**Purpose:**

The purpose of this procedure is to describe the process used to oxidize parts used in the assembly of sensors having Bismuth Titanate crystals. This process is often referred to as “Blue-Oxide”.

**Responsibilities:**

Crystal Department engineering / management is responsible for maintaining this procedure. Crystal Department technicians are responsible for carrying out this procedure.

**Associated Documents: ISO 9001, QAM, QSM, AS9100, TA1051**

**1.0 General Practice**

Certain high temperature sensors use bismuth tittante as a sensing material. It has been found that bismuth titanate loses it’s insulation resistance in a reducing atmosphere (removal of oxygen). Since our sensors are in a hermetic metallic housing, at high temperatures, the metal parts will oxidize. As this process happens, a reducing atmosphere inside the sensor is created, causing the bismuth titanate to cease functioning.

To help prevent the depletion of oxygen it is necessary to pre-oxidize the parts. However, we do not want to put such a heavy oxide that we can no longer weld the sensor. Also, a heavy oxide can create too much scaling on critical surfaces leading to performance issues of the sensor. So, it is critical that we create an oxide heavy enough as to not steal oxygen from inside the sensor, but not too heavy to prevent welding/performance issues. The procedure outlined below (“blue-oxide”) has been found to give us the best chance for success.

**2.0 Safety Precautions**

This procedure requires the use of high temperature furnace, operating at approximately 1200ºF. During this procedure, the operator is required to load parts into the preheated furnace. **Extreme caution must be used during this process. Only trained operators are allowed to perform this operation. Appropriate safety equipment must be worn, including high temperature gloves and headgear with the appropriately shaded visor. The provided tools must be used when loading and unloading the furnace.**

Methanol is used for cleaning in this procedure. Methanol is flammable and must be handled with care. Label all containers appropriately, and dispose of used chemicals in the appropriate chemical waste container.

**3.0 Equipment and Materials**

Sentry Furnace

Tweezers

Finger cots or powder free gloves

Parts per BOM

Furnace loading tool (“pitchfork”)

High temperature Firing Trays (29757-01 or similar)

Ultrasonic cleaner

Methanol

Beakers

Drying oven

**4.0 Pre-Clean Parts (Reference TA1051 for Ultrasonic Cleaner Set-up)**

4.1 Turn on ventilation system.

4.2 Put on chemical goggles.

4.3 Run cycle for **“10 min” with heat on Set Temp 35°C.**

4.4 Gently place parts into beaker. Insure units with delicate components are appropriately spaced to avoid damage.

Note: Electrodes and diaphragms should be cleaned individually (one per beaker).

4.5 Add Lenium to the beaker to cover all the parts.

4.6 After cleaning cycle is complete, put on gloves or finger cots.

4.7 Lift the beaker out of the insert tray.

4.8 Drain beaker over a strainer into a waste Lenium container.

4.9 Place parts into a strainer and rinse thoroughly with **METHANOL**.

4.10 Dry parts in 250 F oven for twenty (20) minutes minimum.

**5.0 Load Parts**

5.1 Gather the tooling and fixtures as defined on the router and/or BOM.

5.2 Do not handle the tooling or parts with bare hands. Always wear finger cots or powder free latex gloves, and use tweezers to handle small parts.

5.3 Load parts into Firing Trays.

5.4 Multiple parts can be loaded if you insure that flat surfaces are not touching other flat surfaces. Edges (line contacts) and corners (point contacts) touching are acceptable.

5.5 Parts such as diaphragms and electrodes will have to be laid flat, but must not overlap each other or the desired oxide will not result on these surfaces.

**6.0 Oxidizing**

6.1 Program the Sentry furnace to 1200°F or 649°C. Allow the furnace to stabilize at temperature for 1 hour minimum. This may and should be done ahead of time.

6.2 **NOTE: The following steps involve opening the door of a very hot furnace. Use extreme caution and wear the required personal protective equipment.**

6.3 Put on the visor headgear and high temperature gloves. Insert the “pitchfork” tool under the firing tray loaded with parts in 5.2.

6.4 Open the furnace door about 6 inches. Using the pitchfork, load the firing tray into the furnace, carefully remove the pitchfork tool, and close the furnace door.

6.5 Set the pitchfork on the heat-resistant surface next to the Cress ovens. Be careful, the end of the pitchfork is very hot. Remove the headgear and gloves.

6.6 Set the timer. Oxidation time 2:45 to 3 hours, and start the timer.

6.7 When the timer times out, put on the headgear and gloves. Pick up the pitchfork.

6.8 Open the furnace door about 6 inches. Carefully insert the pitchfork under the firing tray in the furnace, and lift and remove the tray from the furnace. Set the hot tray onto the heat-resistant platiform next to the oven, remove the pitchfork from the tray, and set aside. Close the furnace door. Remove the headgear and gloves, and set aside.

6.9 Allow the firing tray and assemblies to cool for at least one hour.

6.10 **NOTE: Do not attempt to handle or move the tray for at least one hour. Even after the color changes from orange to black, the tray can be extremely hot and cause serious burns.**

6.11 Once cool, use the filament tweezers to remove the parts from the crucibles. Place parts into their appropriate packaging (plastic trays).

6.12 Repeat steps 4.1 through 6.11 until all the parts on the job are oxidized.