

Application for Amendment for  
Sealed Source and Device Registration  
for the  
  
Model GC88  
Gamma Irradiator  
Registry Number GA 1138-D-105-S

March 17, 2014

Manufacturer:  
**Hopewell Designs, Inc.**  
5940 Gateway Drive  
Alpharetta, GA 30004

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## 1 SUMMARY DATA

**Date:** March 17, 2014

**Manufacturer:** Hopewell Designs, Inc.  
5940 Gateway Drive  
Alpharetta GA 30004  
  
Radioactive Material License GA 1434-1

**Contact:** Chris Vanderpool, RSO, Telephone (770) 667-5770

**Distributor:** Hopewell Designs, Inc.  
5940 Gateway Drive  
Alpharetta GA 30004

**Model Number:** GC88-SL

**Radioactive Source:** X.38 manufactured by QSA Global

**Radionuclide & Max. Acti**Cesium-137, 36 mCi

**Leak Test Frequency:** 6 months

**Principal Use:** Gamma Irradiator, Category I (J)

**Custom Device:** No

## **2 SUMMARY DESCRIPTION**

This amendment is to add the sub model GC88 Superlite (SL). The Model GC88-SL Gamma Irradiator is a portable system designed to irradiate dosimeters, electronic pocket dosimeters, and small detectors. The irradiator consists of a gamma radiation source, shielding, source locating rod, a channel and drawer inside the shield to irradiate the instrument, attenuator(s), and carry handles.

The source used in the device is Cesium-137 in special form encapsulation. The source is permanently mounted inside a shield that completely surrounds the source. A small channel, that enters the shield from the front, provides a passage for an instrument to be placed close to the source and exposed. Attenuator(s) allow different dose rates to be delivered to the dosimeter. The maximum activity of the GC88-SL is 30 mCi of Cs-137.

The device is operated manually and designed to be carried by two people. Typical operational steps consist of: placing an instrument in the drawer, closing the drawer, setting the attenuators, and setting the source rod position. Exposure begins when the drawer is closed and ends when it is opened. The source positioning rod and attenuator(s) are used to control the exposure rate to the instrument being irradiated or calibrated. Exposure rates increase as the source is lowered near the instrument and decrease as the source is raised.

The GC88-SL includes several safety features to assure personnel are not exposed to radiation. The shield limits the exposure rate to  $< 5$  mRem/hr 12" from the surface. The source is permanently enclosed in the shielded container. There is no access for personnel to be exposed. The channel for exposing instruments is too small to permit hands or fingers to be directly exposed to the source.

## **3 CONDITIONS OF USE**

The GC88-SL is designed to be portable and is used to irradiate instruments. The source is shielded at all times. Exposure rates at the surface of the irradiator are limited at all times to less than 5 mRem/hr at 12" from the surface.

### **3.1 ROUTINE OPERATION**

The GC88-SL is used to irradiate instruments for the purposes of checking performance and/or determining element correction factors. The unit is designed to be used in the field by technicians and carried by two people.

Under routine use, an operator would take the following steps to operate the irradiator.

1. Shielded drawer is opened.
2. An instrument is placed in drawer and drawer closed.
3. Exposure begins when drawer is fully closed.
4. Attenuators are changed to adjust exposure rate.
5. The source rod lever is set into the desired position.
6. Exposure ends when the attenuator is closed, drawer is opened, and instrument removed.

During this time, the operator would be operating the irradiator from the front of the unit. The source is shielded at all times, both when the drawer is opened and when it is closed. The operator would not have access to any points inside the shield.

### **3.2 ABNORMAL CONDITIONS**

Abnormal conditions would result from the user not following the standard procedure as described above. The only point where slightly elevated exposure rates occur is where the drawer exits the shield.

If drawer became jammed, the operator might need to work close to the entrance of the shield to free the drawer. Under these conditions, he would be working around slightly elevated exposure rates, but would not be exposed to any direct radiation.

### **3.3 PRECAUTIONS BY USER**

The user is advised in the system manual to:

1. Follow all nuclear regulatory guidelines.
2. Leak test the source every 6 months.
3. Contact Hopewell Designs, Inc. if abnormal conditions develop.

### **3.4 OPERATING CONDITIONS**

The GC88-SL is designed to be portable for the purpose of instrument calibration. In a normal working environment with regards to temperature, humidity, corrosive atmosphere, and vibration; the normal working environment includes 10° to 35°C and 10% to 80% relative humidity. The GC88-SL can be stored in an environment ranging from -20° to 50°C and 5% to 100% relative humidity.

The GC88 has a useful life expectancy of a minimum of 15 years.

## **4 DETAILS OF CONSTRUCTION**

The GC88-SL gamma irradiator is designed to irradiate dosimeters and small instruments. The Superlite (SL) is designed to be portable and carried by two people. The device weighs approximately 170 lbs and consists of the following major components:

Shielding;  
Radiation source;  
Source control rod;  
Attenuator(s); and  
Drawer.

## 4.1 SOURCE SHIELDING

Lead, tungsten, and stainless steel are used to shield the gamma radiation. The shield is box shaped. The outer skin is 1/4" steel, and all joints are welded.

Minimum lead shielding: 0.875"

Minimum tungsten shielding: 0.545"

The source is located in the center of the shield. It is surrounded on all sides by tungsten and lead with a minimum thickness as shown above. 2" of tungsten is located above the source in the source tube. A channel enters the front of the shield for access to the source. A drawer is permanently installed in this channel. The drawer has lead blocks on the front and back so that the drawer opening is shielded whether the drawer is opened or closed.

A tungsten attenuator is located between the source and channel. A tungsten rod exits the front of the shield to allow the attenuator(s) to be positioned. The attenuator is designed to operate only when the drawer is closed; therefore, the drawer is locked into the closed position when the attenuator is open.

Materials used in the shield and source rod consist of steel, stainless steel, lead, and tungsten. No chemical or galvanic reactions have been observed on other containers made of the same materials and used over the last several years, and no such reactions are expected.

## 4.2 RADIATION SOURCE

The source is installed in a tungsten sleeve. A tungsten plug is then threaded into the tungsten sleeve. A set screw is used to secure the sleeve and plug, locking the source into position.

The source is inserted in the lead shield tube. The tube is sized to be slightly larger than the source. A stainless steel shield plug is inserted in the tube and a cover is welded in place to permanently lock the source in the shield.

The source used in the GC88-SL irradiator is Cesium-137 in special form. The special form source is encapsulated in a welded stainless steel capsule. The source is supplied with certificate for source activity, exposure rates, and leak tests. The following source is used in the GC88-SL irradiator. Activity levels are +/-20% of nominal.

Source	Mfg.	Nominal Activity	Maximum Activity	Registry No.
X.38	QSA Global	30 mCi	36 mCi	USA/0363/S-96 Rev.7

## 4.3 ATTENUATORS

A tungsten attenuator(s) is located between the source and the exposure chamber. The attenuators consist of tungsten blocks of varying thickness. The number of attenuators and thickness is set by customer requirements. Typically, the GC88-SL utilizes a single attenuator with a thickness to achieve X20 attenuation. The customer may request other attenuators sizes. The attenuator is housed in a stainless steel lined cavity approximately 2.25" wide x 1" tall x 5.375" long. Tungsten rods extend out the front of the shield to provide manual positioning of each attenuator.

#### **4.4 DRAWER FOR INSTRUMENT**

A rectangular channel is part of the shield and provides a means to move an instrument to the exposed position. It is made of stainless steel and is sized to match the instruments to be calibrated. Maximum cross section is 3" tall by 3.5" wide.

A drawer slides within the channel between the load/unload position and the expose position. The drawer is made of stainless steel with plastic fixtures to locate the instrument. Lead blocks on either end of the drawer shield the source in both positions. The drawer cannot be removed from the shield.

#### **4.5 CONTROL**

The GC88-SL is manually operated. The only features that can be manipulated by the operator are the source locating handle, attenuator(s), and the drawer.

### **5 LABELING**

Three labels are attached to the GC88-SL: a radiation warning label, a DOT-7A shipping label, and a manufacturer's label. The labels are constructed of aluminum with silkscreened text, and are attached with fasteners to the side of the shield where they are clearly visible. Examples of the labeling are included in Appendix B. The radiation warning label is 3" x 5" with a yellow background with a magenta radiation symbol and magenta lettering. This label states: "Caution Radioactive Material"; gives the specific isotope, amount and date; and declares the manufacturer is Hopewell Designs, Inc. (770) 667-5770. The DOT-7A shipping label is 3" x 5" with an aluminum background and black lettering. It states: "USA DOT-7A Type A, Radioactive Material, Type A Package, Special Form, Non-Fissile UN 3332". The manufacturer's label is 2" x 4" with an aluminum background and black lettering. It states: "Hopewell Designs, Inc., 5940 Gateway Drive, Alpharetta, GA 30004, (770) 667-5770; Model GC88-SL, Weight \_\_\_\_ LBS; and Serial Number \_\_\_\_."

