# Strain Gage Installations with PBX Cement

## Introduction

PBX Cement is a two-component cement that is composed of a powder and a solvent. This cement requires a final cure of +600° F (+316°C). It has a useful temperature range from –450° F to +1200° F (-268° C to +649° 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
- Sandblast Preferred as the bond is primarily mechanical. (Course Silicon Carbide Paper as an alternate)
- M-Prep Conditioner A
- M-Prep Neutralizer 5A
- GSP-1 Gauze Sponges
- CSP-1 Cotton Applicators
- MJG-2 Mylar Tape

### 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 Instructions and Adhesive Characteristics

***Mixing Adhesive***

Thoroughly mix the adhesive before application, being sure it has a uniform color and consistency.
Follow the cure schedule found in steps 4 and 5 of this instruction bulletin.

## Getting Started

The installation procedure presented here is somewhat abbreviated and is intended only as a guide in achieving proper gage installation with PBX Cement. 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

Sandblast with course sand medium (As an alternate dry-abrade the gaging area with 220- grit silicon-carbide paper) to remove any scale or oxides on the base material.

With a 4H (hard) drafting pencil on aluminum or a ballpoint pen on steel, burnish whatever alignment marks are needed on the specimen. Wet 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**

***Base Coat application*** – Thoroughly mix the PBX Cement using a clean spatula or glass stirring rod. The base coat consists of a layer of cement approximately 0.003 inches (0.08 mm) when the cement is wet and uncured. The thickness of the base coat is determined by using a layer of 0.003 inch thick MJG-2 mylar tape, which is laid parallel to, and slightly overlapping, the roughened area. Note: If the surface the strain is to be installed on is only flat in one axis, such as a cylinder, the two layers of tape must be applied on the curved surface so that the spatula will be drawn along the flat axis. A strip of the MJG-2 mylar tape can be placed across each end of the gage area to limit the flow out of the cement. A liberal amount of the cement is applied to one end of the gage area. Spread the cement smoothly by slowly drawing the spatula across the gage area in one movement. Allow to cure for 30 minutes at room temperature and then carefully remove the mylar tape. After the appropriate air drying, cure the base coat at +200° F (+93° C) and +300° F (+149° C) for 30 minutes.

**Step 5**

***Gage Installation*** – The ZC-Series free filament foil gage is attached to a Teflon® backing with strips of fiberglass tape. These gages are very thin, typically 0.0005 in to 0.00075 in [0.013mm to 0.019mm], and very fragile.

Using a razor blade, lift the tape from the Teflon backing so that the gage and tape together can be removed from the backing.

Place the gage in position on the base coat using the fiberglass tape to hold it in place.

Using a GT-11 camel hair brush, apply a coat of cement over the gage grid, being sure to cover the junction of the strain gage tab with the foil leads. Thorough wetting is obtained by “wiggling” the brush over the gage foil.

Air dry for 30 minutes,(1) 30 minutes at +200°F [+93°C], and then 30 minutes at +300°F [+177°C].

Allow to cool, then remove the fiberglass tape using a dental pick and tweezers.

After the tape has been removed, apply cement over the exposed areas of the strain gage grid.

Air dry for 30 minutes[(1)],30 minutes at +200°F [+93°C], and then 30 minutes at +300°F [+177°C].

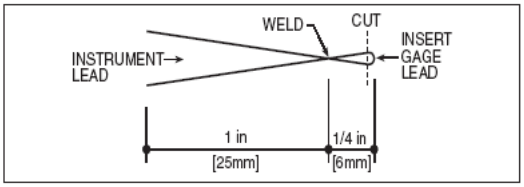
**Step 6**

***Leadwire attachment*** – A high temperature wire suitable for high temperature and welding must be used for the leadwire. There are a number of wires that can be used:

- SS Sheath with a variety of leadwires (Ni-clad copper, Ni-clad silver, chromel, alumel, Nichrome)
- Nextel Insulated leadwires
- Ceramic coated leadwires

Put the unsized glass sleeving over leadwire on the end near the gage to keep the leadwire from shorting out.

Cut two lengths 2-1/2 inches (64 mm) of Nichrome V wire (1-KL-16-002) 1/16 x 0.002 inches (1.6 mm x 0.05 mm) and fold each in half. Spot weld three times, 0.25 inches (6 mm) from the folded end, then trim off the fold. (see sketch)




Insert gage lead between the 0.25 inch (6 mm) end of the transition ribbons, and spot weld the two layers of Nichrome at a minimum of three points.

Repeat for the second lead

Strip the insulation from the end of the leadwire and place this exposed wire between the two layers of Nichrome (which have not been welded) on the gage leads. For the three wire method, put both leads between the other Nichrome ribbon.

All exposed leads and ribbons should then be coated with PBX Cement. Allow to air dry for 30 minutes at room temperature. Cure at +200° F (+93° C) for 30 minutes and 30 minutes at +300° F (+149° C).

The final cure is at +600° F (+316° C) for 1 hour.