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<br>200 Street Name<br>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 |
| Direct inquiries to | Chris Oliver |
| **Tel:** (03) 9433 2333 | **Email:** psdl@arpansa.gov.au |

Signed: _____ (Authorised Signatory) Date:

Duncan Butler, Director, Primary Standards Dosimetry Laboratory

per C-M Larsson, CEO of ARPANSA

NATA WORLD RECOGNISED ACCREDITATION

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**

CIPM MRA

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** | ClientA_Name |
| **Ionisation chamber** | PTW 30013, serial number 5122 |
| Polarising voltage | -250 V on the guard electrode |
| Collected charge polarity | Positive (Central Electrode Negative) |
| Reference point | The geometrical centre of the cavity |
| Geometry | Mark on chamber stem facing the radiation source<br>Chamber stem vertically upwards, cable down<br>Horizontal radiation beam<br>Source-detector distance 100 cm<br>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

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

| 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 | % |