### **6 TESTING OF PROTOTYPES**

The GC88-SL was run through a comprehensive series of tests to demonstrate and verify that it performed safely and reliably, and met all specifications. A prototype unit was tested for reliability, durability, and shielding. This evaluation demonstrated that the device is: 1) safe to operate; 2) operates reliably; and 3) meets all specifications.

The GC88-B is another model in this series similar in design to the GC88-SL. The GC88-B irradiator has been in operation for several years and has operated safely and reliably during that time.

#### **6.1 TESTING FOR SAFE OPERATION**

The GC88-SL is a lightweight variation of the GC88 and was tested for safe operation by operating the device under routine conditions and under error conditions. For routine operations, the device was cycled through the normal exposure cycle repeatedly to confirm all functions

performed as expected. The drawer was moved to the exposed position and back. The attenuator was operated repeatedly.

## 6.2 SAFETY EVALUATION

An evaluation was performed to determine safety status during normal and abnormal operation.

The GC88-SL was evaluated to determine if it is safe to operate. This analysis sought to determine the probability of exposing the operator (or any other person) to radiation levels exceeding regulatory limits. Data used in the evaluation came from engineering analysis and data on the prototype. Three cases were reviewed: 1) installation/maintenance; 2) normal operation; and 3) abnormal operation.

**Installation/Maintenance.** The GC88-SL is shipped as a complete unit with the source already installed in the shield. (The shield also serves as a DOT-7A shipping container.) At installation, the unit is moved into place with mechanical assistance. The shipping covers are removed. Source pull rod, source locating cover and the shelf are attached. The technician is not exposed to any elevated levels of radiation during this process.

For maintenance, no items inside the shield require servicing. All components that require maintenance are in non-radiation or low radiation areas. These items can be serviced without any excessive exposure to radiation.

**Normal Operation.** For normal operation, the operator works at the front of the irradiator. There are no elevated exposure rates anywhere that are accessible to the operator.

**Abnormal Operation.** Evaluation of the prototype has demonstrated that the GC88-SL would remain safe, even when error conditions occurred. If an accident occurred in which the GC88-SL was tipped over so that the shield fell to the floor, would the source be damaged, or radiation levels become elevated? The GC88-SL is constructed from steel, lead, and tungsten shielding. The outer casing is made of 1/4" steel plate with continuous welds on all joints. An analysis was performed as part of the DOT-7A certification. In this analysis, it was shown that only minor damage would result if the shield were dropped from a 4 ft. height.

In the unlikely event that an instrument becomes stuck inside the channel, there would be no elevated exposure rates outside the irradiator. In the event an instrument becomes stuck the operator would raise the source to the highest position and close the attenuator to reduce exposure rates when the drawer is opened. In order to free the stuck drawer the operator might need to pull hard on the drawer to open it. The channel for the drawer is too small to insert a hand. The operators hand could be exposed to slightly elevated exposure rates at the entrance to the channel, but exposure would be to the hands, not whole body.

## 6.3 TESTING FOR RELIABILITY

The GC88-SL is designed for an estimated life of 15 years. To evaluate reliability, the source positioning rod, drawer, and attenuators were operated repeatedly. The components operated smoothly the entire test. They were then evaluated for excessive wear and found to have little or no wear.

The potential for inadvertent exposure to radiation resulting from failure of components is extremely remote. The source is fully shielded at all times. The operator does not have access to the any elevated exposure rates. If failures occur, the instrument might receive the wrong amount of exposure, but the operator will not be placed in any danger.

The device was evaluated to determine if it fully complied with the standards of ANSI Standard N43.6 (N542) "Classification of Sealed Radioactive Sources."

The results of these tests and evaluations showed that the irradiator was in compliance with the specifications.

## **7 RADIATION PROFILES**

The GC88-SL shielding was designed so that exposure rates would be  $< 5$  mR/hr 12" from the surface of the shield under operating conditions.

### **7.1 METHODOLOGY**

Multiple pathways were evaluated to determine if exposure rates were  $< 5$  mR/hr 12" from the surface of the shield. An analysis was performed using Micro Shield v.9 by Grove Engineering. The exposure rates were calculated using a 30 mCi Cs-137 source. Four locations were analyzed and measurements calculated at the surface of the device, 5cm, 30cm, and 100cm.

The results of the analysis show that the radiation exposure rates are  $< 5$  mR/hr 12" from the surface of the shield. A table of the radiation survey is included in the section 7.2.

### **7.2 RESULTS**

The shield was evaluated for multiple cases. The highest exposure rates are presented below for the front of the drawer, at the attenuator handle, at the top of the shield where the source rod is installed, through the side of the shield, and through the bottom of the shield.

The cases were modeled using a maximum activity 36 mCi source. Typically, the source installed will be in the 30 mCi range so the exposure rates will be less. Each case was considered with the source configured as close to the sample point as possible with the attenuator in the open position. \*Note: The device is designed to sit on a level surface during operation and will not be carried or transported when the source is in the unshielded position.

**Maximum Radiation Levels (mR/hr)**

Survey Location	Surface	5 cm	30 cm	100 cm
Front of the drawer	15.4	11.3	3.73	0.79
Attenuator handle	0.3	$<0.3$	$<0.3$	$<0.3$
Top of the shield	12.5	3.1	0.24	0.05
Through the side of the shield	1.1	0.4	0.04	$<0.04$
*Through the bottom of the shield	85	40	5.7	0.47

## **8 QUALITY CONTROL**

Quality Control remains the same as the original application.

## **9 INSTALLATION, SERVICING, & INSTRUCTIONS TO USERS**

### **9.1 SHIPPING AND INSTALLATION**

The GC88 series irradiators are shipped fully assembled and requires only minor set up to prepare it for use. The storage shield is shipped from Hopewell Designs, Inc. to the source manufacturer, typically QSA, Inc., where the source is loaded into the storage shield. The shield is rated as a DOT-7A container. A copy of the DOT-7A certification is included in the system manual. The unit is then shipped to the user.

Installation consists of removing the GC88-SL from the pallet, checking for damage, and moving the unit to the calibration room. Any packing material is removed from around the irradiator.

The shipping caps are removed from the top of the shield and the front of the drawer. A source pull rod is attached to the source rod, and then the source location cover is bolted to the top of the shield. The unit is then operated to confirm proper operation. Any minor adjustments are made as required. A radiation survey is performed to confirm exposure rates are  $< 5$  mR/hr 12" from the surface of the shield. Installation is typically performed by the user.

### **9.2 SERVICING**

Routine servicing entails checking that all mechanical components are aligned and working smoothly. Service is performed by the user at 6 month intervals.

The mechanical components have service lives that should extend beyond the useful life of the irradiator and should not need to be replaced. However, should the need arise, these components can be removed and serviced without giving excessive dose to the technician performing the work. This work can be performed by either Hopewell Designs, Inc. or the user.

The radiation source is permanently sealed in the shield and can not be serviced. The shield must be returned to the source manufacturer for replacement and/or servicing.

