Model GC60 Gamma Beam Irradiator

The Model GC60 Gamma Beam Irradiator provides a uniform radiation field for calibrating radiation detection instruments and irradiating personnel dosimetry. This irradiator is available with up to 7 radioactive sources in a wide range of activities. The system comes complete with radiation sources, shielded enclosure, beam collimator, safety interlocks, and control panel. Optional equipment that can enhance capability include attenuators, positioning tracks, and automated controllers.

- Up to 7 Sources
- Cesium-137 Sources - 10 mCi to 2200 Ci
- Cobalt-60 - 10 mCi to 5 Ci
- Fail-Safe Design
- Timer or Fully-Automated Operation
- Precision Linear Positioning Track
- 0 - 8000X Attenuator Set

Radioactive Sources

The sources are doubly encapsulated, hermetically sealed, special form sources. The source capsule is fabricated of stainless steel. Sources are available in a range of sizes up to 450 Ci for Cs-137 and 5 Ci for Co-60

Standard source sizes that are available are:

10 mCi	500 mCi	10 Ci	50 Ci	450 Ci
50 mCi	1Ci	20 Ci	100 Ci	1200 Ci
100 mCi	5 Ci	30 Ci	200 Ci	2200 Ci

Sources are housed in an aluminum holder with fins to facilitate movement The source is moved to the exposed position by compressed air and held in place by a suction cup. Photoeyes and vacuum sensors indicate source position. In the shielded position, the source is shielded on all sides with lead and tungsten.

The sources are held in a motorized carousel that rotates to align the selected source with the transport tube. With the source in the storage position, radiation levels 12" from the surface of the device are <5 mR/hr. The source is moved between the two positions in less than 1 second via the control panel.

Shielded Enclosure

The shield consists of two steel-encased lead cylinders. The storage shield holds the carousel and sources. A second smaller shield consists of the collimated opening where the beam centerline is 1 meter above the floor. Lead surrounds the tube through which the source travels, providing sufficient shielding to limit the radiation level to < 5 mR/h at 12" from the surface of the shield when sources are in the shielded position. Overall dimensions, including pneumatic components and base plate, are 24” wide x 24” deep x 60" tall.

Systems and solutions for irradiation applications, X-Ray inspection, positioning equipment, and radiation shielding. We offer a wide range of standard products and custom designs to match your specific requirements. Call today to see how we can help.

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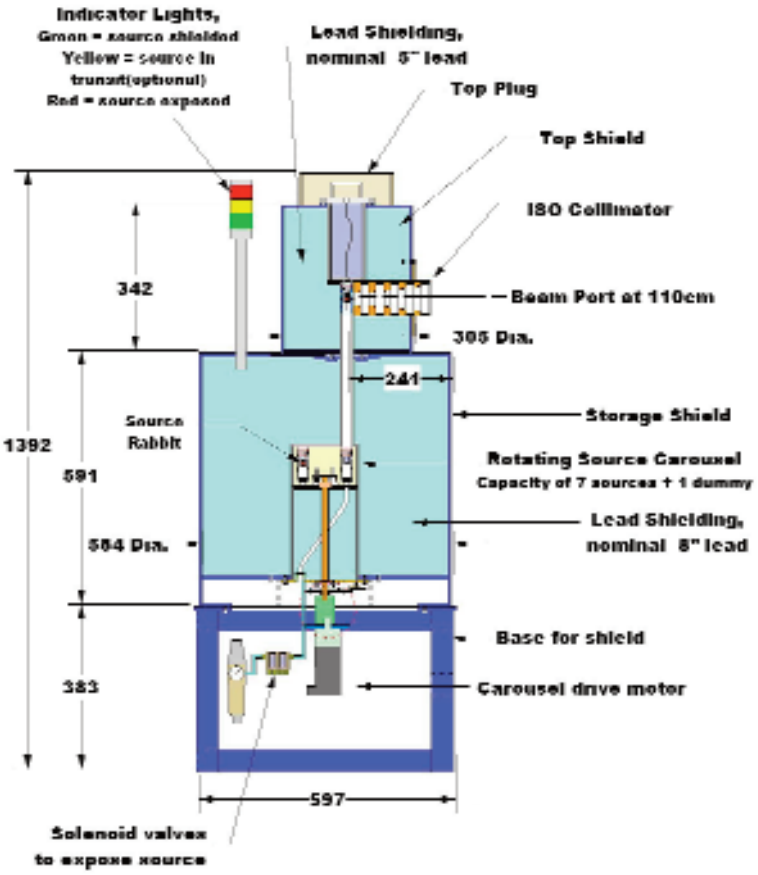


A cylindrical beam collimator, which defines and limits the extent of the useful beam, is provided as an integral part of the shield. It confines the full strength beam to a maximum solid angle of 30°. Radiation levels fall off rapidly outside of the cone of radiation defined by the tungsten collimator. The standard collimator has a 15° beam angle and is available in other sizes upon request.

Safety System

The irradiator system incorporates many features to make it a safe system to operate. "Fail Safe" design constraints have been applied to all components that involve source exposure. The safety interlock system must be fully satisfied before an exposure can occur. Status panels show radiation conditions at a glance. The entire system has been designed to meet or exceed guidelines and regulations found in ANSI Standards N43.3 and NCRP 88.

