

## Solder & Flux manual for ceramic, crown & bridge alloys. Soldering techniques and hints

Pre-soldering: for nickel-chrome and cobalt-chrome-base alloys.

1. Pre-soldering is a high temperature brazing operation, combining high temperature (1975 F -1080 C) solder, and high temperature (fluoride) flux, and the troubled metal framework.
2. To minimize the rocking movement of long span bridges, cut the joints on the heaviest part of the long-span frame after completion.
3. Use cutting and roughing wheels to clean and prepare the wall of the joints from both sides, leaving a space of approximately 0.3 -1 mm for the solder to flow through. Stream the dies to a perfect sitting position on your working model, ready for the soldering procedures.
4. Place both finished frame parts on the working model. Do not hold the joints together using Duralay, (like precious) or other type of holding material, avoiding any metal contamination. To hold both frames together, simply use sticky wax. Holding the bridge in place, flow the sticky wax all the way around the joint and keep holding the bridge until the wax gets completely hard. Cut a metal rod or a wooden stick, and place it along the frame attaching it to the metal frame with heavy sticky wax. Prior to soldering, make sure all parts of the metal frame are completely seated on the working model, and all excess sticky wax is completely removed.
5. Remove the frame from the model, and place #8 (4mm) gauge; round sprue wax under the joint area to be soldered; hold it in place with more sticky wax.
6. High temperature investment materials are recommended for use with Dent-All Solder. Materials such as "high temp", "Ceramigold", "High Span" or other similar investments with the same high temperature. Low temperature investments also can be used with Dent-All Solder. Materials such as "Beauty Cast" low temperature investment. Mix a portion of investment with water, the mix should have a thick texture to give better results. Hold the bridge upside down, vibrate the investment mix into the coping(s) abutments. When the copings are filled, add an extra amount on the top and place the frame on a patty of investment prepared in block form. The metal frame must set high off the investment, except the margins which should be covered  $\frac{1}{2}$  mm.

NOTE: A: Try to flow the mixture of investment material all the way inside the frame copings.

Remove moisture from the remaining investment using a towel, and make a base block wider than the metal frame.

NOTE B: Place the bridge over the investment material, but avoid sinking in the bridge too deep, allowing the heat transfer during the soldering process to reduce the soldering time, and minimizing the oxides created during the process. Dry the bridge for 25 to 30 minutes.

- 7) After the investment is completely hard, trim down the designated areas for the thongs. Boil out and clean all sticky wax completely off the joints and the frame. The soldering joint should be cleared from any investment, or wax, as the joints will be soldered with a large amount of low intensity heat.
- 8) Use an even amount of Dent-All Flux on a soldering joint; run the same amount around the joint to be soldered. The use of flux is to prevent oxidation, and to help the solder flowing easily with low intensity heat, (note: High-intensity heat will burn the flux). Place the block inside a burnout oven at 302 F (225 C), and gradually raise the temperature to 850 F (485 C), and hold it at that temperature for 15-20 minutes. Prepare your high fusing soldering rod, and apply some high fusing flux over it. Use oxygen and gas oroxygen propane (reduced flame) to approximately  $\frac{1}{2}$ " long.

Remove the preheated bridge from the oven and apply more flux to the joint. When flux starts flowing through the joints, pull the solder rod back, heat the joint to an orange-white color, and bring the solder wire to the joint. Apply the solder thought the joint, and hold the torch close to the solder for about 5-10 seconds per joint. During the soldering process, concentrate on the heat of the abutment part, as it is the thinnest part and therefore oxidizes the first. Allow 2-3 layers of solder to flow on the lingual, labial, occlusal, and gingival surfaces to make sure the solder has brazes more than the solder joint wall. Up to this point, you have soldered

half of the joint; you should move to the second part of the joint and repeat the above procedures once more and this will help the solder to flow brazing through the two walls, creating a strong connection.

- 9) Once the bridge is invested and cleaned with aluminum oxide (60 microns), make sure all flux is removed from the metal. Test the joint strength by holding opposite ends of the bridge and applying pressure; if the bridge does not break, that joint is now mechanically strong enough. Observe for any thin hairlines occurring after the soldering; if that occurs, the bridge has a great tendency of breaking or destroying when the porcelain is baked; therefore, cut the bridge and repeat soldering procedure, making sure that the walls to be soldered are not oxidized.
- 10) You can apply this solder to other similar soldering procedures in case of miscast margin, depressed areas, holes and others. Any porcelain applications in these types of areas will cause porcelain breakage during cementation, or shortly after, if it is not Pre-Soldered or re-waxed.

#### PRE-SOLDERING NICKEL-CHROMIUM ALLOYS WITH BERYLLIUM:

Ceramic-Base metal alloys that contain Be have been most successful for metal-ceramic restoration, but achieving strong acceptable solder joint it takes more knowledge and experience. It is necessary to observe carefully the defects and the quality of the Pre-Solder joints. The main reason, the caution of Pre-Soldering Ni-Cr-Be alloys is the reaction of Be-quick oxidation on the metal surface during the Hi-Heat application. Weather the soldering technique with sensitivity Beryllium oxidation is a problem; it is possible to create an acceptable Pre-Solder joint with the change of methods. The difficulty comes with more soldering joints at the same time, and the preparation is done as follows:

STEP 1- Before assembling the metal work, clean the joints, flux and Pre-Solder each side separately without overheating. This method is more effective and easy to work with. Now we have successfully applied solder separately on each side of the joint.