### **9.3 RADIOLOGICAL SAFETY INSTRUCTIONS**

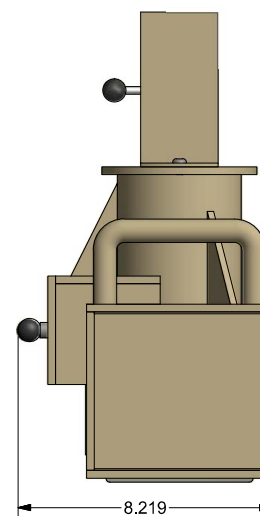
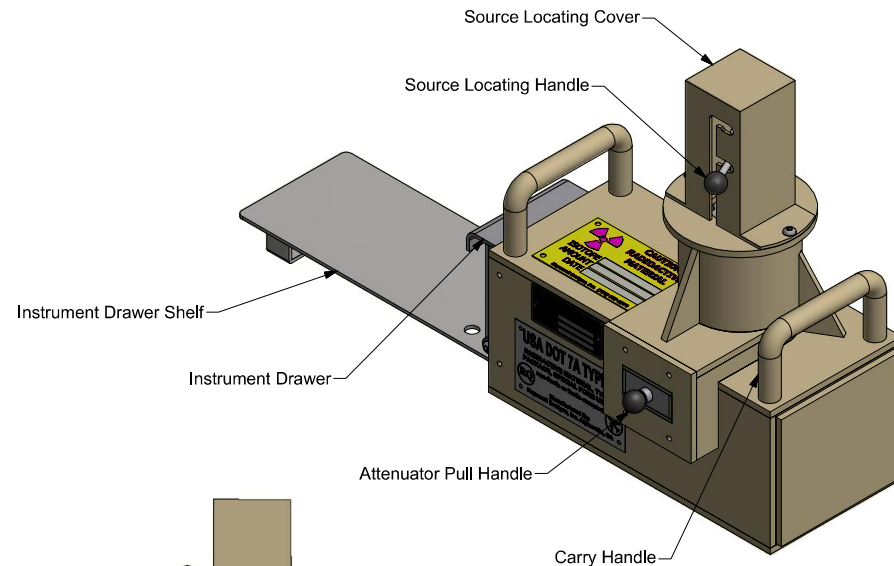
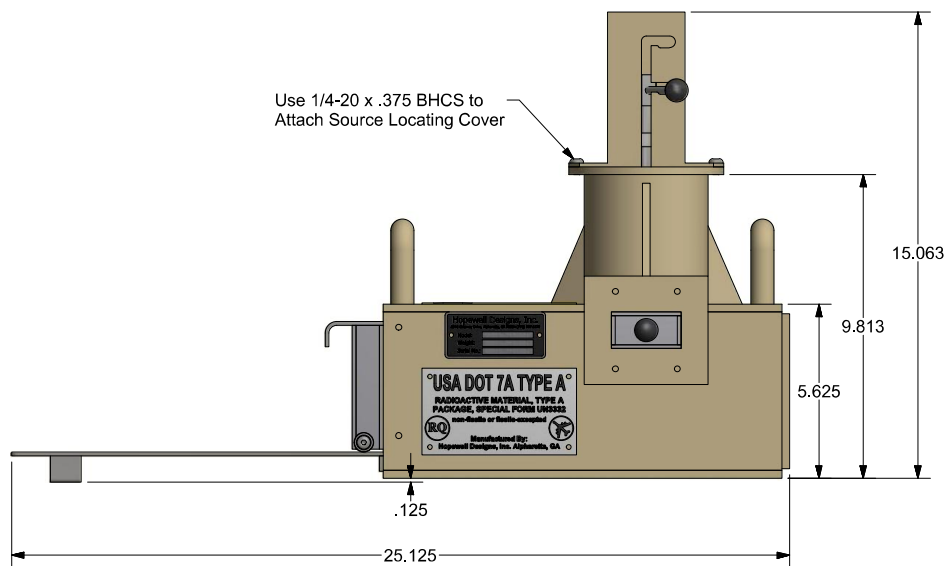
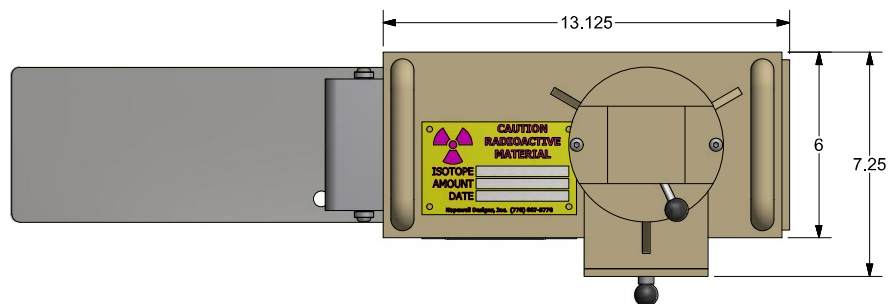
A system manual is supplied with the device. This manual includes the following information:

1. Technical description of the device;
2. Operating, maintenance, and installation instructions;
3. Radiation safety instructions; and
4. Source certificates.

Radiation safety instructions are incorporated into the system manual. These instructions include:

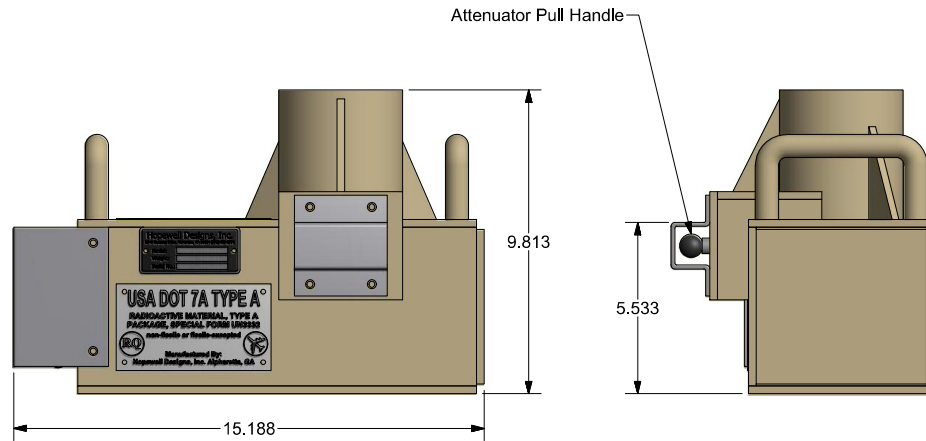
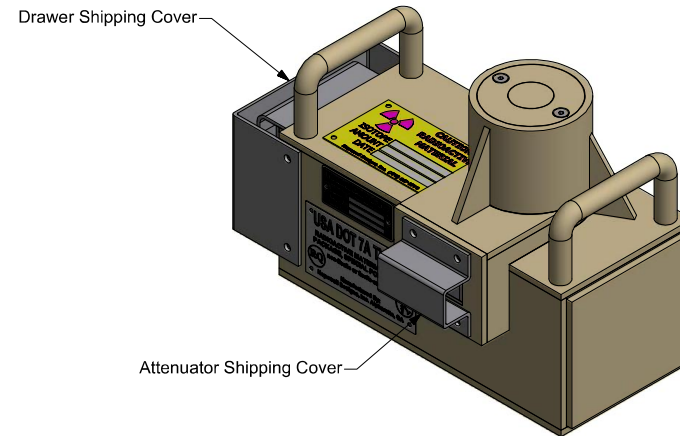
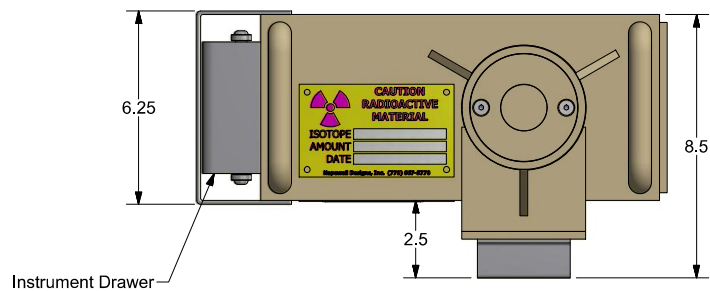
1. General radiological safety information;
2. Leak test procedures;
3. Disposal procedures;
4. Specific instructions for operation and maintenance; and
5. Radiation exposure rates at the exterior surfaces.

## **Appendix A: Engineering Drawings**



# **Irradiator Assembled for Typical Use**

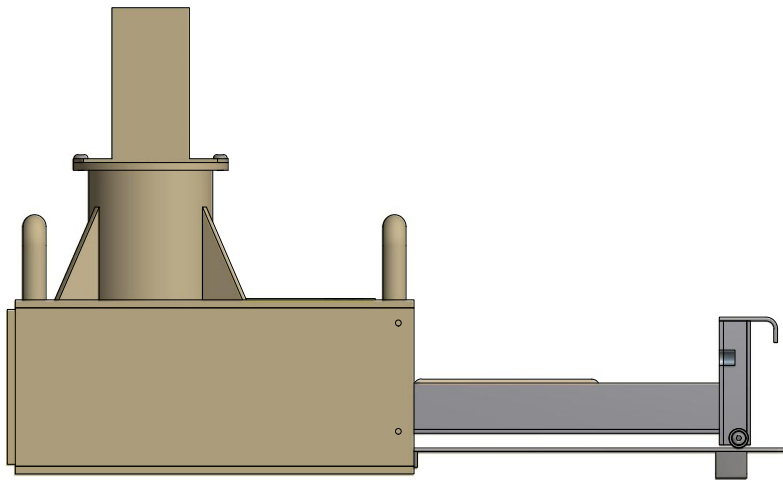
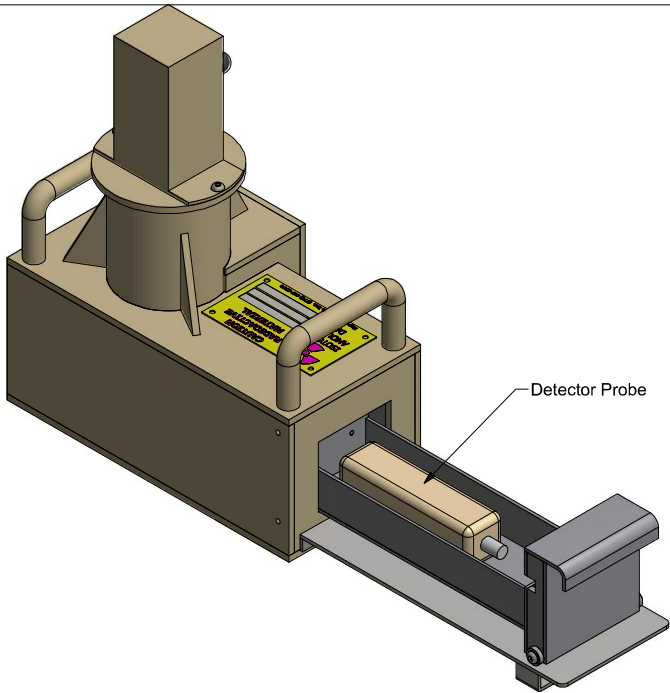
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				REVISION	DATE	GC88SL		
				RAK	3/5/2014			
				RLH	3/5/2014			
				± 0.125		Overall Assembly		
				2/25/2014				
				SCALE: 1:4	SIZE: B			NUMBER: 4818
REV NO.	DESCRIPTION	DATE	AUTHOR	FILE NAME: C:\WORK\HSP CORREL\brackets.dwg				DATE PLOTTED: 3/5/2014



