

MODEL 7412

IN-SITU ANNEALING PROCEDURE

GE DETECTOR INTEGRAL CRYSTAT

IN-SITU ANNEALING PROCEDURE
Ge DETECTOR/INTEGRAL CRYOSTAT

I. General

A. Description

This procedure describes the process of annealing moderate radiation damage without removing the detector from the cryostat. This procedure requires familiarity with vacuum systems and proper equipment and handling procedures. Extreme caution is necessary to prevent damage to such things as Be windows. No guarantees that this procedure will work 100% are expressed or implied.

B. Equipment Required

From Canberra Repair Kit

- 1) Temperature Controller with sensor and sensor block.
- 2) Heating tape
- 3) Seal-off Valve Operator
- 4) Seal-off Valve Cover

From Customer

- 1) He mass-spec Leak Detector with LN₂ trapped diffusion pump
- 2) Laboratory-type-hot-air gun
- 3) Detector Test Setup-Electronics & MCA
- 4) Silicone Vacuum grease

II. Preparation

A. Loss Rate Check

First confirm that the cryostat rate loss rate is normal. If the cryostat loss rate is excessive ($\geq 1.5\text{L/day}$), the cryostat should undergo a pump cycle before the warmup and annealing procedure is attempted. Failure to do so may cause overpressurization and damage to the cryostat hardware including Beryllium windows in particular on units so equipped.

B. Warm-up

Empty the Dewar, turn it on its side with the neck plug removed, and allow it to warm up to room temperature. This should take approximately 24 hours.

C. Preamp Removal (Slimline Cryostats Only)

Remove the preamplifier body and associated hardware. Be careful to avoid damage to electrical feedthroughs. Take note of wiring arrangement so it can be reproduced.

D. Seal-Off Valve Preparation

Remove the cover from the vacuum seal-off valve. On slimline cryostats, this valve is located between the feedthroughs. On conventional cryostats the valve is located on the service body across from the preamplifier or at the rear of the horizontal part of the vacuum chamber.

Clear away any vacuum grease that is packed in the seal-off valve housing with a lint-free towel. If the valve is indium-soldered, remove the indium by melting it with a heat gun and using a solder-sucker or cotton swab to wipe it off.

Check the valve operator to confirm that it fits the seal-off valve but do not open the valve at this time.

III.

Evacuation

During the anneal bake, the cryostat should be pumped to prevent contamination of detector surfaces and to rejuvenate the adsorber (molecular sieve or charcoal).

A. Pumping Station

Attach the valve operator to the dewar and connect the unit to a vacuum pumping station to pump the residual gas from the system. The best pump for this purpose is a helium leak detector having a

mechanical roughing pump and an LN₂ trapped diffusion pump.
(Beware of untrapped or faulty pumping systems as backstreaming can ruin detectors.)

B. Valve Operation

The valve operator consists of a vacuum manifold with a built-in mechanical activator which attaches to and moves the plug to open and close the valve. To evacuate the cryostat, use the following sequence of operations.

- 1) Attach valve operator to seal-off valve.
- 2) Engage the valve plug by pushing in the operator handle and turning handle clockwise about 4 turns.
- 3) Evacuate the valve body with the roughing pump.
- 4) Slowly withdraw the handle to open the valve. The roughing pump pressure should increase as the pump is exposed to the cryostat which is at relatively high pressure.
- 5) Continue roughing until the system pressure drops and the vacuum system can be crossed over to high vacuum.
- 6) Leak check the cryostat. If a leak is found, backfill the cryostat with dry N₂ gas and fix the leak if possible. Repeat the evacuation procedure after the leak has been fixed.

IV.

Anneal

With the cryostat on the leak detector and pumped down stuff the heating tape into the Dewar and keep it below the bottom of the neck tube. Attach the temperature sensor to the aluminum block and drop the block into the Dewar also. Set the temperature controller to 100°C and turn it on. The getter will outgas again as the tail heater warms it. Leave the heater on and continue pumping for 12-16 hours. During the last hour, heat the exposed parts of the cryostat to about 80°C using a heat gun so that these surfaces will outgas internally.

Seal-off

For vacuum
bakeout only,
60°C to 80°C for
16 to 32 hours.
Must be
pumping. V.

A. Valve Operation

Close the valve by pushing in the valve handle until the plug seats in the valve body.

Turn the handle to CCW to disengage the plug.

(The plug offers little resistance to movement, so it is difficult to know whether it is seated properly or whether the handle has been disengaged. Check the position of the handle for proper seating, and observe the handle backing as it is turned CCW to ensure that it disengages.)

B. Final Assembly

After verification that the anneal cycle(s) is successful, fill the recess in the seal-off valve with vacuum grease and install the valve cover.

VI. Evaluation

Cool down the detector for the recommended time, reinstall the preamplifier (if required), and check the leakage current vs. applied bias in accordance with the instructions in the detector manual. If the leakage current is in the right range at or above the depletion voltage of the detector check Co-60 resolution. If the leakage current is high warm up the detector for 24 hours, recool it and check it again. (This procedure is often necessary to remove residual surface contamination.)

If the resolution recovery is not complete you may repeat the anneal cycle with or without continuous pumping of the cryostat. For the last hour of the anneal cycle, however, the cryostat should be re-evacuated.