

GCL Calibration Certificate

Report No: AC-5737-34800

Calibration: As Calibrated

Results: In Tolerance

FLUKE

Biomedical

NVLAP[®]

FOR THE SCOPE OF ACCREDITATION UNDER NVLAP CODE 200566-C

Fluke Biomedical: Pressurized Ion Chamber Survey Meter

Model: 451P-DE-SI-RYR

Serial No: 5737

Asset No: n/a

Customer: NEW UNIT

PO: n/a

BO/SO: 43955

Date Received: 20-Jul-15

Date Calibrated: 20-Jul-15

Customer's Requested Due Date: 20-Jul-16

Temperature: 22.18 degrees Celsius

Pressure: 728.42 mmHg

Humidity: 45.8 % Relative Humidity

NOTES

This calibration is traceable to international standards. Dose equivalent conversion factors are taken from HPS N13.11-2001 and ICRU Report 47-1992. This report must not be used to claim product recertification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

The calibration is warranted to be within specified accuracy limits, at the time of calibration. In the event of a calibration error, our liability is limited to standard recalibration cost.

Proper function and reliability of the instrument described in this document are highly dependent upon handling and use. It is recommended the user establish a technique to monitor the constancy of the instrument response before and after its return to the manufacturer.

This certificate applies only to the item(s) being calibrated. It shall not be reproduced except in full, without the written approval of the calibration laboratory.

If there are any problems with the calibration of the instrument, please contact the Calibration Laboratory Director.

Measurement uncertainties expressed in this report are calculated in accordance with the methods described in ANSI/NCLZ Z540-2 1997, U.S Guide to the Expression of Uncertainty in Measurement and IEC Guide to the Expression of Uncertainty in Measurement, 1995 using a coverage factor of k=2, corresponding to a confidence level of approximately 95%.

Calibrated by: Mahood, Bruce
Technician

Date: 20-Jul-15

Reviewed by: *Richard Abbott*
Richard Abbott, Technical Services Manager

Date: 20-Jul-15

Check Source Reading	N/A
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Rate Calibration							
Source	Distance (cm)	No. of Atten	UUT Range	Units	Reference Rate	UUT Rate	% Error
20 Ci Cs-137	935.08	5	0 to 5	uSv/hr	1.8	1.795	-0.28 - Pass
20 Ci Cs-137	910.48	4	0 to 5	uSv/hr	3.6	3.633	0.92 - Pass
20 Ci Cs-137	907.00	3	0 to 50	uSv/hr	18	17.82	-1.00 - Pass
20 Ci Cs-137	886.30	2	0 to 50	uSv/hr	36	36.15	0.42 - Pass
20 Ci Cs-137	896.56	1	0 to 500	uSv/hr	180	177.1	-1.61 - Pass
20 Ci Cs-137	905.92	0	0 to 500	uSv/hr	360	359.5	-0.14 - Pass
2000 Ci Cs-137	778.48	3	0 to 5	mSv/hr	1.8	1.806	0.33 - Pass
2000 Ci Cs-137	763.17	2	0 to 5	mSv/hr	3.6	3.552	-1.33 - Pass
2000 Ci Cs-137	779.89	0	0 to 50	mSv/hr	36	36.65	1.81 - Pass

Dose Calibration					
Integration Calibration Point	UUT Range	Units	Reference Exposure	UUT Exposure	% Error
2000 Ci Cs-137, 100 sec	0 to 500	uSv	100	100	0.00 - Pass

Calibration Procedure: CAL-450-451.pdf

Calibration Description: The 451P-DE-SI-RYR has an operating range of 0 to 50 mSv/hr. The unit is exposed through the side of the detector and calibrated on all ranges. All readings were corrected for background. The % Error was calculated using Equation 1.

Environmental Constraints: The 451P-DE-SI-RYR survey meter is designed to read accurately from -20 to 50C. The unit is pressurized, therefore, requires no air density corrections.

Calibration Uncertainty: 3.6% with 2.4% associated with the uncertainty of the source.

Accuracy Requirement: 10% of Reading

Equation 1:
$$\%Error = \frac{100 * (UUT - Reference)}{Reference}$$

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Standards Used - Tri-Source Workstation

Standards used for monitoring Lab Temperature, Pressure, & Humidity

IRM No.	Description	Manufacturer Model	Traceability No.	Serial No.	Cal Due
1673	Thermo-Hygrometer	Fluke 2626H	B4B11021	A5B575	8-Nov-2015
1703	Precision Barometer	Honeywell HPB200	278134003	CL025834	8-Sep-2015

The following standards were used in the calibration of the Tri-Source Range

IRM No.	Description	Manufacturer Model	Traceability No.	Serial No.	Cal Due
1219	2 liter Ion Chamber	Exradin A7	DG 10409/99	113	7-May-2020
1234	33 cc Ion Chamber	PTW 23361	DG 10417/99	415	7-May-2020
1233	2 cc ion chamber	PTW 23331	DG 10419/99	824	7-May-2020

The following standards are used for Daily QA

IRM No.	Description	Manufacturer Model	Traceability No.	Serial No.	Cal Due
0988	Electrometer/Dosimeter	Victoreen 530	F530-234-7-31-2014	234	31-Jul-2015
1987	330cc Ion Chamber	Fluke 550-3	58355-1 58356-1	1534	6-Dec-2015

X-ray calibration stations are calibrated using NIST traceable ion chambers. Calibration points are verified daily using internal standard operating procedures