



Australian Government

Australian Radiation Protection and Nuclear Safety Agency

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CALIBRATION REPORT
on a therapy ionisation chamber for
MEDIUM-ENERGY KILOVOLTAGE X-RAYS

Client

ClientA_Name
200 Street Name
Suburb NSW 2020

Ionisation chamber

PTW 30013, serial number 5122

Period of tests

12/02/2021

Previous calibration

Not previously calibrated at ARPANSA

Test and report by

Duncan Butler

Report date

2021-10-07

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Signed: _____ (Authorised Signatory) Date:

Duncan Butler, Director, Primary Standards Dosimetry Laboratory

per C-M Larsson, CEO of ARPANSA



Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or
measurements included in this document are
traceable to Australian/national standards

NATA Accredited Laboratory Number: 14433



This certificate is consistent with the capabilities that are
included in Appendix C of the MRA drawn up by the
CIPM. Under the MRA, all participating institutes
recognize the validity of each other's calibration and
measurement certificates for the quantities, ranges and
measurement uncertainties specified in Appendix C (for
details see www.bipm.org).

GENERAL COMMENTS

Chamber description - PTW 30013

Accessories Supplied

- Buildup cap

Preliminary Inspection

- The ionisation chamber had no obvious damage or faults on receipt.

Calibration Coefficient

- The calibration coefficient is the number by which the charge from the chamber, in nC, must be multiplied to obtain the air kerma [1]. The calibration factor for the electrometer must also be taken into account when measuring the charge from the chamber.

Calibration Coefficients for Medium-Energy X-ray (MEX) Qualities in Air

- The calibration coefficients for the chamber for each X-ray beam quality from the Gulmay Comet X-ray generator were determined by comparison with the ARPANSA Medium Energy Free-Air Chamber, which is the Australian primary standard of air kerma for medium energy X-rays.
- The Gulmay Comet X-ray generator is constant potential and the X-ray tube has a tungsten target.

Recombination Correction Measurement

- Not measured.

Polarity Correction Measurement

- Not measured.

Notes

- The ionisation chamber was tested in accordance with ARPANSA Standard Operational Procedure ARPANSA-SOP-0816 Version 7.

References

- [1] AAPM protocol for 40-300 kV x-ray beam dosimetry in radiotherapy and radiobiology, C.-M. Ma, Chair, C. W. Coffey, L. A. DeWerd, C. Liu, R. Nath, S. M. Seltzer, J. P. Seuntjens, Med. Phys. **28** (6) 868-893, 2001



Air Kerma Calibration Certificate - Medium-Energy X-rays

Client

Ionisation chamber

Polarising voltage

Collected charge polarity

Reference point

Geometry

ClientA_Name

PTW 30013, serial number 5122

-250 V on the guard electrode

Positive (Central Electrode Negative)

The geometrical centre of the cavity

Mark on chamber stem facing the radiation source

Chamber stem vertically upwards, cable down

Horizontal radiation beam

Source-detector distance 100 cm

Circular beam of diameter 10 cm

Build-up

Build-up cap removed except where stated. Calibrated free in air.

Polarity and recombination

Corrections not applied

Reference conditions

20°C, 101.325 kPa and 50% humidity

Measurement date(s)

12/02/2021

Uncertainties (U) are given at a confidence level of approximately 95% (k=2)

Table 1: Subset of air kerma calibration coefficients

Beam code	Tube voltage	Added filter	Added filter	HVL	HVL	Nominal effective energy [1]	Nominal air kerma rate	NK [2]	U
	kV	mm Al	mm Cu	mm Al	mm Cu	keV	mGy/s	mGy/nC	%
NXA50	50	4.0	0.0	2.39	0.08	30	0.4	45.75	1.4
NXA70	70	4.0	0.0	3.19	0.11	34	0.8	46.29	1.4
NXB100	100	4.5	0.0	4.74	0.18	42	1.5	46.66	1.4
NXC120	120	6.0	0.0	6.38	0.28	49	1.8	46.87	1.4
NXD140	140	9.0	0.0	8.44	0.45	58	1.8	47.05	1.4
NXE150	150	4.0	0.5	0.0	0.84	72	1.4	47.31	1.4
NXF200	200	4.0	1.0	0.0	1.63	95	1.6	47.47	1.4
NXG250	250	4.0	1.6	0.0	2.57	120	1.8	47.5	1.4
NXH280	280	4.0	3.0	0.0	3.5	147	1.4	47.53	1.4
NXH300	300	4.0	3.0	0.0	3.7	153	1.7	47.54	1.4

[1] The energy of a monoenergetic beam with the same HVL in mm of Cu

[2] The air kerma calibration coefficient

* With buildup cap on

Calibrated by Duncan Butler



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Table 2: Complete set of air kerma calibration coefficients for all MEX beams