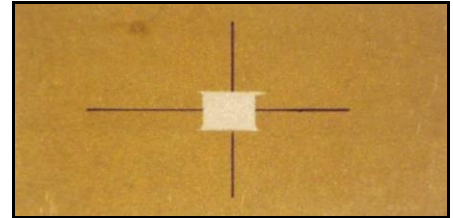




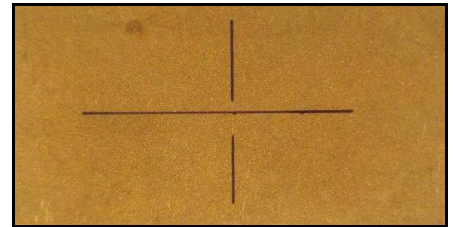
STRAIN GAGE INSTALLATION TECHNIQUES USING CERAMIC CEMENTS

1. LAYOUT

A) Determine location of center of gage grid on component.
Mark cross hairs for center of grid.



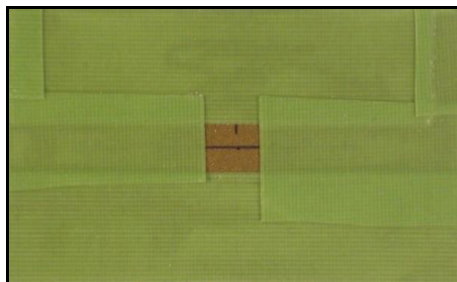
B) Measure area to be prepared. Typically, a 12-125 gage will get a spot .250" wide x .350" long. Note: grid center is not in the center of the prepped area. This will allow enough room for lead anchoring.



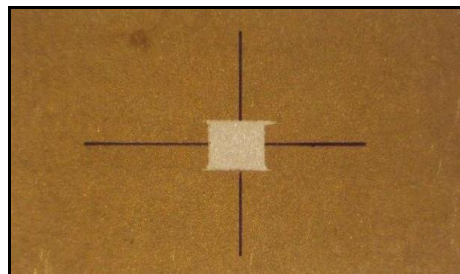
2. MASKING AND SURFACE PREP

Although not the only method of surface prep, the best method is to gritblast using 120 grit aluminum oxide set at 60 PSI. This will roughen the surface and remove any oxide. If this is not available, 80 grit sandpaper will also work.

Outline area to be gritblasted with a quality tape designed for this purpose. We recommend Greenbelting tape p/n 170-10 green.



Taped and ready for grit blasting

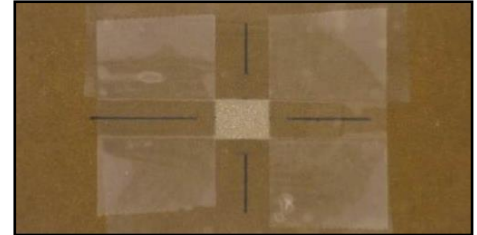


Grit blasted and tape removed

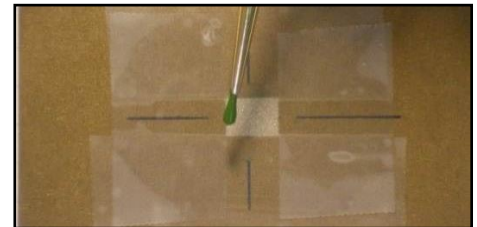
3. CEMENT PRE-COAT

There are 2 methods of precoating the prepared installation area. The first is to outline the precoat area with cellophane tape and spread cement using a clean razor blade. This assures proper thickness and clean edges. The second method is done without using tape. This requires more skill and a steady hand. On complex parts it may be necessary to use this method.

