FLUKE®
Biomedical

Victoreen® 6000-530B

Image Intensifier Ion Chamber

Operators Manual

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Fluke Biomedical
Radiation Management Services

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Section 1
Introduction

1.1 General Description

The Model 6000-530B Image Intensifier Ion Chamber is a low profile ion chamber designed to measure diagnostic
x-rays.

1.2 Application

The Model 6000-530B Image Intensifier Ion Chamber is specifically designed for measurement of exposure rate at the input phosphor of fluoroscopic image intensifier tubes. Its sensitive area and form factors have been adapted for placement inside the spot film tray of common image intensifier systems. Also included is a detachable handle for easy insertion and removal. When the host instrument is a Model 6000 series or a Model 4000M+, precise measurements may be made at low exposure rates (down to 10 µR/min) if the Model 6000-530B Preamplifier is used (See the Model 06-524- 2000 manual for operating instructions).

1.3 Specifications

Chamber

Volume	150 cm^3
Nominal Sensitivity	45 nC/R
Housing Material	Acrylic
Housing Color	Clear
Housing Size	6.5 in diameter (16.5 cm diameter)
Surface Area	110 cm^2, 5.5 in diameter
Weight	30 oz (840 g)
Handle Length	16.5 in (41.9 cm)
Height	0.720 in
Cable Length	10 ft (3 m)
Cable Termination	BNC/Banana
Window Thickness	.110 in (2.79 mm)
Total Attenuation	0.275 mm Al equivalent @ 30 keV
Operating Voltage	200 – 300 V DC
Compatible With	Model 6000 Series, 4000M+, & RAD-CHECK® PLUS

Chamber Energy Dependence

kVCP	NIST	Approx. HVL AL	Coul/µRx 10^{-}	Correction
60	M60	1.68	5.0	1.04
75	-	4.1	4.8	1.00*
100	M100	5.1	5.1	1.06
150	M150	10.2	5.4	1.12

**Calibration Point*

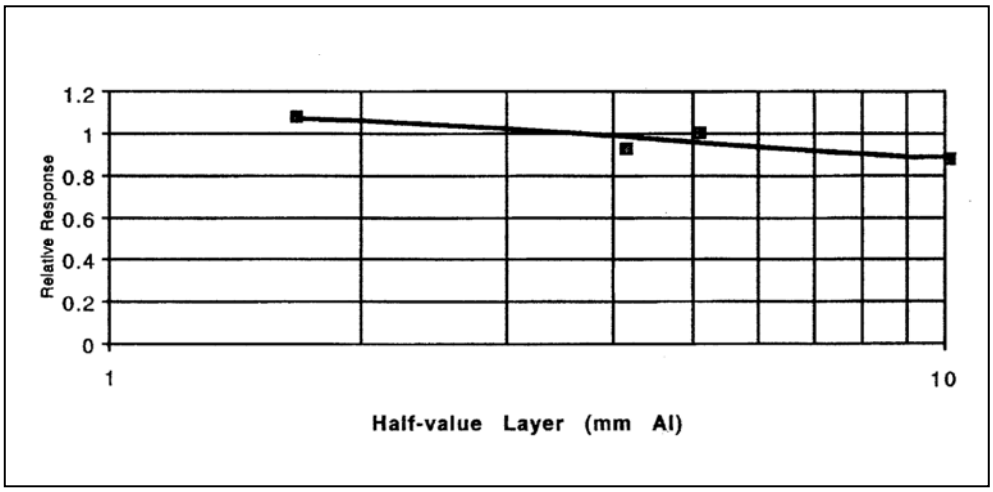

Figure 1-1. Model 6000-530B Energy Response

1.4 Receiving Inspection

Upon receipt of the unit:

1. Inspect the carton(s) and contents for damage. If damage is evident, file a claim with the carrier and notify Fluke Biomedical, Radiation Management Services at 440.248.9300.
2. Remove the contents from the packing material.
3. Verify that all items listed on the packing list have been received and are in good condition.

NOTE

If any of the listed items are missing or damaged, notify Fluke Biomedical.

1.5 Storage

The storage requirements for this instrument are listed below.

1. The instrument shall be stored in a cool, dry location.
2. If the instrument is taken from it's current location and is to be placed in a new location with a different ambient temperature, allow the instrument to reach the new location's ambient temperature before applying power.

1.6 Procedures, Warnings and Cautions

The equipment described in this manual is intended to be used for the detection and measurement of ionizing radiation. It should be used only by persons who have been trained in the proper interpretation of its readings and the appropriate safety procedures to be followed in the presence of radiation.

Although the equipment described in this manual is designed and manufactured in compliance with all applicable safety standards, certain hazards are inherent in the use of electronic and radiometric equipment.

Warnings and **Cautions** are presented throughout this document to alert the user to potentially hazardous situations. A **Warning** is a precautionary message preceding an operation that has the potential to cause personal injury or death. A **Caution** is a precautionary message preceding an operation that has the potential to cause permanent damage to the equipment and/or loss of data. Failure to comply with **Warnings** and **Cautions** is at the user's own risk and is sufficient cause to terminate the warranty agreement between Fluke Biomedical and the customer.

