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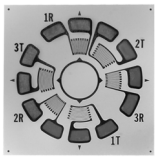
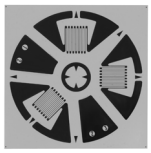
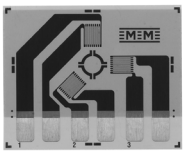
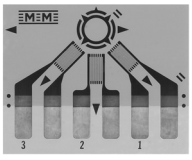
Special Use Sensors - Residual Stress Strain Gages

The most widely used practical technique for determining residual stresses is the hole-drilling strain gage method described in ASTM Standard E837. With this method, a specially configured strain gage rosette is bonded to the surface of the test object; and a small, shallow hole is introduced into the structure, through the center of the gage, with a precision drilling apparatus. Strains in the immediate vicinity of the hole are measured, and the relaxed residual stresses are computed from these measurements. The general theory of making residual stress measurements is covered in Vishay Micro-Measurements Tech Note TN-503, Measurement of Residual Stresses by the Hole-Drilling Strain Gage Method and the requisite hardware is described in Bulletin 304.

CONSTRUCTION

All gages are constructed of self-temperature-compensated foil (06 and 13 S-T-C) on a flexible polyimide carrier, and incorporate a centering target for use with a precision milling guide. EA-Series (A-Alloy) gages are available “open-faced” or with solder dots and encapsulation (Option SE); CEA-Series (A-Alloy) gages have encapsulated grids, and rugged, copper-coated solder tabs. Construction of the N2K Series (K-alloy) is similar to the N2A Series and includes copper pads (DP) on the solder tabs. The 062UM gage permits installation adjacent to weldments and intersecting surfaces.

GAGE PATTERN AND DESIGNATION Insert Desired S-T-C No. in Spaces Marked XX.		RES. IN OHMS	DIMENSIONS					
			GAGE LENGTH	GRID CTR'LINE DIA.	TYPICAL HOLE DIA.		MATRIX	
					Min.	Max	Length	Width
EA-XX-031RE-120 EA-XX-031RE-120/SE		120 ± 0.2% 120 ± 0.4%	0.031	0.101	0.03	0.04	0.29	0.29
			0.79	2.56	0.8	1.0	7.4	7.04
			Due to small pattern size, measurement error can be magnified by slight mislocation of drill hole. Pattern not recommended for general-purpose applications.					
N2K-XX-030RR-350/DP		350 ± 0.4%	0.30	0.170	0.090	0.100	0.37	0.37
			0.76	4.32	2.3	2.5	9.4	9.4
			Special six-element configuration that provides somewhat higher output than three-element designs.					
EA-XX-062RE-120 EA-XX-062RE-120/SE		120 ± 0.2% 120 ± 0.4%	0.062	0.202	0.06	0.08	0.42	0.42
			1.57	5.13	1.5	2.0	10.7	10.7
			Most widely used RE pattern for general-purpose residual stress measurement applications.					
EA-XX-125RE-120 EA-XX-125RE-120/SE		120 ± 0.2% 120 ± 0.4%	0.125	0.404	0.12	0.16	0.78	0.78
			3.18	10.26	3.0	4.1	19.8	19.8
			Larger version of the 062RE pattern.					
CEA-XX-062UL-120		120 ± 0.4%	0.062	0.202	0.06	0.08	0.50	0.62
			1.57	5.13	1.5	2.0	12.7	15.7
			Fully encapsulated with large copper-coated soldering tabs. Same pattern geometry as 062RE pattern.					
CEA-XX-062UM-120		120 ± 0.4%	0.062	0.202	0.06	0.08	0.38	0.48
			1.57	5.13	1.5	2.0	9.6	12.2
			Fully encapsulated with large copper-coated soldering tabs and special trim alignment marks. Trim line spaced 0.068 in [1.73 mm] from hole center. Limitations may exist in data reduction equations.					

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