5, 11, 16, 23	2.2	1 x 10⁶	P135
For large strain measurement	Ultrahigh-elongation wire strain gages **KLM**	CuNi alloy wire	Epoxy	EC-30: 0 to 60 CC-36: –10 to 80	—	—	20	1 x 10⁶	P144
	High-elongation foil strain gages **KFEL**	CuNi alloy foil	Polyimide	CC-36: –10 to 80	—	—	15	1 x 10⁶	P145
For antimagnetic applications	Noninductive foil strain gages **KFN**	NiCr alloy foil	Polyimide	PC-6: –196 to 150 CC-33A: –196 to 120	0 to 150	11, 16, 23	1	1 x 10⁴	P149
	Shielded foil strain gages **KFS**	CuNi alloy foil (120Ω) NiCr alloy foil (350Ω)	Copper foil	PC-6: –196 to 150 CC-33A: –196 to 120 EP-34B: –55 to 150	10 to 100	11, 16	0.5	1 x 10⁴	P151
Internal strain	Foil strain gages for bending strain measurement **KFF**	CuNi alloy foil	Acrylate	CC-33A: –50 to 80 EP-18: –50 to 80 EP-34B: –50 to 80	20 to 60	11, 16, 23	0.2	4 x 10⁶*B	P152
With protector	Foil strain gages with protector **KCH**	CuNi alloy foil	Polyimide	Protector: Stud bolt Strain gage EP-34B, CC-33A: –40 to100	—	11	1	1.2 x 10⁶*A	P153

Notes

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*3. Typical values with uniaxial gages. Strain level: ±1500 με; *A: ±1000 με; *B: ±500 με, *C: ±100 με

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