Adequate warnings are included in this manual and on the product itself to cover hazards that may be encountered in normal use and servicing of this equipment. No other procedures are warranted by Fluke Biomedical. It shall be the owner's or user's responsibility to see to it that the procedures described here are meticulously followed, and especially that Warnings and Cautions are heeded. Failure on the part of the owner or user in any way to follow the prescribed procedures shall absolve Fluke Biomedical and its agents from any resulting liability.

Indicated battery and other operational tests must be performed prior to each use to assure that the instrument is functioning properly. If applicable, failure to conduct periodic performance tests in accordance with ANSI N323-1978 (R1983) Radiation Protection Instrumentation Test and Calibration, paragraphs 4.6 and 5.4, and to keep records thereof in accordance with paragraph 4.5 of the same standard, could result in erroneous readings or potential danger. ANSI N323-1978 becomes, by this reference, a part of this operating procedure.

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Section 2
Theory of Operation

2.1 Theory Of Operation

An ionization chamber consists of a defined volume of air in which ions produced by radiation passing through the chamber can be collected and measured. The Model 6000-530B is a parallel plate ion chamber, consisting of a guarded center electrode placed between two outer plates, which also serve as windows. A potential difference in the range of approximately 200 - 300 volts is placed across the plates of the ion chamber (the high voltage applied to the ion chamber will depend on the host instrument used). When ionizing radiation passes through the chamber, ion pairs are produced, each pair consisting of one positive and one negative ion. Under the influence of the electric field produced by the potential on the plates, the ions move toward their oppositely charged plate. Upon arrival, they are neutralized by the free charges on the plates, taking an electron from the negative plate and adding an electron to the positive plate. This causes a current to flow through the external electronics connected to the plates, the magnitude of which is proportional to the rate of exposure to radiation.

The sensitivity of an ion chamber depends on the number of air molecules in the chamber, in fact these quantities are directly proportional. The number of molecules is a function of volume, temperature, and pressure. The volume of air in the chamber is fixed, but since it communicates with the atmosphere, temperature and pressure will vary. The chambers are calibrated at Fluke Biomedical at a temperature of 22°C and a pressure of 760 mmHg. A correction factor should be applied to the reading given by the ion chamber, based on the ambient temperature and barometric pressure at the time the measurement is made. For diagnostic x-ray use, this is usually unnecessary since the errors are on the order of 0.3% per degree Celsius and 0.1% per mmHg. In any event, the correction factor is calculated by the following expression:

$$cf = \frac{760}{P} \times \frac{T + 273.16}{295.16}$$

Where T is the temperature in degrees Celsius and P is the pressure in mmHg.

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Section 3
Operation

3.1 Installation

CAUTION

Ensure all power is removed prior to installing the Model
6000-530B Ion Chamber.

Installation of the Model 6000-530B consists of connecting the optional preamp to the host equipment, if desired, providing an electrical interface to the ion chamber, and performing a calibration. A handle is also included with the ion chamber for placing the ion chamber in the spot film tray of an image intensifier assembly.

Electrical Interface

Final electrical interface connections between the preamplifier, the Ion Chamber, and the host instrument are listed in Table 3-1, and are shown in the applicable drawing number 6000-530B for the Model 6000-530B Ion Chamber

Table 3-1. Electrical Interface Connections

Connector	Description
BNC	Ion Chamber Output
HV (BIAS)	Ion Chamber High Voltage

3.2 Setup

Because the Model 6000-530B Ion Chamber may be used with many commercially available electrometers and dosimeters, please refer to the applicable instrument manual for set up and calibration.

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Section 4
Maintenance, Calibration and Troubleshooting

4.1 Maintenance

The Model 6000-530B Ion Chamber requires no routine maintenance, other than routine inspection of the chamber for damage.

4.2 Calibration

The Model 6000-530B Ion Chamber is accompanied by the chamber's sensitivity on the side of the ion chamber. If sensitivity factor is not available, the ion chamber may be returned to Fluke Biomedical so that a new sensitivity factor may be obtained, or by the customer by intercomparison with a known ion chamber.

NOTE

Obtain the value of chamber sensitivity in dimensions of exposure per unit charge and the charge calibration factor for the host instrument in dimensions of charge per displayed exposure unit, prior to referring to the applicable preamplifier manual.

4.3 Troubleshooting

WARNING

Extreme care must be used when troubleshooting a system that has power applied. All standard troubleshooting precautions apply.

WARNING

Once a problem has been located, remove all power before continuing with the repair.

CAUTION

Personnel performing the troubleshooting must be familiar with the operation of the system and the location of each piece of equipment used.

Troubleshooting consists of checking the wiring and verifying inputs/outputs are present on all connectors. If a problem develops with the Ion Chamber, return the chamber to Fluke Biomedical.

NOTE

If a problem cannot be resolved by applying the troubleshooting procedures described above, contact Fluke Biomedical at 440 248.9300 for assistance.

4.4 Applicable Drawings and Bill of Materials

Drawing	**Description**
6000-530B	Model 6000-530B Ion Chamber Assembly

Bill of Material	**Description**
6000-530B	Model 6000-530B Ion Chamber Assembly

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