Strain Gage Installations with Denex #3 Adhesive

Description

Denex #3 is a single component epoxy which can be solvent thinned with acetone for easy application. This adhesive is designed for a "B" stage cure and therefore need not be stored in a refrigerator. It also has low creep at elevated temperature. The operating temperature range is –452° F to +400° F (-269° C to +204° C) with a short-term capability (1 hour) to +500° F (+260° C).

Installation Accessories

For proper results, the procedures and techniques presented in this bulletin should be used with qualified Micro-Measurements installation accessory products. M-LINE accessories used in this procedure are:

- CSM Degreaser or GC-6 Isopropyl Alcohol
- Silicon Carbide Paper (SCP-1, SCP-2, SCP-3)
- M-Prep Conditioner A
- M-Prep Neutralizer 5A
- GSP-1 Gauze Sponges
- CSP-1 Cotton Applicators
- MJG-2 Mylar Tape
- GT-14 Pressure Pads and Backup Plates
- HSC-1, HSC-2, HSC-3 Spring Clamps

Handling Precautions

While this material is considered relatively safe to handle, contact with skin and inhalation of vapors should be avoided. Immediate washing with ordinary soap and water is effective in cleansing should skin contact occur. For eye contact, rinse thoroughly with a copious amount of water and consult a physician. For additional health and safety information, consult the Material Safety Data Sheet, which is available upon request.

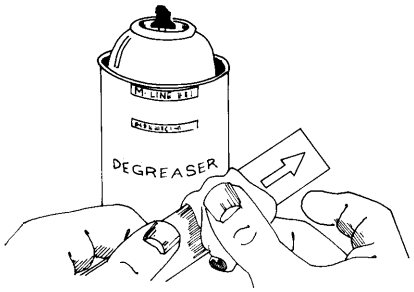
Mixing Adhesive

1. This adhesive is a single-component epoxy and no mixing is required.
2. Acetone can be added to thin the adhesive when necessary.

Getting Started

The installation procedure presented here is somewhat abbreviated and is intended only as a guide in achieving proper gage installation with Denex #3 Adhesive. Micro-Measurements Instruction Bulletin B-129, "*Surface Preparation for Strain Gage Bonding*", presents recommended procedures for surface preparation, and lists specific considerations that are helpful when working with most common structural materials.

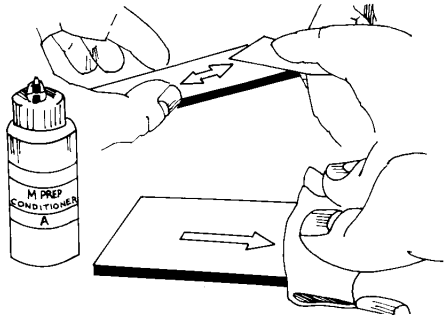
Step 1



The surface preparation technique used is the same basic cleaning procedure described in Micro-Measurements Instruction Bulletin B-129, "*Surface Preparation for Strain Gage Bonding*". The initial step is to thoroughly degrease with solvents such as CSM Degreaser or GC-6 Isopropyl Alcohol. CSM Degreaser is preferred whenever possible since this is a very active degreaser. The substitution of GC-6 as a degreasing agent should be considered for materials that may be sensitive to strong solvents.

Any degreasing should be done with clean solvents. Thus the use of a "one-way" container, such as the aerosol can, is highly advisable.

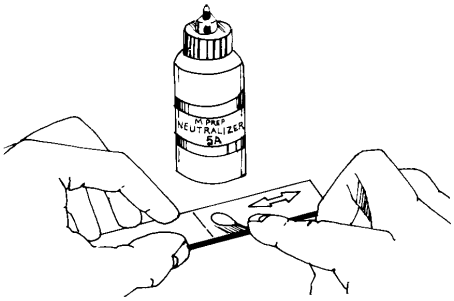
Step 2



Dry-abrade the gaging area with 220- or 320-grit silicon-carbide paper to remove any scale or oxides on the base material. Apply M-Prep Conditioner A and wet-abrade the gage area. Keep the surface wet while abrading. Remove the residue and Conditioner by slowly wiping through the gaging area with a gauze sponge. The wet-abrade and wiping procedure should then be repeated with 400-grit silicon-carbide paper.

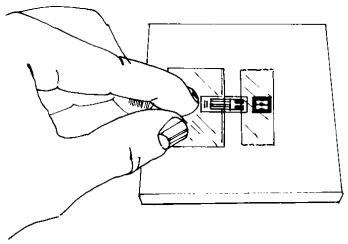
With a 4H (hard) drafting pencil on aluminum or a ball-point pen on steel, burnish whatever alignment marks are needed on the specimen. Rewet the surface with Conditioner A and scrub with cotton-tipped applicators until a clean applicator is no longer discolored by the scrubbing. Remove the residue and Conditioner by slowly wiping through the gaging area with a gauze sponge. Do not wipe back and forth over the gage area since this may allow contaminants to be re-deposited on the cleaned area.

Step 3



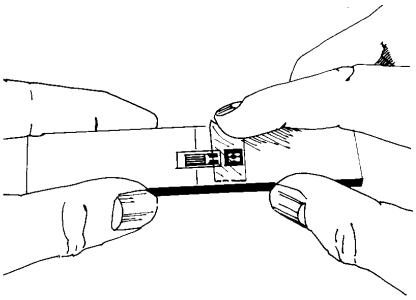
Apply a liberal amount of M-Prep Neutralizer 5A to the gage area. Keeping the surface wet, scrub with cotton-tipped applicators. Do not allow evaporation of the cleaning material on the specimen surface since this would leave a thin, unwanted film between the adhesive and the specimen. Remove the Neutralizer by slowly wiping through the gage area, allowing the gauze sponge to absorb the Neutralizer. Do not wipe back and forth over the gage area since this may allow contaminants to be re-deposited on the cleaned area.