EMO Buttons. The Emergency Off (EMO) buttons are large, red mushroom-style buttons located on the irradiator and at the control panel. When any EMO button is pressed, the source(s) return to the shielded position.

Door Interlock. A door interlock is provided for the room entrance door. When the door is open, power to the source air cylinders is broken, preventing source exposure. Two redundant micro switches monitor the door interlock position.

Status Indication System. A red warning light is mounted on top of the irradiator, and is on whenever the source is not fully shielded. A green light is on when the source is fully shielded. On the control console, indicator lights show source position, attenuator position, and interlock status.

Pneumatic Systems. The air systems are designed so that any failure will shield the sources. Low pressure will activate the low pressure switch, preventing operation. If the expose solenoid fails, the source remains shielded.

Non-Routine Shutdown

The system is designed to move the source(s) to the shielded position whenever conditions are not exactly right. When an irradiation is in progress, the source(s) return to the shielded position whenever:

1) the "EMO" push-button is pushed
2) the "Return" push-button is pushed
3) the timer times out
4) power is lost
5) the system is turned off
6) an error occurs (including loss of air pressure and/or door interlocks opened).

Control Panel

The control panel provides for complete control and monitoring of the irradiator. The front panel has expose and return pushbuttons, indicator lights, an emergency off pushbutton, an LCD display that shows exposure time, and a keyed power switch. A keypad provides data entry for exposure time and source selection for dual source systems. When optional equipment is part of the irradiator, controls are added for these features.

When power is applied to the system via the keyed power switch, indicator lights turn on to show source position. Interlock status is displayed on the LCD display. When the safety interlock circuit is satisfied, an exposure can be started by pressing the expose push-

button. The carousel rotates to the selected source. The source is blown to the exposed position and captured by the suction cup. The indicator lights change from green to red to show the source is exposed. The source is returned to the shielded position when the exposure time is reached or when the return pushbutton is pressed. A timer allows both preset and manual operation for the time of exposure. Exposure time can be set and is displayed up to 1,000,000 seconds. When zero is entered for time, the exposure operates in manual mode and will continue until the return pushbutton is pressed. The controller monitors for error conditions and will terminate an exposure when an error occurs. Errors include safety interlock circuit opened during exposure, emergency off switch actuated, low air pressure, as well as other items. Before an exposure can continue, the error must be cleared, the safety interlock circuit satisfied, and the expose pushbutton pressed.

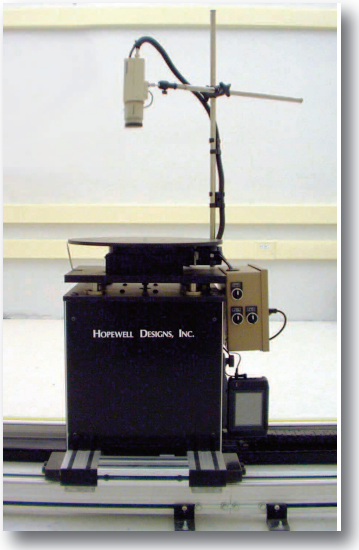
Optional Equipment

Attenuators

A set of four attenuators can be used individually or in combination to provide beam intensity attenuation ranging from 0 to X8000. The four attenuators provide adjustments of X2, X4, X10, and X100, and are available in manual and automated models. The manual model requires the operator to install the desired attenuators. In the automated version, each attenuator is actuated by a pneumatic cylinder that mobilizes to open the attenuator. Indicating attenuator position, are reed switches on the air cylinders. Controls are located at the control panel which also shows the position of each attenuator.

A stand-alone compressor can be provided to actuate the source and attenuator air cylinders if instrument air is not available.

Attenuator Set with Pneumatic Actuators



Linear Positioning Track

- 1, 2 or 3 axes
- Manual or automated
- Up to 10m travel
- +/- 1 mm accuracy
- 100 Lbs. capacity
- Camera for viewing instruments
- Laser alignment
- 120 VAC available at platform
- RS-232 connection at platform for instruments

Linear Positioning Track with Camera to View Instrument Being Calibrated

Linear Positioning System

The linear positioning system (LPS) provides a means to precisely position a radiation survey instrument or TLDs an exact distance from the irradiator. The LPS, operated via the control panel, can move up to three axes over a range of 10 meters with an accuracy of ± 1 mm. The LPS consists of a framework, linear rails, up to three axes of travel, a platform, and drive system.

To ensure that the platform is precisely aligned to the radiation beam and remains parallel to the beam throughout its travel, the framework for the linear rails is designed and manufactured to be extremely rigid and flat. The framework is extruded aluminum. The linear rails are mounted on extruded aluminum brackets that fit into framework. The framework is made in two sections to facilitate installation. Adjustable feet on the legs allow the framework to be leveled. The framework is bolted to the floor.

High precision linear rails are provided to keep the platform exactly aligned to the radiation beam. The rails consist of parallel, hardened steel round ways. Four precision ball bushings ride on the rails to provide accurate, repeatable positioning with a minimum of backlash or side-play.

