TECHNIQUE

Attachment Techniques for Weldable Strain Gages and Temperature Sensors

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Also available in printed form as Measurements Group Instruction Bulletin B-131

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 hand-probe 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.

Attachment Techniques for Weldable Strain Gages and Temperature Sensors

CEA-Series Weldable Strain Gage

The CEA-Series weldable strain gage combines a fully encapsulated self-temperature-compensated constantan foil grid with large, rugged copper-coated tabs for direct leadwire attachment.

LWK-Series Weldable Strain Gage

The LWK-Series weldable strain gage has a 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.

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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 bulletin, consult the specific Material Safety Data Sheets, which are available upon request.

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 0.03 in (0.8 mm) in diameter. The Model 700 Portable Strain Gage Welding and Soldering Unit was specially designed for installing weldable sensors.

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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-1A 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.

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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.

The procedures for welding are given on the following pages.

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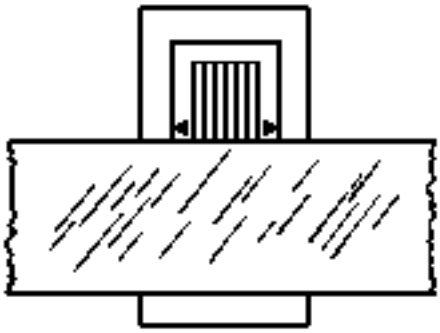
Gage Handling and Welding Procedure

Step 1

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



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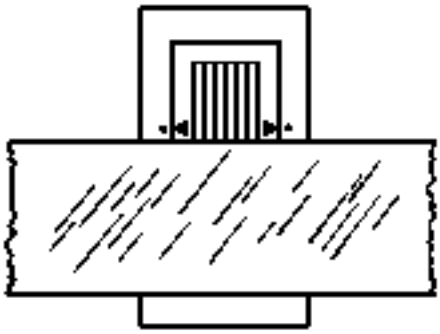
Gage Handling and Welding Procedure

Step 2

Tack the metal carrier in place with a single weld adjacent to the alignment triangles on each side of the gage, close to but not touching the gage backing.



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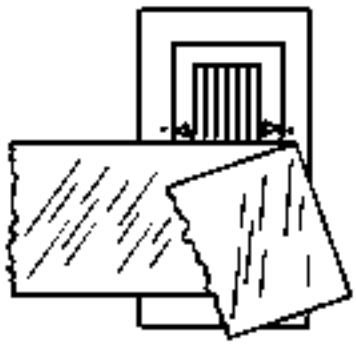
Gage Handling and Welding Procedure

Step 3

Remove the PDT-1 drafting tape by peeling it back directly over itself, being particularly careful not to distort the metal carrier during tape removal.



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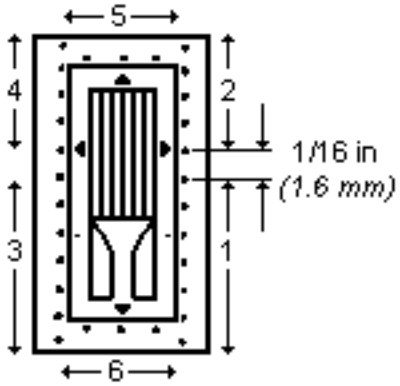
Gage Handling and Welding Procedure

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 1/16 in *(1.6 mm)* centers. Weld across the top and bottom of the carrier.



Note: For the LWK Series, follow the same welding sequence shown above, 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.

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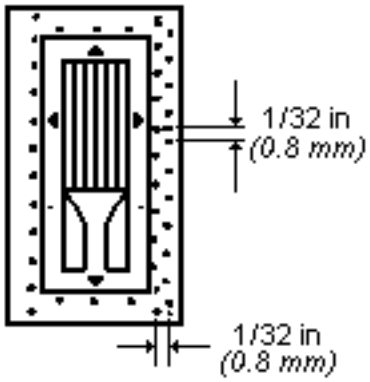
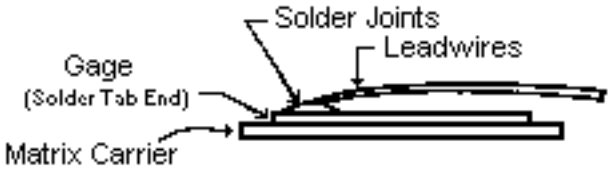
Gage Handling and Welding Procedure

Step 5

Complete the welding procedure by welding a second row approximately 1/32 in (0.8 mm) outside the first row, spacing the welds as shown here.



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



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Gage Handling and Welding Procedure

Common Welding Problems

Problem: Expulsion of metal at the weld, or deformation of carrier or specimen material
Probable Cause: Excessive weld-energy setting or electrode force

Problem: Reduced electrode life
Probable Cause: Excessive weld-energy setting or insufficient electrode force

Problem: Poor weld strength
Probable Cause: Insufficient weld-energy setting or electrode force

Problem: Sparking
Probable Cause: Insufficient electrode force, pitted welding electrode, or insufficient surface preparation; welding electrode partially on gage backing

Problem: Welding requires excessive electrode force or a high weld-energy setting
Probable Cause: Poor connection to welder "common" cable or poorly prepared specimen surface