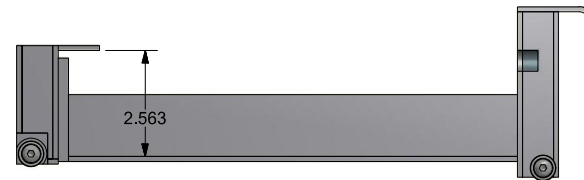
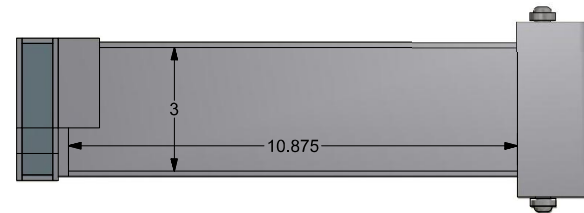
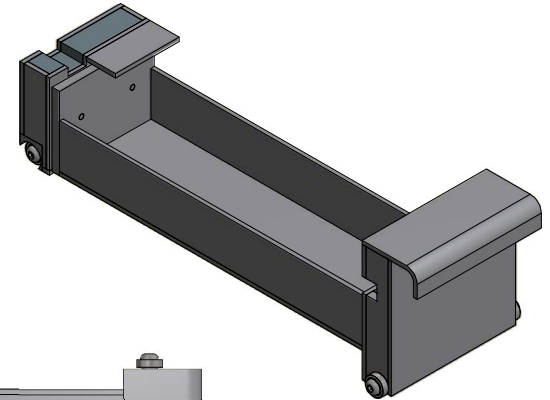
**Irradiator Assembled for Shipping with Covers**

**Approximate Weight for Shipping: 167 lbmass**

				PROJECT NAME		HOPEWELL DESIGNS, INC.	
				2175 Redstone/ US Army		5940 Gateway Drive, Alpharetta, GA 30004	
				GC88SL		GC88SL	
				DATE	DATE		
				A. Knotakis	RAK	3/5/2014	
				R. Howell	RLH	3/5/2014	
				APAD			
				DIMENSIONS TO SURFACE (INCLUDES SURFACE)		± 0.125	
				DATE		2/25/2014	
				SCALE	1:4	B	
				NUMBER		4818	SHEET 3 of 24
				FILE NAME		4818-IRP GC88SL-Rev01.dwg	
						DATE 3/5/2014	
REV NO.	DESCRIPTION	DATE	AUTHOR				



SCALE 1 / 4

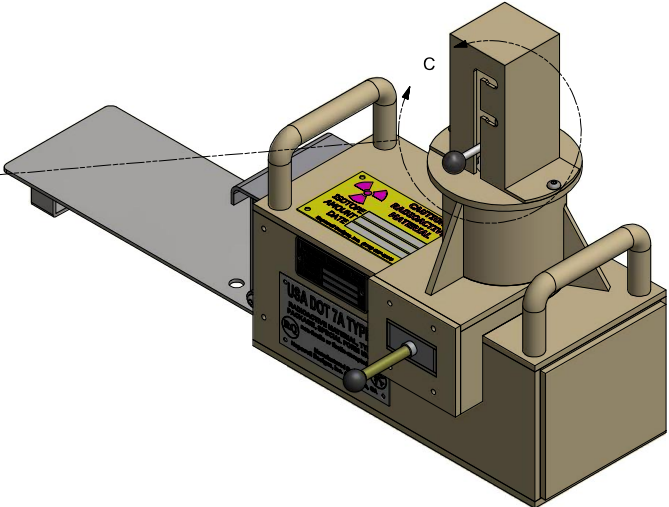
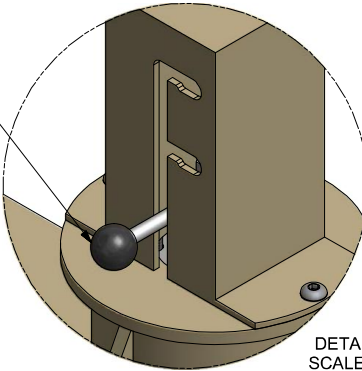


**Internal Drawer Dimensions for Detectors**

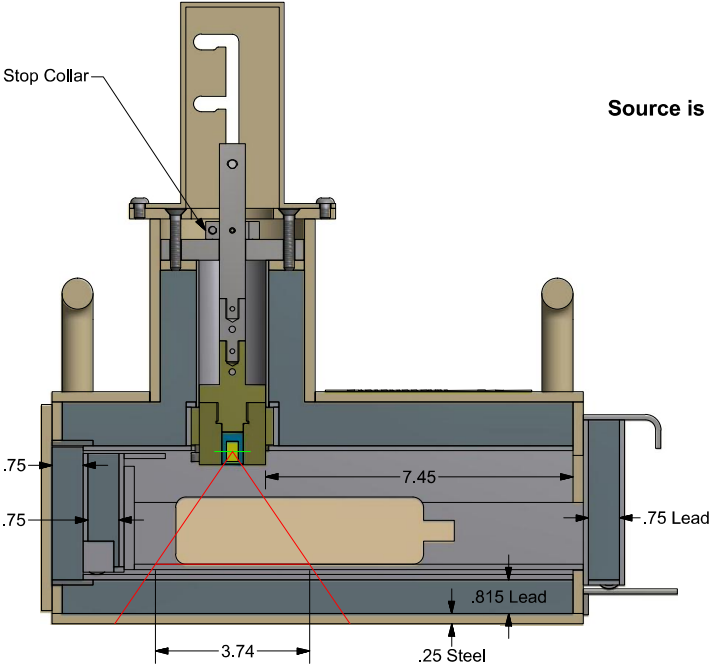
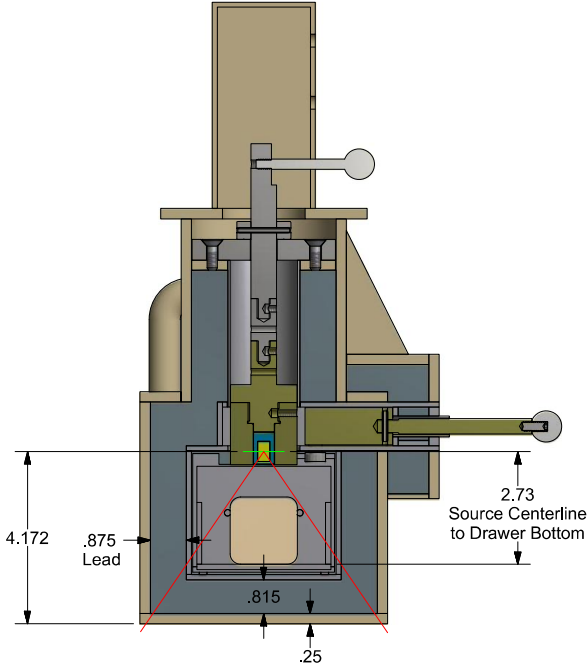
				<b>HOPEWELL DESIGNS, INC.</b> 5940 Gateway Drive, Alpharetta, GA 30004			
				<b>GC88SL</b>			
				Drawer Views			
				SCALE: 1:3 DATE: 2/25/2014 REV: B NUMBER: 4818 SHEET: 4 of 24			
REV NO.	DESCRIPTION	DATE	AUTHOR	FILE NAME: 481801 HOP GC88SL 01.dwg DATE: 3/5/2014			

				± 0,063		Source Located Above Attenuator	
				2/25/2014			
				SCALE: 1:3	REV: B		
REV NO.	DESCRIPTION	DATE	AUTHOR	FILE NAME: A00000-HOP-CC0000-00000000.dwg		DATE 3/5/2014	

To locate source in lowered position, open attenuator then lower handle in groove until stop collar is resting on top of shield. Attenuator can only be open in this position.