The LPS can have up to three axes of travel: the X-axis is parallel to the radiation beam, the Z-axis is vertical, and the R-axis rotates in the horizontal plane. Each axis includes a scale (in cm) to confirm positioning. Typical ranges are: X-axis 10 meters; Z-axis 40 cm; and Rotational axis 360°. The platform is designed to facilitate mounting instruments and phantoms in a stable, repeatable fashion. It is made from aluminum plate that has been black anodized. A grid is engraved on the plate in 1 cm squares. Holes are drilled and tapped in the plate in 10 cm intervals to allow jigs to be bolted to the platform. Platform size is 30 cm x 40 cm. It can hold 100 lb. without deflection.

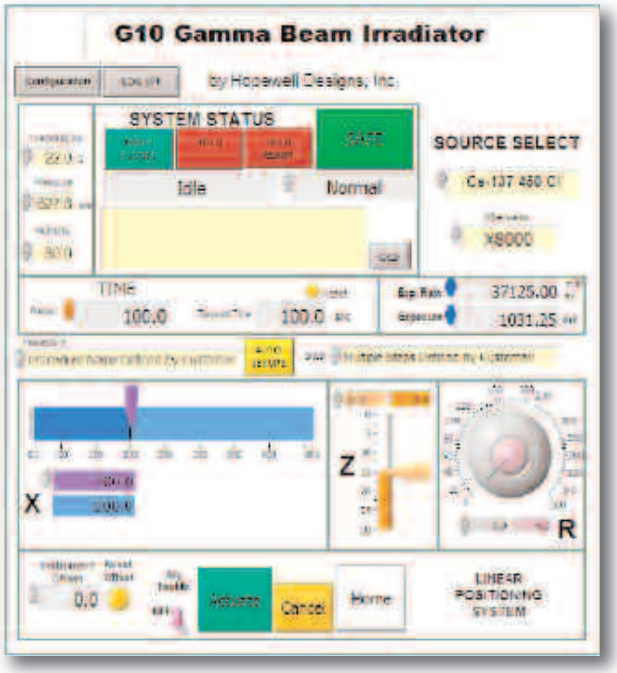
The LPS is offered with manual, automated, or a combination of drive systems. With manual X and R axes, the operator manually moves the axis to the desired position and clamps it in place. The Z-axis is driven by a motor manually controlled by the operator with a switch on the platform. The drive system uses stepper motors to provide extremely accurate positioning without sacrificing speed or ease of use. The X-axis operates at a maximum speed of 20 cm/s, and the Z-axis at 1 cm/s. Positioning accuracy, even on 10 meters systems, is ± 1 mm.

When operating under computer control, an operator can input the desired position, or enter the desired exposure rate and the position will be calculated. An X-axis instrument offset is used to enter the distance from the instrument's centerline to the center of the platform. The X-axis values then show distance to the instrument's centerline.

Computer Based Control Panel

- **Calculates Exposure Rate & Decay Correction**
- **Automatic Set-Up of Irradiator**
- **Automated Calibration of Irradiator**

The GC60 can be supplied with a computer based control system. This approach offers several advantages: calculation of exposure rate via polynomial equation, automatic set up of irradiator, automated calibration of irradiator, and enhanced ease of use. The computer screen shows controls and indicators for interlock status, expose/shielded state, preset and elapsed time, preset and actual positions for track, source and attenuator selection, and automatic set up procedure and step. The automated controller uses the latest model of computer and includes circuit boards for interfacing to the inputs and outputs, the linear positioning track, and the electrometer.



Computer Control Screen

Computer Control Panel

With the power of the computer available for calculations, the irradiator control system can calculate the track's X-axis distance based on a desired **exposure rate.** This calculation includes decay correction and is based on a polynomial equation that precisely matches the measurement data collected for that source/attenuator/position combination. When distance is changed, the exposure rate for that position is **calculated**. The same arrangement holds for time and exposure – when one is changed, the other is calculated and displayed.

The **one button set up** routine speeds up instrument calibration and increases accuracy by quickly configuring the irradiator to match the instrument's calibration procedure. With the change of one button, this routine configures source, attenuator, track position or exposure rate, and time or exposure. These configurations are arranged in procedures and steps that the user defines. Whenever the operator changes a step, the irradiator is re-configured to match that step.

The **irradiator calibration** requires that hundreds of data points be collected to determine exposure rates for distances along the positioning track. This data must be collected for each source and each attenuator. With the computer control system, this process is automated. The computer is connected to the electrometer via GPIB interface. The irradiator control system presents a set up screen that allows the operator to specify distances, exposure time, and number of exposures at each position. Once the operator starts the exposure, the control system performs the exposures at each position, collects the exposure rate from the electrometer and saves it to a spreadsheet file. The automated sequence continues until all data is collected. An equation curve fit program is used to fit the data to a polynomial equation. This equation is then coded into the software control program.

The computer based control system enhances ease-of-use by automating and simplifying many steps of the calibration process. It handles the mundane, repetitive tasks and lets the operator concentrate on the calibration procedure.