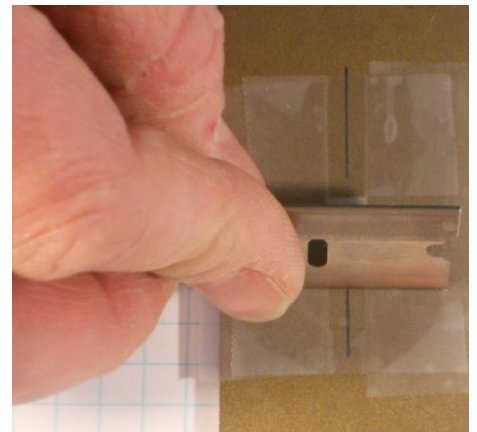
A) Outline area with cellophane tape. Edge of tape should be slightly inboard of edge of gritblast



B) Apply a drop of ceramic cement to one end of gritblasted area. Be sure to apply enough cement to cover entire area



C) While holding razor blade at a slight angle and applying light pressure, drag blade across entire area. When entire area has been covered with a thin, even coating, let cement air dry for 10 min before removing tape.



Before curing cement, all tape must be removed.

Cure requirements for precoat:

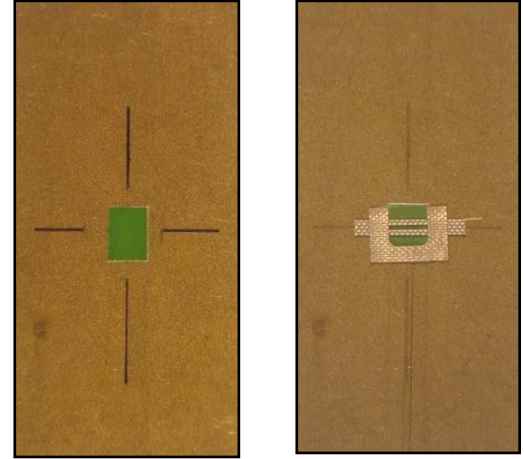
1. Air dry for 30 minutes
2. Bake at 200°F for 30 minutes
3. Increase oven to 400°F for 30 minutes
4. Increase oven to 600°F for 30 minutes

Allow part to cool completely before proceeding to next step.

4. APPLY STRAIN GAGE

A) Pre-coat is cured

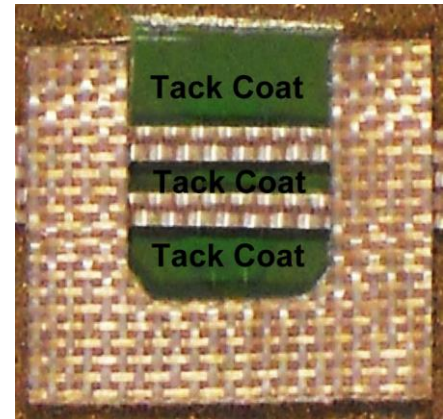
B) Install gage on pre-coated area using alignment marks



A.

B.

C) Apply a layer of ceramic cement (tack coat) where shown. Cement should not touch tape. Extra care should be taken to assure that cement does not touch sides of tape. This will cause the adhesive from the tape to loosen and possibly lift. It will also cause sharp edges where the cement meets the tape. This will create a weak bond between the first and second layers of cement.



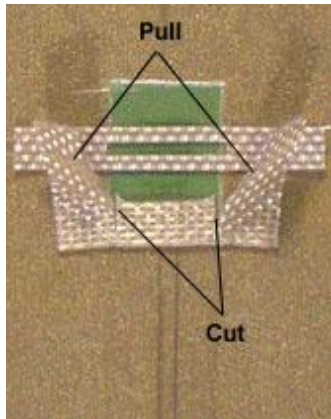
D) Curing the tack coat (partial curing)

1. Air dry cement for 30 minutes to 1 hour
2. Place in cool oven and cure for 30 minute at 200°F
3. Increase oven to 325°F for 30 minutes

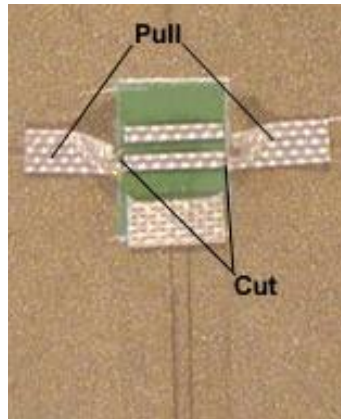
Note: If tape adhesive reaches 350°F, it can vulcanize the tape and it will be very difficult to remove.