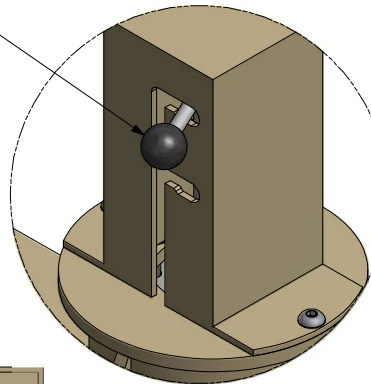


Source is in lowered position with attenuator open

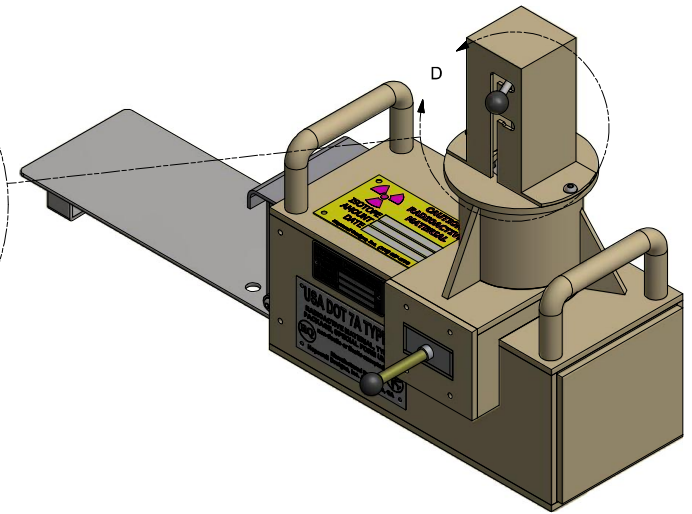


PROJECT NAME			HOPEWELL DESIGNS, INC.		
GC88SL			5940 Gateway Drive, Alpharetta, GA 30004		
DESIGNED	RAK	3/5/2014	GC88SL		
APP'D	RLH	3/5/2014			
TOLERANCES UNLESS OTHERWISE SPECIFIED			Source Located at Bottom of Travel		
DATE			± 0.063		
DATE			2/25/2014		
SCALE			1:3	SHEET	6 of 24
REV NO.			DESCRIPTION	DATE	AUTHOR

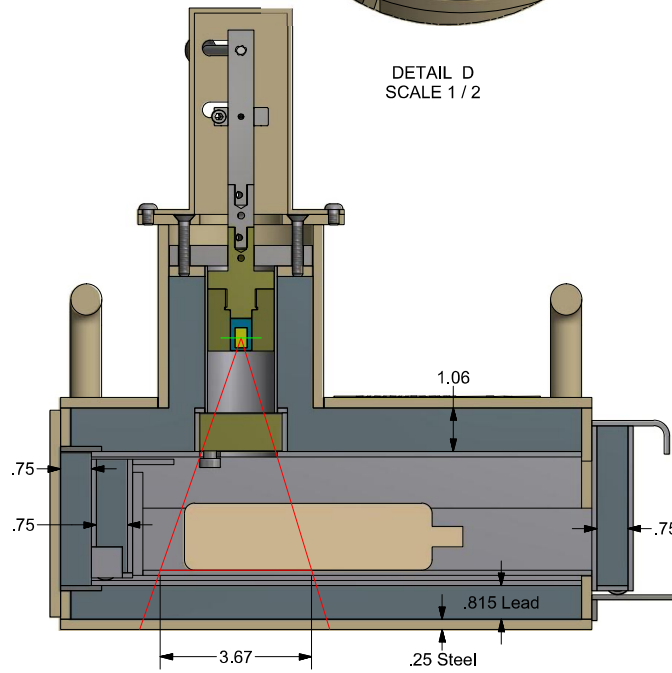
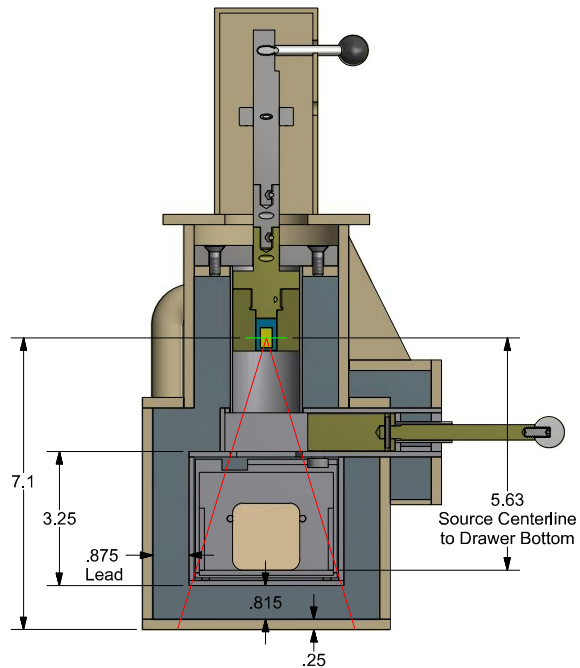
To locate source in top of travel position,  
place position handle in top notch.  
Attenuator can be open or closed in this position.



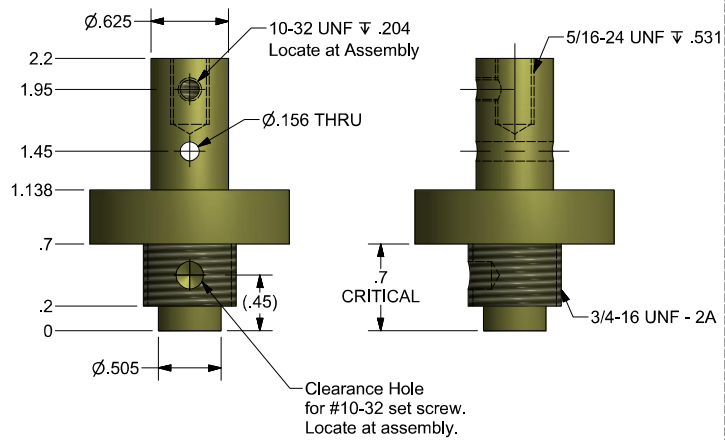
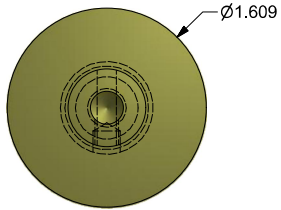
DETAIL D  
SCALE 1 / 2



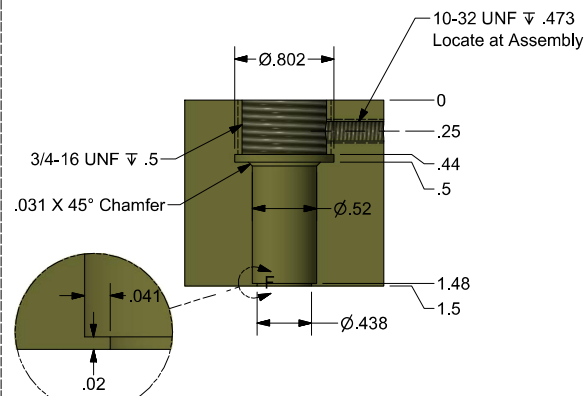
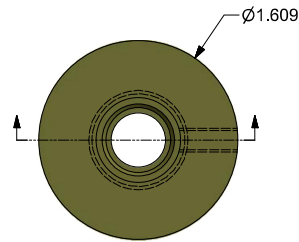
Source is at top of travel with attenuator open



					DRAWING TOLERANCE (UNLESS NOTED)		± 0.063		Source Located at Top of Travel			
					DATE		2/25/2014					
					SCALE	1:3	GRID	B	NUMBER	4818	SHEET	7 of 24
REV NO.		DESCRIPTION		DATE	AUTHOR	FEC NAME ENTERED FOR CORRELATION ONLY					DATE UPDATED	3/5/2014