Step 4



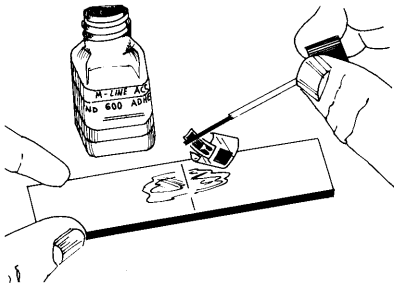
Remove a gage from its mylar envelope with tweezers, making certain not to touch any exposed foil. Place the gage, bonding side down, onto a chemically clean glass plate or empty gage box. If a solder terminal is to be incorporated, position it next to the gage. While holding the gage in position with a mylar envelope, place a short length of MJG-2 mylar tape down over about half of the gage tabs and the entire terminals.

Step 5



Remove the gage/tape/terminal assembly by peeling the tape at a shallow angle (about 30°) and transferring it onto the specimen. Make sure gage alignment marks coincide with specimen layout lines. If misalignment does occur, lift end of tape at shallow angle until assembly is free. Realign and replace. Use of a pair of tweezers often facilitates this handling.

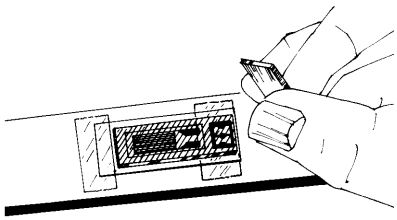
Step 6



Now, by lifting at a shallow angle, peel back one end of the taped assembly so as to raise both gage and terminal. By curling this mylar tape back upon itself, it will remain in position, ready to be accurately repositioned after application of adhesive.

Apply a single thin even coat of Denex #3 with the brush applicator to the prepared surface, gage backing and terminal. Do not allow the adhesive applicator to touch the tape mastic. Allow it to air dry for approximately 20 minutes at 70° F (21° C) or accelerate by placing under a heat lamp for 5 minutes. Longer air-drying times are required at lower temperatures and/or higher humidity. Denex #3 will not be tacky at room temperature when it is free of solvent.

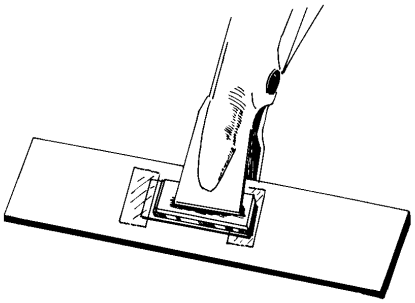
Step 7



Return gage/terminal assembly to its original position over layout marks. Use only enough pressure to allow assembly to be tacked down. Overlay gage/terminal area with a piece of thin TFE-1 teflon film . If necessary, anchor Teflon in position with a piece of mylar tape across one end.

Cut a 3/32-in (2.5- mm) thick GT-14 silicon gum pad and a metal backup plate to a size slightly larger than the gage/terminal areas, and carefully center these as shown below. Larger pads may restrict proper spreading of adhesive, and entrap residual solvents during cure process.

Step 8

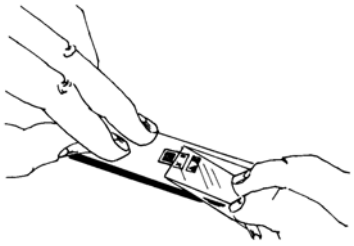


Either HSC spring clamps, as shown here, or dead weight can be used to apply pressure during the curing cycle. The clamping pressure should be 30 to 50 psi (210 to 350 kN/m). Place clamped gage/specimen into a cool oven and raise temperature to the desired curing level at a rate of +5° to +20° F (+3° to +11° C) per minute. Air bubbles trapped in the adhesive, uneven gluelines, and high adhesive film stresses often result from starting with a hot oven. The recommended cure for this adhesive includes one hour at +250° F (+121° C), followed by one hour at +350° F (+177° C). For transducers, the recommended cure is 4 hours at +325° F (+163° C). The recommended post cure is one hour at 25° F (15° C) above the maximum operating temperature.

Step 9

Upon completion of the curing cycle, allow even temperature to drop at least +100° F (+55° C) before removing specimen. Remove clamping pieces and mylar tape. It is advisable to wash off the entire gage area with either RSK Rosin Solvent or toluene. This should remove all residual mastic and other contamination. Blot dry with a GSP-1 gauze sponge

Step 10



The gage and terminal strip are now solidly bonded in place. To remove the tape, pull it back directly over itself, peeling it slowly and steadily off the surfaces.

This technique will prevent possible lifting of the foil on open-faced gages or other damage to the installation. It is not necessary to remove the tape immediately after gage installation. The tape will offer mechanical protection for the grid surface and may be left in place until it is removed for gage wiring.

Final Installation Procedure

Select appropriate solder and attach leadwires. Remove solder flux with RSK Rosin Solvent.
Select and apply protective coating.
Micro-Measurements gages have been treated for optimum bonding conditions and require no pre-cleaning before use unless contaminated during handling. If contaminated, the back of any gage may be cleaned with a CSP-1 Cotton Applicator slightly moistened with M-Prep Neutralizer 5A.