5. REMOVE TAPE

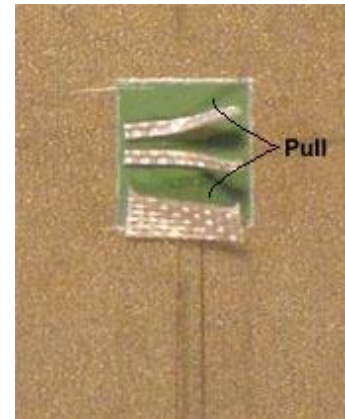
A) Using sharp razor blade, cut tape in 2 places as shown. Pull tape in the direction shown.



B) Using sharp razor blade, cut tape in 2 places as shown. Pull tape in the direction shown.



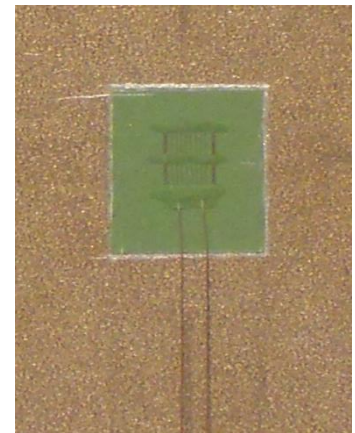
C) Carefully remove tape by pulling in the direction shown.



D) Gage is now ready for final curing of tack coat.

1. Place into a cool oven and cure for 30 min at 200° F.
2. Increase temp to 400°F for 30 min.
3. Increase temp to 850°F for 2 hours.
to remove tape residue.

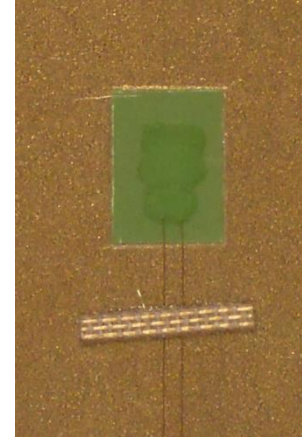
Note: Verify with engineering that part can go to 850°
If not, then cement must reach 600°F minimum for 30 min.





6. FINAL COVER COAT

Apply cover coat to gage by placing a small amount of cement (drop) in between existing tack coat. The recommended technique is to place the cement and not brush the cement as this can cause gage damage. This will allow you to achieve a uniform thickness over entire gage area.



7. FINAL CURE

1. Allow the cement to dry at room temp for 30 min – 1 hour.
2. Place in cool oven and bake at 200°F for 30 min.
3. Increase oven temp to 400°F for 30 min.
4. Increase oven temp to 600°F for 30 min.

Installation is now complete. Ready to test gage for resistance and leakage to ground.



CERAMIC CEMENT HANDLING INSTRUCTIONS

Safety Precautions:

Review the MSDS issued on the cement to be used and comply with safe handling recommendations prior to handling cement.

General Handling Procedures:

A new bottle should be placed in a vertical position and the contents allowed to settle before opening. If the shipment was received with the bottle on its side, and the cement in contact with the cap, shake the contents until cement and liquid are homogeneous, then place bottle in vertical position and allow contents to settle.

Carefully remove cap and wipe residual cement from inside of cap and from inside of neck of bottle using gauze pad. Be careful not to contact cement. Wear surgical gloves when handling cement. Some cements are carcinogens and moderately strong acids. Once the cap and neck are wiped perfectly clean, always keep bottle in vertical position so material does not contact neck of bottle, if, during use, cement does contact neck of bottle, wipe clean with gauze pad before replacing bottle cap. Material left on neck will migrate under cover and solidify on threads making cover removal difficult.

Mixing of cement is done next. Using a stainless steel spatula, stir cement for about 10 minutes or until cement is homogeneous. Sometimes, during air shipment, cement settling and aircraft vibration produces a very solid compaction of powders. This solid mass may be broken up with a small screwdriver and mixed into the liquid. Once mixed, the cement will be fluid as normal.

