# Purpose

The purpose of this document is to describe the process for poling and cleaning ceramic crystals using the immersion circulator baths and pc board fixtures.

# Responsibilities

It is the responsibility of Crystals Engineering to maintain this document.

It is the responsibility of Crystals Production to execute this process.

# Associated Documents

ISO9001, QAM, QSM, AS9100

# Safety Precautions

## Heated Oil Baths

The poling boxes are filled with poling oil that is heated to over 100°C, so caution must be used to prevent burns. Safety glasses and nitrile gloves must be worn while working with this equipment.

## High Voltage

The poling process requires the application of high DC voltage to the crystals. Voltages at 10kV DC are common and some crystals may require even higher voltages. Care must be taken to avoid electrical shock. Power supply outputs must be turned off before loading and unloading poling boxes.

## Heated Solvent

The vapors of solvents such as lenium should not be inhaled.

## Charged Piezoelectrics

The crystals will generate a static charge as they cool from both the poling and cleaning processes. Care must be taken when handling these crystals to either short them using metal tweezers, or handle them with gloved hands to prevent an electrical discharge. This might either shock the person handling the parts, or ignite nearby flammable solvents.

# Materials and Equipment

## Chemicals

* Poling Oil
* Lenium ES

## Equipment

* Nitrile Gloves and Safety Glasses
* Immersion Circulation Baths: PolyScience 28L Heated Circulator, or equivalent
* Power Supplies: TDK-Lambda model FLX-30P7, or equivalent
* High Temperature cables with High Temperature banana connectors
* Poling Fixtures
* Cleaning Fixtures
* Lenium Vapor Degreaser: Reliant Ultra 2012LE, or equivalent
* Tweezers
* Digital Timer
* Pig Mats and Paper Towels
* Air Handling/ventilation Systems

# Poling Procedure

## Preparation for Poling

* + 1. Turn on and preheat the poling baths. The temperature should be set to the poling temperature specified on the router. This can and should be done 1-2 hours in advance so the poling bath has time to stabilize at temperature.
    2. Turn on the power supplies and let them warm up. The manufacturer recommends 30 minutes of warm up time for the TDK-Lambda power supplies.
    3. Turn on the vapor degreaser and let it warm up. Refer to the operation manual of the vapor degreaser being used for operation and settings. The “Vapor Up” light must be on before cleaning parts.
    4. Turn on any air handling units associated with the poling process. These should be on at any time when the oil is heated and may create an odor.

## Poling the Crystals – Manual Process

* + 1. Load the poling fixture with the appropriate number of crystals. If there are not enough crystals remaining in the lot to fill all the locations in the fixture, use an insulator dud in each unused location.
    2. Confirm the power supply out is off, then connect the poling fixture to the power supply using two high temperature leads, if it is not already.
    3. Set a digital timer to the appropriate time, as indicated on the router.
    4. Remove the lid from the oil bath, submerge the poling fixture, then replace the lid.
    5. Confirm the power supply is set to 0 Volts, then turn the output ON.
    6. Set the power supply to the appropriate voltage, as indicated on the router. Refer to the power supply manual for operation instructions.

NOTE: Watch the voltage and current displays on the power supply as the crystals charge up. Be sure the appropriate voltage is achieved and there is no shorting or arcing. If this occurs, the power supply will automatically turn off the output and reapply after a brief time. If a crystal has broken, the supply may be shorted out and you will need to remove the damaged crystal, replace it with a dud and restart the poling run.

* + 1. Once the time has elapsed, silence the alarm and turn the power supply output OFF. Watch the voltage on the crystals decrease.
    2. Turn the power supply voltage setting back down to 0 Volts in preparation for the next run.
    3. Remove the lid from the oil bath, remove the poling fixture, set the poling fixture onto pig mats to absorb most of the hot oil, then replace the lid.
    4. Place the cleaning rack on top of some paper towels to catch most of the oil dripping from the parts.
    5. Remove the crystals from the poling fixture and place them into the appropriate cleaning rack.

NOTE: Do this using metal tweezers and gloved hands to avoid getting a shock. The crystals will build up charge as they cool.

* + 1. Once all the crystals are removed from the poling fixture, it may be reloaded and the process repeated.

## Cleaning the Crystals

* + 1. Open the top door to the vapor degreaser, set the rack of crystals on the platform, then close the door.
    2. On the control panel, confirm recipe #17 is loaded, then press the button to start the cleaning cycle.
    3. Once the cleaning cycle is complete, the amber light will be lit.
    4. Open the door, retrieve the rack of clean crystals, then close the door.
    5. Remove the crystals from the rack using gloved hands and tweezers, and place them in plastic trays.

NOTE: Touching the crystals with bare hands at this point may dirty them and may cause a nasty electrical shock.

## Shut Down

* + 1. Turn the temperature setting of the poling bath(s) to 30°C.

NOTE: Do NOT turn the controller off, or there will be no indication of the temperature of the oil inside. Only turn off the controller if the oil is already at room temperature and no work is planned for an extended period.

* + 1. Turn the power supply(s) off.
    2. Do not turn off any air handling systems unless the oil is at room temperature.