STEP 2- Clean and grind the excess solder and flux on each joint, place and adjust each part of the bridge framework on the die assembly model, create the needed gap (0.3 mm) for the actual soldering procedure and follow the usual method assembly with sticky wax; invest the bridge over a block using hi-temperature investment and let it dry for approximately 30 minutes. After the sticky wax is removed by streaming or boiling out, the invested metal-frame block need to be pre heated.

STEP 3- Apply Hi-Fusing flux evenly all over the joints, and place metal-frame block in the oven for the pre-heating procedure and raise the temperature to 850 F ( 485 C) and hold it for 25 to 30 minutes.

STEP 4- Soldering: Use Gas-Oxygen torch with small tip at 80 degree flame angle; now the actual soldering is a lot easier, the soldered joint will allow the additional solder to flow to the gap with greater ability, and create the necessary strength.

Next, bench cool, sandblast the excess investment and flux and prepare for finish.

#### POST SOLDERING:

Post soldering is a low temperature brazing operation, combining low temperature 1150 F-1250 F (620 C – 680 C) solder to a low temperature fusing flux. This process is normally done, after the completion of porcelain application, or for most Cr& Br type casting on contacts or additions. The most common procedure in post soldering is: Using a regular oven-soldering technique.

Use Dent-All low fusing Post-solder and low-fusing flux. After cleaning and heat soaking in the porcelain oven, cut and place very small pieces of solder into the joint. Place the oven temperature at 1000 F (540 C) raise the temperature gradually to 1400 F ( 760 C). Remove the cast, bench cool and finish. A fine gold solder 615 F (326 C) can be used, following the same procedure.

## TECHNICAL TIPS:

### 1) Problem – Incomplete casting ( miscast)

#### CAUSES

- a. Improper Spruing
- b. Low burnout temperature.
- c. Incomplete heat soak.
- d. Low fluidity
- e. Inadequate winds of casting machine.
- f. Inadequate amount of alloys in the crucible.

#### SOLUTIONS

- a. Use an 8 gauge sprue to the thickness portion of coping
- b. Proper burnout is at 1650 F (899 C); heat soak for one hour and calibrate the oven before placing the ring
- c. Heat soak for one hour per ring. Allow additional time for more than one ring.
- d. The torch should be adjusted to allow a full of 30 psi for oxygen, through the torch. The flame should always be neutral.
- e. Set your casting machine one turn more than standard.
- f. Add 50% fresh metal to button. One ingot per every five units is recommended.

### 2) Problem- Porosity in casting

#### CAUSES

- a. Improper Spruing.
- b. Overheated metal
- c. High residual value of the oxide.

#### SOLUTIONS

- a. Use the indirect sprue method for multiple units.
- b. Cast when the metal slumps, and before the oxide shell breaks open
- c. Once melting has begun, do not reduce the flame.

### 3) Problem – Gases (bubbles ) on the surface of the porcelain

#### CAUSES

- a. Improper preparation and , cast surface cleaning
- b. Baking the porcelain too often
- c. Contaminating the metal surface with oxide, and leaving residue of flux on soldered areas.
- d. Improper and incomplete sandblasting
- e. Overgalzing the porcelain

#### SOLUTIONS

- a. Follow framework preparation
- b. Improve your bake-on technique. Do not over brake.
- c. Use aluminum oxide stones, discs, grinding wheels and diamond instruments.
- d. Use 60-micron aluminum oxide. Do not recycle.
- e. Calibrate your porcelain oven for the proper glazing temperature.

### 4) Problem –Cracks in the porcelain

#### CAUSES

- a. Sharp corners and edges on framework.
- b. Over baking and Over glazing

#### SOLUTION

- a. Round out all edges and corners during frame preparation.
- b. Calibrate your porcelain oven.
- c. Purge your porcelain oven regularly.
- d. Build up the incisal edge of the dies in case of short anterior preparation, to create an equal thickness after casting, equaling the TCE 0.10 in/in FX 10-6, of the porcelain and the metal, or use metal lingual protection.

## PURGING

When processing non-precious high silver alloys, post soldering or calibration with (silver) porcelain, contaminating oxides can be deposited on muffle walls. Routine purging in a properly ventilated area is recommended using the following procedure:

- 1) Preheated (dried carbon rod is placed on tray in a muffle at 650C- 1200 F, muffle door is positioned and vacuum chamber is closed.
- 2) Draw 25" + vacuum and raise temperature to 1093 C (2000 F) at 55C (100F) per minute. Hold vacuum for 10 minutes. Air firing the carbon will not decontaminate muffle.
- 3) Shut off power to furnace, hold vacuum and cool muffle to room temperature.
- 4) Release vacuum, remove carbon and check walls and floor of muffle for deposited metals; remove if any are present.

NOTE: Do not use pieces of old carbon rods.

## CAUTION:

Do not use the same discs, wheels and finishing stones at the same time.

Example: Cobalt-Chrome alloys and Nickel-Chrome alloys. Keep your grinding tools separate so as not to cause contamination from one metal to another.

### Working up the porcelain:

Follow the instructions of the ceramic manufacturers. Build your porcelain correctly, and save extra firing steps. That way your porcelain does not over crystallize and become brittle.

## NOTE:

To provide for the integrated system ceramic/alloy, we recommend to cool the metal slowly in front of the muffle if the metal TCE is higher than 14.2 m/mk, or to cool the metal quickly, if the metal TCE is lower than 14.2 m/mk.