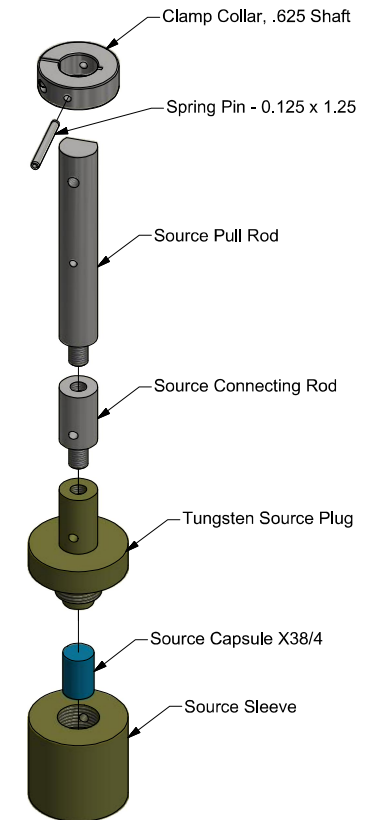


Tungsten Source Plug  
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MAT'L: Tungsten



DETAIL F  
SCALE 5 : 1

Source Sleeve  
QTY: 1  
MAT'L: Tungsten



SCALE 1 / 2

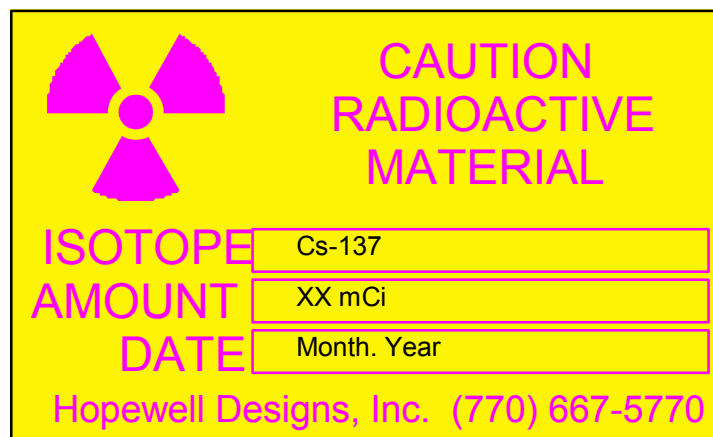
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REV NO. A. Knotaitis R. Howell		REV NO. RLK		DATE 3/5/2014		GC88SL	
DATE 3/5/2014		REV NO. RLK		DATE 3/5/2014		Source Holder Details	
TOLERANCES TO SURFACE (UNLESS NOTED)				± 0.005			
DATE 2/25/2014							
SCALE 1:1		REV NO. B		NUMBER 4818		SHEET 21 of 24	
1:1 scale Approved by GC88SL: knotted@us.army.mil				DATE 3/5/2014		DATE 3/5/2014	

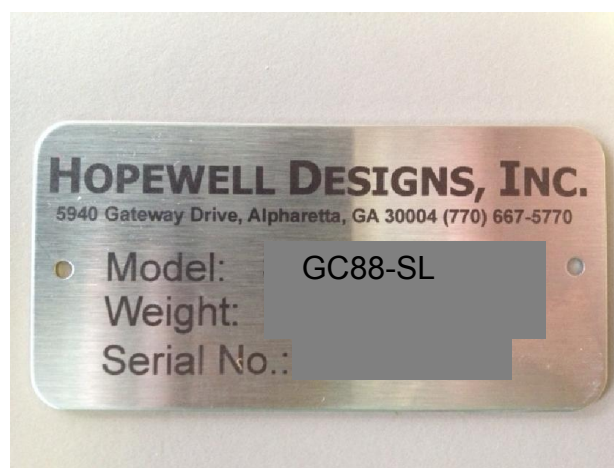
## **Appendix B: Labeling**



Type A Label, 3" x 5", Silver background, black letters



Radiation Label, 3" x 5", Yellow background, magenta letters



Manufacturer's Label, 2" x4", Silver background, black letters

## **Appendix C: System Manual**

# **Hopewell Designs, Inc.**

5940 Gateway Drive • Alpharetta, GA 30004 • (770) 667-5770

[www.hopewelldesigns.com](http://www.hopewelldesigns.com)

***MODEL GC88-SL***

***GAMMA IRRADIATOR***

***OPERATIONS & MAINTENANCE MANUAL***

***Date: March 17, 2014***

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## **1 Introduction**

The Model GC88-SL, designed and manufactured by Hopewell Designs, Inc., is a self contained irradiator that provides radiation beams of varying strength for calibrating radiation detection instruments.

This Operations and Maintenance Manual presents a technical overview of the irradiator system, describes the operation, and reviews maintenance procedures. Appendices include all the supporting information necessary to operate and maintain the system.

### **WARNING:**

**Read these instructions carefully before unpacking, using, storing, transporting or disposing of these devices for safety reasons and to ensure correct usage.**

1. These systems produce radiation which can cause damage to health unless all instructions and regulations governing their use are observed.
2. The calibration systems must only be operated by authorized, competent, trained personnel. The system should be secured to prevent unauthorized operation of the equipment.
3. All relevant local and national regulations, codes of practice and international transport regulations must be followed.
4. The calibration systems must not be used or operated for purposes not agreed to in writing by Hopewell Designs, Inc., or the warranty is void.
5. The systems may not be modified without written agreement from Hopewell Designs, Inc., or the warranty is void.
6. All accidents must be reported immediately to the local safety authorities.
7. These instructions must be adhered to at all times.

## **2 Technical Description**

The GC88 Superlite (SL) Irradiator is a self contained irradiator in which the source is mounted in the center of the shield and permanently shielded. The irradiator is steel box 15.2" x 8.5" x 10.3" tall. A source is mounted in the middle. An exposure chamber is located under the source. Lead and tungsten surround the source and exposure chamber. A drawer allows instruments to be moved to the center of the shield and exposed. The source locating rod and attenuators provide a means to vary the exposure rate. The irradiator is self-contained and no elevated exposure rates are possible outside the shield.

See drawing 4818RO in the appendix for more information. The major components are described below:

1. radioactive source
2. source locating rod
3. shielded enclosure
4. drawer
5. attenuators

## **2.1 Radioactive Source**

The GC88-SL has a ~30 mCi Cs-137 source in the center of the shield. The source is a doubly encapsulated, hermetically sealed, special form source. The source capsule is fabricated of stainless steel. The source is permanently mounted in the center of the shield through a hole in the top of the shield. After installation, this access hole is bolted and welded closed.

The source shines down into a cavity approximately 3.5" x 3" and then into the drawer channel. When the drawer is either in the closed or open position radiation levels outside the shield are <5 mR/hr 12" from the surface.

The shield is made of a steel box 13" x 7.25" x 9.8" tall. The outer skin is ¼" steel with all seams welded. A channel contains a drawer that slides into and out of the exposure area in the center of the shield. The source is located above this channel. Lead with a minimum thickness of 0.75" fills the shield and surrounds the drawer channel and source.

At the back of the shield is a panel that provides access to the rear of the channel. On top of the shield is a panel for access to the source. On the right side is a panel that contains the attenuators and handles. After installation, these panels are bolted and welded closed. No access is available for service.

## **2.2 Drawer**

A stainless steel drawer slides in and out of the shield. Steel-encased lead shielding is mounted on the front and back of the shield to reduce exposure rates out the front of the drawer channel. The drawer slides onto a shelf at the front of the shield. An interlock on the attenuator prevents the drawer from being opened unless the attenuator is closed.

## **2.3 Attenuators**

An attenuator is located between the source and the drawer channel. The attenuator slides in and out of the beam by pushing a handle on the side of the shield. The nominal attenuation is X20.

## **3 System Operations**

The GC88-SL is used as a calibration check for radiation survey meters and/or dosimetry. It has no electrical components, and the mechanical components are simple to use. The drawer is opened and closed to place an instrument in the exposure chamber. The attenuators are opened or closed to adjust the exposure rate. The source positioning rod raises and lowers the source to adjust exposure rates.

The exposure rates outside the shield remain low for all modes of operation of the GC88-SL.

### **3.1 Drawer Operation**

The drawer is pulled open to load an instrument. The appropriate fixture is placed in the drawer. The instrument is placed on the fixture with the detector closest to the shield. The drawer is fully closed to place the instrument fully in the radiation field.

**Note:** The bottom attenuator must be closed before the drawer can be opened. A mechanical interlock will prevent the drawer from opening if the bottom attenuator is open.

### **3.2 Attenuator Operation**

The attenuator provides a nominal 20X attenuation. The attenuator is pushed in to decrease the exposure rate.

### 3.3 Source Rod Operation

The source can be positioned at 3 different distances. The source rod is lifted and the handle is moved into the slots to position the source. The different distances combined with the attenuator provide 5 different exposure rates. The attenuator must be open to allow the source rod to move to the lower most position.

