

# 1 MAINTENANCE

## 1.1 ELECTRON GUN MAINTENANCE AND CLEANING

These are general maintenance recommendations; some guns may have specific care, handling, or vacuum requirements.

### HANDLING

Although the Electron Gun is quite rugged, it should be handled carefully and not knocked or dropped. Some guns have obviously-fragile ceramics and fine connections on the exterior of the gun tube; others have similar fragile parts inside the gun, which could also be damaged. Care should be taken that the gun does not hit against anything when inserting it or removing it from the vacuum chamber. Careful handling and storage are important when the gun is out of vacuum.

### GENERAL CLEANING

Optimum performance of the Electron Gun requires clean vacuum surfaces. As described in the Operating Hints, it is important to keep the gun clean by using proper handling procedures, such as wearing gloves, maintaining a good vacuum, and storing the gun properly. The system into which the gun is mounted should also be clean, including the flanges and gaskets. Dust and debris can be blown off equipment using compressed, microscopically-clean gas, such as nitrogen or a can of tetrafluoroethane. Exterior surfaces can be wiped with isopropanol and a lint-free cloth.

### STORAGE

When the Electron Gun is not in vacuum, it should be stored carefully. Mounted guns can be bolted into their original stainless steel shipping tube to protect the knife edge on the flange and to keep the gun clean. Small unmounted guns and other parts can be placed in sealed bags, foil, or covered containers. The gun and other equipment which goes into vacuum should be stored on closed shelves.

Most guns can be stored in the laboratory at normal temperatures and pressures. While at room temperature, the standard refractory metal cathodes used in most electron guns are not harmed by repeated exposure to atmospheric gases. If a gun has a barium oxide (BaO) cathode, it is best to store the gun in vacuum; if it must be stored out of vacuum, it should be placed in a clean, dry environment such as a tightly sealed plastic box with desiccant, as BaO is susceptible to degradation by water vapor.

### BAKEOUT

Bakeout involves heating the gun while in vacuum to remove and pump away contaminants, adsorbed materials, water vapor etc. that may interfere with vacuum or gun performance. **Before bakeout, all the gun cables must be removed.** In some guns, there are magnetic coils, a pneumatic Faraday cup actuator or other assemblies which are more heat-sensitive and must also be removed or heated differentially; care should be taken that these assemblies are not heated above their recommended maximum temperatures. Maximum temperatures for bakeout are given in the gun specifications. Some bakeout methods are described in the Operating Hints Section 5.3.3.

### FIRING UNIT MAINTENANCE

As the Electron Gun is operated, insulating layers may build up on the Wehnelt (G-1) and other apertures. These insulating layers are usually formed from evaporated cathode material, oil, or other vacuum system contaminants. As these layers form, changes in the operating characteristics may be observed. At some point, the performance of the electron gun may deteriorate so that the firing unit requires cleaning. The best method of removing the insulating layers is to install a new firing unit, which has the benefit that the cathode is replaced at the same time.

Alternatively, the cathode may fail suddenly, due to the loss of leg material over time. If the cathode burns out, the firing unit will need to be replaced with a new or rebuilt firing unit.

Firing units can be rebuilt at Kimball Physics; a rebuilt firing unit includes a new cathode. Spare firing units may also be purchased from Kimball Physics. Detailed gun disassembly and firing unit replacement instructions are given in Section 6.3. For a few gun models, it is not recommended that users replace the firing unit themselves, and no disassembly instructions are given.

**The entire system, gun, firing unit, or power supply can be returned to Kimball Physics for evaluation, disassembly, cleaning and rebuild; see shipping instructions in Section 2.1.**