Attachment Techniques for Weldable Strain Gages and Temperature Sensors

INTRODUCTION

The Weldable Gage is a precision foil sensor bonded to a metal carrier for spot welding to structures and components. Spot welding is often more convenient than adhesively bonding a gage, particularly in field testing applications where bonding conditions are not ideal. This type of gage is also well-suited to laboratory test programs requiring elevated-temperature testing and minimum installation time.

After minimal surface preparation, spot welding is easily accomplished with a stored-energy handprobe spot welder. The gage is useful immediately after welding and leadwire attachment. Environmental protection is as easily applied to or installed over a welded gage as an adhesively bonded gage.

CEA-Series Weldable Strain Gage

This gage combines a fully encapsulated self-temperaturecompensated constantan foil grid with large, rugged copper-coated tabs for direct leadwire attachment.

LWK-Series Weldable Strain Gage

Fully encapsulated self-temperature-compensated modified Karma (K-alloy) grid, with an integral three-wire lead system, and wide temperature capability.

WWT-Series Weldable Temperature Sensor

The WWT temperature sensor is manufactured from high-purity nickel foil and incorporates an integral three-tab terminal for leadwire attachment. This sensor complements the weldable strain gage by monitoring the temperature at the gage location for thermal output correction. With the appropriate matching network, a strain indicator will serve as a direct-readout instrument.

For additional information on the Weldable Gage product line, and the general operating characteristics of Micro-Measurements strain gages, refer to the Precision Strain Gages databook.

Welding Unit

Best results are obtained with a 20 watt-second (minimum) capacitive-discharge spot welder, with a repetition capability of at least 15 welds per minute. It is recommended that the welder employ a spring-type ground clamp to ensure a low-resistance connection between the welder "common" terminal and specimen. Use a welding electrode with a spherical tip approximately 0.03in [0.8mm] in diameter. The Model 700 Portable Strain Gage Welding and Soldering Unit was specially designed for installing weldable sensors. Refer to Bulletin 302 for specifications.

Surface Preparation

Although surface preparation for welding is less critical than for adhesive bonding, the surface must be free of grease, rust, scale, oxides and surface irregularities for efficient welding.

Step 1

Degrease the specimen with an appropriate solvent such as CSM Degreaser.

Step 2

Hand grind, abrade with silicon-carbide paper, or file the surface until smooth.

Step 3

Thoroughly wash with an appropriate solvent to remove all residue.

Safety Note

Safety goggles should always be worn during all installation processes. Serious and permanent eye injury could otherwise occur. In case of accident, secure immediate medical attention. For additional health and safety information concerning the products discussed in this Application Note, consult the specific Material Safety Data Sheets, which are available upon request.

Gage Handling and Welding Procedure

A sample metal carrier is supplied with each package of gages for practice welding. It is essential to first determine the proper weld-energy setting and electrode force. A setting of approximately 10 watt-seconds, with firm electrode force, will generally produce satisfactory welds. After a practice weld, pull the metal carrier from the specimen surface; with a satisfactory weld, a small slug of metal will break away from either the carrier or the specimen at the weld.

Attachment Techniques for Weldable Strain Gages and Temperature Sensors

Document No: 11131
Micro-Measurements

1 of 2
micro-measurements@vishaypg.com

Revision 13-Apr-10
www.micro-measurements.com

Step 1
Align the gage on the specimen surface by placing a short piece of drafting tape across the lower portion of the gage assembly.

Step 2
Tack the metal carrier in place with a single weld ad- jacent to the alignment triangles on each side of the gage, close to but not touching the gage backing (Figure 1).

Step 3
Remove the drafting tape by peeling it back directly over itself (Figure 2), being particularly careful not to distort the metal carrier during tape removal.

Step 4
Continue spot welding, close to the gage backing, welding from the center tacks to the ends of the carrier, completing one side at a time and spacing the welds on approximately 1/16in [1.6mm] centers. Weld across the top and bottom of the carrier (Figure 3).