### 3.4 Padlock

When the system is not in use, it should be locked to prevent unauthorized use. A padlock should be locked to the shelf in front of the drawer.

## 4 Maintenance

### 4.1 Routine Maintenance

The Irradiator has been designed and built using the finest components available to assure maximum performance with minimum maintenance. All components have life cycles that should last beyond the expected useful life of the source and calibrator. The following items should be checked periodically.

Description	Inspection Frequency	Action
Drawer movement	6 months	Check for smooth operation. If drawer sticks, add a few drops of the oil to the shelf. Do not oil the interior of the drawer.
Attenuator(s)	6 months	Check for smooth operation. If attenuators stick, add a few drops of the oil to the handle.

### 4.2 Installation

The GC88-SL comes partially assembled with the sources already loaded. Installation consists of the following steps:

1. The equipment is unpacked and inspected for shipping damage. A radiation survey is performed.
2. The shipping covers for the drawer and attenuator are removed.
3. The shelf is attached to the front of the shield so the drawer can slide on it.
4. Button head bolts are screwed into the remaining empty holes.
5. The source handle is installed.
6. The source locating cover is installed.
7. Radiation surveys are performed with the attenuators opened and closed, and drawer open and closed.
8. A site acceptance test is conducted to confirm all systems are operational.
9. Training is given to the personnel who will operate the system.

Note: Shipping covers should be saved in the event the unit needs to be shipped in the future.

### 4.3 Preparation for Shipment

The GC88-SL is a Type A DOT shipping cask. If shipment is required, preparation for shipment consists of the following steps:

1. Close the drawer and all attenuators.
2. Remove the shelf on the front of the shield.
3. Remove the source locating handle and cover.
4. Attach the metal shipping covers to the front of the shield to cover the drawer and the side of the shield to cover the attenuators. Secure with 4 bolts each.
5. Place the shield on a pallet and securely strap it down.
6. Prepare all shipping paperwork and notify proper authorities per regulatory requirements.

#### **4.4 Radioactive Source Requirements**

This device contains radioactive source material. Possession of this device requires that the user have a valid radioactive license from state or federal authorities that permits possession of this source material. The device produces a vertical beam of radiation that is fully enclosed inside the irradiator at all times.

Shipment of this device and the radioactive source material must be conducted under proper procedures to assure that all state and federal regulations are followed for the possession and shipment of this material. The device is a Department of Transportation Type A container. To prepare it for shipment, follow Section 4.3 "Preparation for Shipment" above. Proper shipping paperwork for radioactive sources must be completed. The recipient must be notified prior to shipment.

The device contains radioactive sources and lead shielding, both of which could pose an environmental hazard. Both materials are contained inside a steel cover.

This device has a recommended working life of 15 years.

##### **4.4.1 Leak Testing**

Leak tests of the radioactive source must be performed at intervals not to exceed 6 months. This test involves taking a cotton swab and wiping the most accessible surface to the source and evaluating the swab for removable contamination. Follow these steps to perform the leak test:

- Open the drawer.
- Using a cotton swab moistened with alcohol, wipe the inside of the drawer. Also wipe the top of the shield where the source cover is located (the disk that is bolted and welded to the top of the shield).
- Allow the swab to dry. Do not handle the portion of the swab used for the wipe with bare hands.
- Perform leak test analysis using instrumentation capable of detecting 0.005 microcuries of radioactive material.

##### **4.4.2 Source Disposal**

The irradiator should be returned to an authorized recipient such as the irradiator manufacturer or source manufacturer for purposes of disposal. The recipient should be notified prior to shipment of the device to arrange for shipping instructions and disposal fees.

## **5 Warranty Information**

Hopewell Designs, Inc. hereby grants conditional warranty for one (1) year from the date of purchase to cover parts and labor required to correct equipment, which it manufactures.

Hopewell Designs, Inc. makes no guarantees with respect to the merchantability or use of the equipment for any purpose other than the express function for which it was sold. The customer shall not hold Hopewell Designs, Inc. responsible or liable for any implied warranty or consequences accruing due to the performance of this equipment, but only for the operation of this equipment. Hopewell Designs, Inc. reserves the right to repair or replace faulty equipment at its discretion. The preferred mode of repair or replacement is through the return of defective parts or components. Remote diagnostics will be supported to determine the nature of a suspected warranted problem. Should on-site service be required and the failure is determined to be a result of negligence, abuse, or improper use of the equipment, the customer will be responsible for service and travel expenses in addition to the cost of any equipment or materials. Hopewell Designs, Inc. will honor the terms of warranty of the manufacturer for any equipment not produced by Hopewell Designs, Inc. but supplied as part of a system. For non-domestic customers, the same terms apply with a maximum limit of two unpaid service visits. Hopewell Designs, Inc. agrees to provide service and replacement parts for periods beyond the initial warranty agreement at time and materials rates.

## ***Hopewell Designs Inc.***

5940 Gateway Drive, Alpharetta, GA 30004

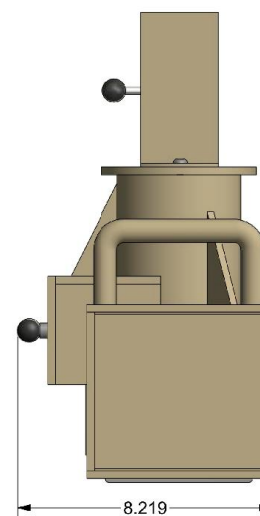
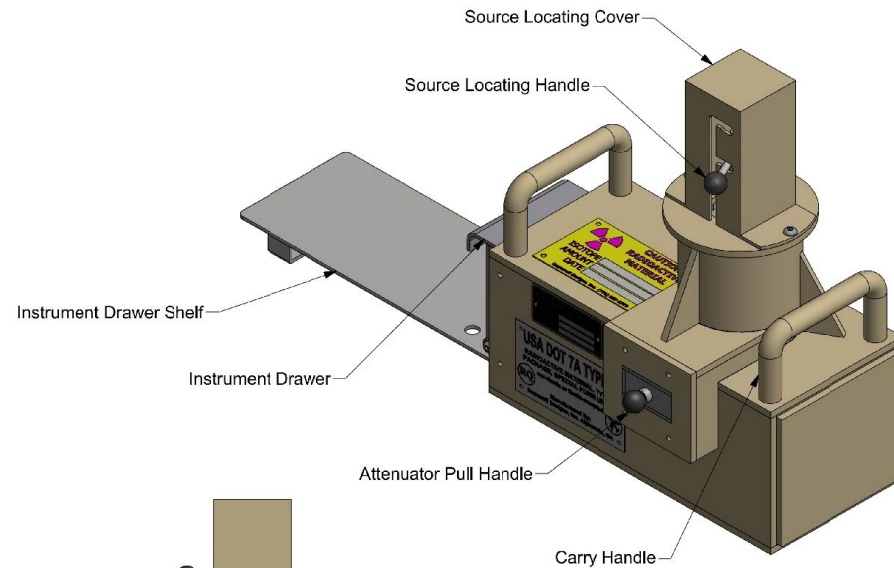
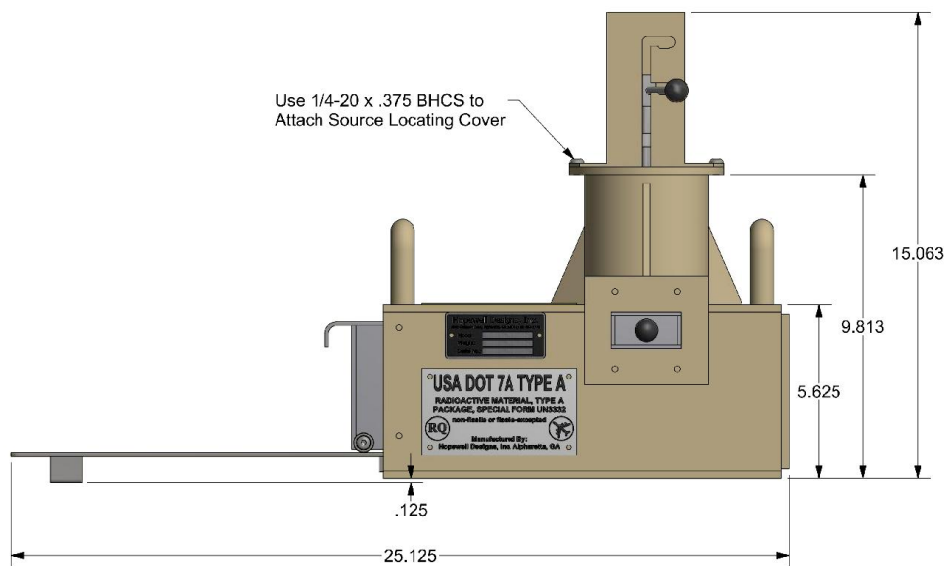
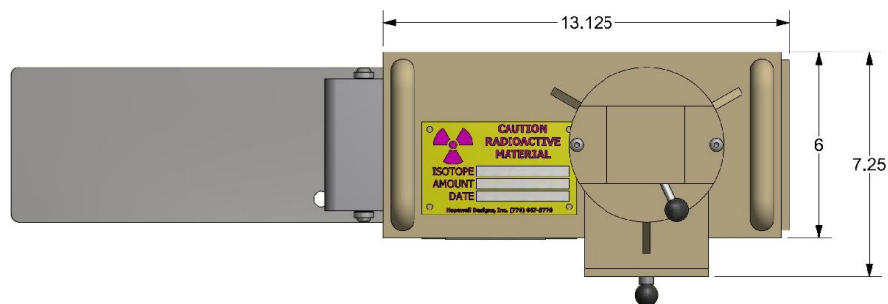
Phone: 770-667-5770, Fax: 770-667-7539