The cap should be replaced on the bottle as soon as possible when the cement is not in actual use to prevent evaporation of liquid. Liquid will evaporate quickly in the winter or in arid locations where the humidity is low. Use thinner supplied with the cement to replace evaporated liquid or to adjust cement flow ability. Never add more than the contents of one vial of thinner to the bottle of cement, because excess thinner will weaken cement. Never add water to cement, not even a few drops as water will weaken cement. Never use water to clean brush during job. Brush cleaning is done by dipping brush in cement and wiping on gauze pad. The gauze pad is hand held in gloved hand and brush should be wiped dry after each brush stroke. Water is only used to clean brush and spatula after job is done. Be sure all water is dried before brush is used again. Mark or identify brush with type of cement used. Do not use brushes from silicate based cements to bond platinum or palladium based sensors because silica contamination will result.



TIPS ON USING CERAMIC CEMENT

Precautions:

Most cements contain corrosive and/or toxic ingredients. Read the MSDS prior to using any cement.

1. Shelf Life

The shelf life given on the package is usually the un-opened shelf life of the adhesive. After opening and using, the shelf life depends on how long the contents are actually exposed to air. As the liquid evaporates, the cement thickens and becomes more difficult to use. When opened and used daily, the shelf life of the cement is about two weeks. The cement should be discarded when it becomes difficult to use. Some thinning with thinner, if supplied from factory (up to 30 drops) is permissible. Do not thin with water as this will weaken bond. The bottle should be capped at all times when not actually in use.

2. Mixing

It is a characteristic of most ceramic cements that the solids and liquid rapidly separate and the segregated powder becomes somewhat solid in a short time. Initial mixing should be done using a stainless steel spatula. Mix thoroughly until a uniform liquid consistency is achieved. Constant mixing is necessary during use. Mix the cement thoroughly between brush strokes.

3. Application

Cement is applied using an artist's brush size #00, #0 or #1. A larger brush or a polypropylene sponge may be used for pre-coating larger areas for lead wire routing. Once the surface is prepared properly (see instruction sheet), a thin pre-coat of cement is applied using a rapid brush movement. Apply about .001" to .002" pre-coat. Practice is required to develop a technique for thin, uniform pre-coats. Do not attempt to patch up pre-coats. An uncured pre-coat can be removed with a damp gauze pad. Partly dry cement will absorb liquid from the fresh cement and tend to coagulate (ball up) the mixture and produce a non-uniform and thick coating. It is easier to totally remove a pre-coat and start over than to patch. Cement which has not been heat cured is water soluble and may be easily removed.

4. Apply Gage

Once the pre-coat is properly cured and cooled all the way to room temperature, the gage is laid in place. Be sure the gage grid is in intimate contact with the pre-coat. Inspect under magnification (4X to 10X).

Using a small artist's brush, apply cement to the gage end loops by working the cement from the tape carrier edge outward. The cement layer should be tapered so that the cement does not actually touch tape (See sketch). The first coat and final coat should overlap in a long bond line. In no case should the cement go up against the tape producing a vertical cement boundary, which can produce a site for voids or cracks in the cement. Since cement shrinks as it cures, a vertical boundary produces shrinkage cracks which cause premature gage failures under strain.

Bond the leads using the same procedure as for the grid. After curing the first coat, remove tape while specimen is still hot. With a razor, cut the grid carrier tape at each side of the grid. Then, using sharp tweezers, remove tape by curling it at 45° to the grid. Be careful not to pull upward on the gage strands, which could stretch them or pull them out of the adhesive.



After tape removal, examine the gage under magnification and be sure all tape or other residue is removed. When the specimen is fully cooled, apply a final coat of cement to the grid using the artist's brush. The brush stroke should be in the direction of the grid. This coating should produce a bond between the first cement coating and the final coat. The total thickness of the cement should be "as thin as possible". The outline of the grids should be visible like "ribs on a lean cow". Overall thickness should not exceed .010" total. Installations as thin as .006" have been accomplished.

IMPORTANT:

After use, thoroughly wipe the inside neck of the cement bottle and the threads using a gauze pad. Wipe the bottle cover and cover threads also, until they are perfectly clean. Place the bottle cover on tightly and store. Dispose of cleaning materials and used brushes per instructions given in hazardous data sheets.