Note: For the LWK Series, follow the same welding sequence shown in Figure 3, omitting sequence No. 6 (the area over which the integral leads extend). Sequences 1 and 3 must extend to the end of the metal carrier.

Step 5
Complete the welding procedure by welding a second row approximately 1/32in [0.8mm] outside the first row, spacing the welds as shown in Figure 4.

Note: Leadwires may be preattached to the CEA and WWT Series using the technique shown in Figure 5. Special care must then be taken to prevent the leads from peeling up the gage tab area or otherwise damaging the gage.

COMMON WELDING PROBLEMS

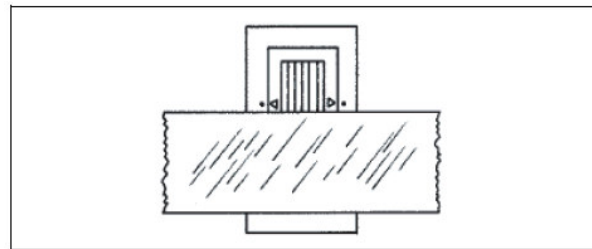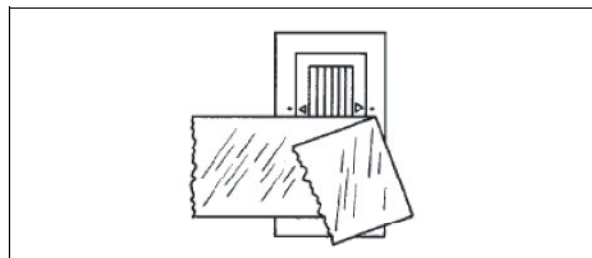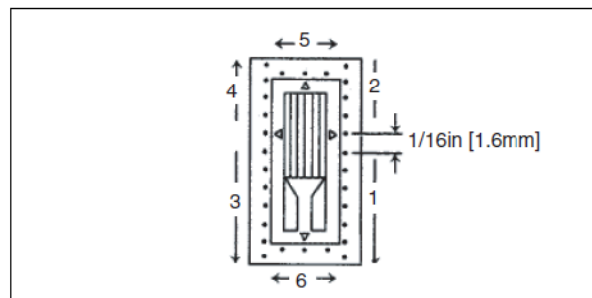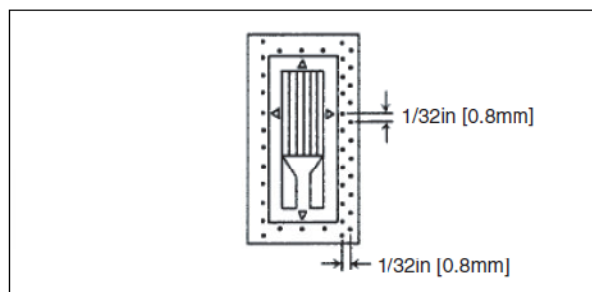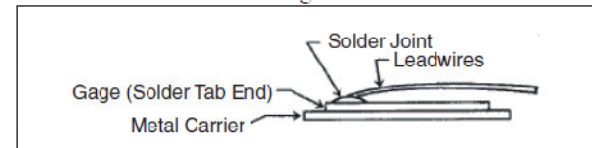| PROBLEM	PROBABLE CAUSE
Expulsion of metal at the weld, or deformation of carrier or specimen material	Excessive weld-energy setting or electrode force
Reduced electrode life	Excessive weld-energy setting or insufficient electrode force
Poor weld strength	Insufficient weld-energy setting or electrode force
Sparking	Insufficient electrode force, pitted welding electrode, or insufficient surface preparation; welding electrode partially on gage backing
Welding requires excessive electrode force or a high weld-energy setting	Poor connection to welder "common" cable or poorly prepared specimen surface

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Attachment Techniques for Weldable Strain Gages and Temperature Sensors