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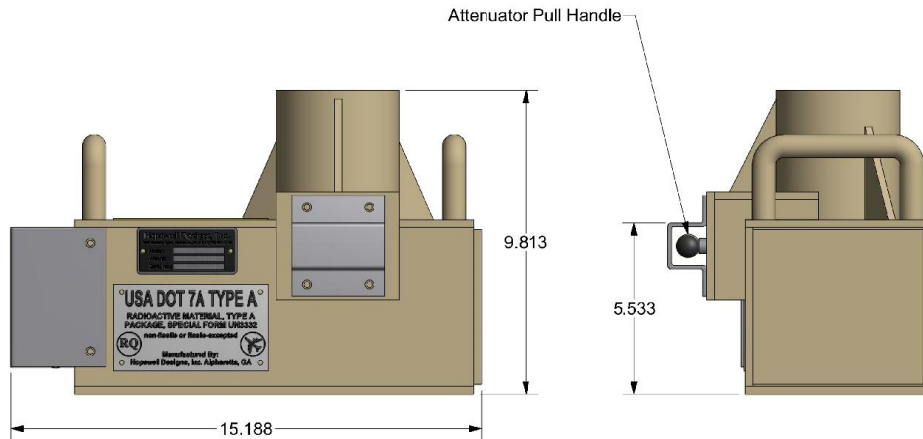
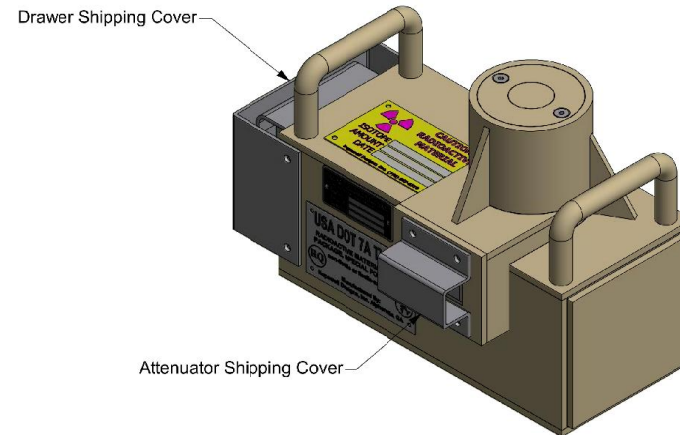
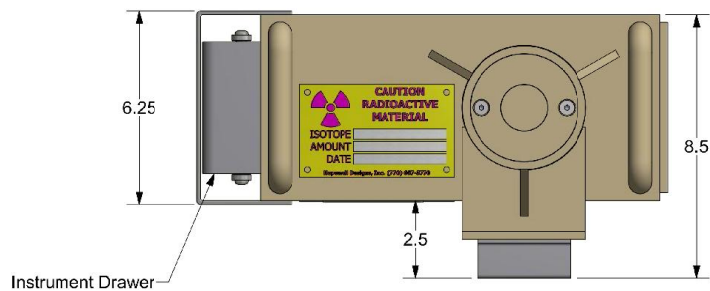
### **Appendices**

Appendix - System Drawings and Diagrams



# **Irradiator Assembled for Typical Use**

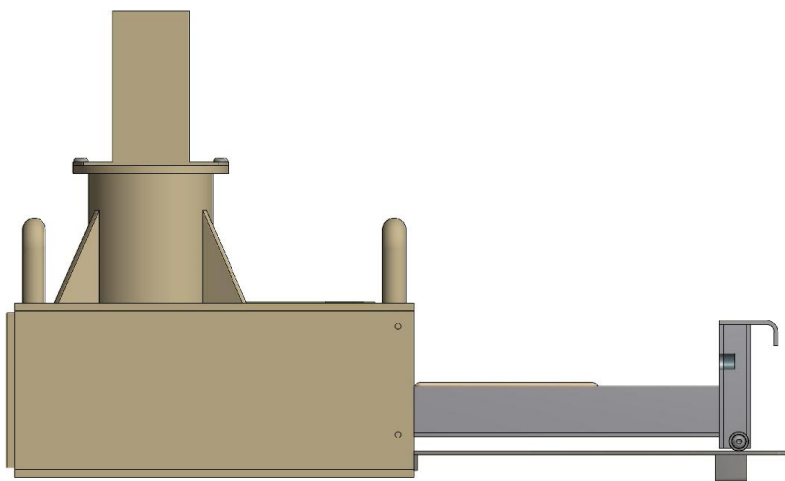
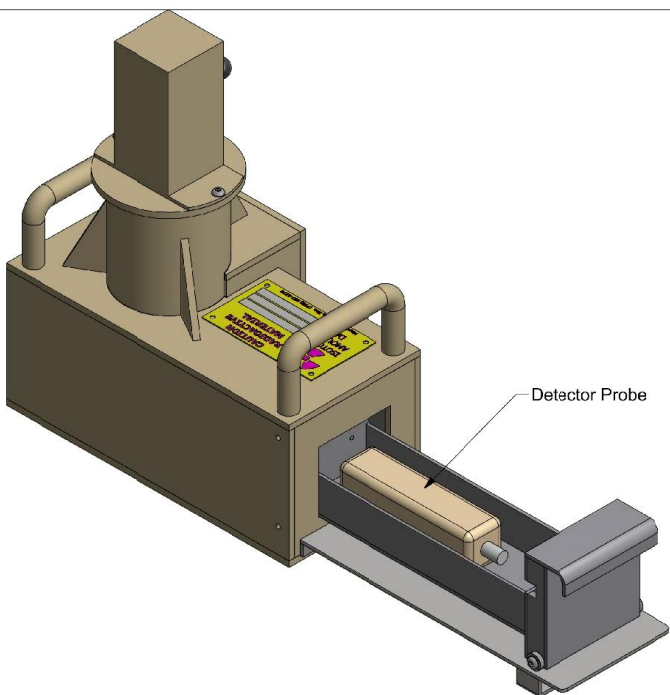
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		RLH		3/5/2014		Overall Assembly	
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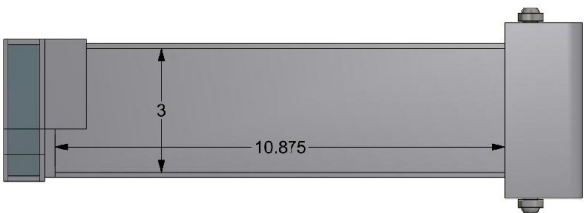
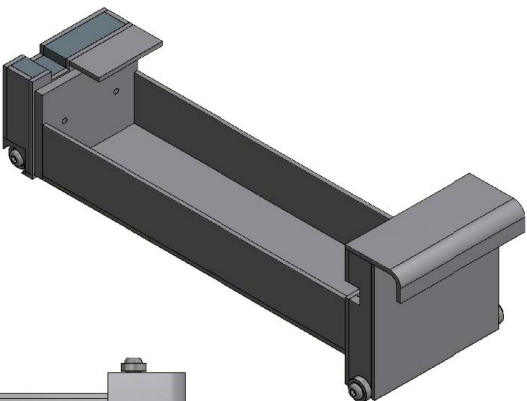
**Irradiator Assembled for Shipping with Covers**

**Approximate Weight for Shipping: 167 lbmass**

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				GC88SL			
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APR-2		R. Howell		RLH		3/5/2014	
APR-2							
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REV NO.				DESCRIPTION		DATE	
AUTHOR				DATE		SHEET 3 of 24	
				DATE		3/5/2014	



SCALE 1 / 4



**Internal Drawer Dimensions for Detectors**

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				3/5/2014			