



# Institut für Strahlenschutz und Dosimetrie

Akkreditierte Prüf- und Inspektionsstelle Nr. 26  
am Landeskrankenhaus Innsbruck - Universitätskliniken  
Rechtsträger Tirol Kliniken GmbH  
Firmenbuchnummer: 55332x, Firmenbuchgericht: Landes- als Handelsgericht Innsbruck



6020 Innsbruck • Innrain 66/I • ÖSTERREICH/ AUSTRIA  
Tel. +43 512 504-25720 • Fax. +43 512 504-25729 • E-Mail: [iki.ii.isd@tirol-kliniken.at](mailto:iki.ii.isd@tirol-kliniken.at)

(Ablage 53)

editor: Dr. Thomas Schöpf

phone: +43 50504 25722

Innsbruck, 27.06.2019

## TEST REPORT – measurement of the ATTENUATION EQUIVALENT

### PPb 10/2019

Measurement of the ATTENUATION EQUIVALENT of radiation protection materials according to IEC 61331-1 (2014) in the modified broad beam geometry	
Client	Amray Medical
Address of the client	Surg Equip Ltd T/A Amray Medical, 9-11 Greenhills Industrial Village, Drogheda, Co. Louth, Ireland
Order date / number	26.02.2019 / IS-1314-1/2019 and 03.06.2019 / IS-1314-3/2019

Copies / number	two / nr. 1
Number of pages	- 4 pages -
Attachment: number / total number of pages	-

every exemplar of the report consists  
of numbered pages

All results of this test-report are only valid for the submitted test samples!

*In case of a duplication or a publication of the test report, only the whole report may be shown word and form-faithfully and without omission or additive. Duplication or publication requires the written agreement of the Institute for Radiation Protection and Dosimetry.*

The institute is accredited as testing laboratory according to ÖVE/ÖNORM EN ISO/IEC 17025 2007 and as inspection laboratory of type according of ÖVE/ÖNORM EN ISO/IEC 17020 2012. A list of all accredited test methods will be send on request.

## 1. Order:

Measurement of the LEAD EQUIVALENT of radiation protection materials in the modified broad beam geometry. This test report is a partial summary of our test reports 04/2019 and 08/2019.

## 2. Description of the test sample:

The test samples are nine material samples of radiation protection material. The description of the samples follows in the table of chapter 5.

The ATTENUATION RATIO and the LEAD EQUIVALENT was determined according to the Email from Helen Johnston from 7<sup>th</sup> February 2019 and from 31 May 2019. All material samples are quadratic with a side length of 10,0 cm.

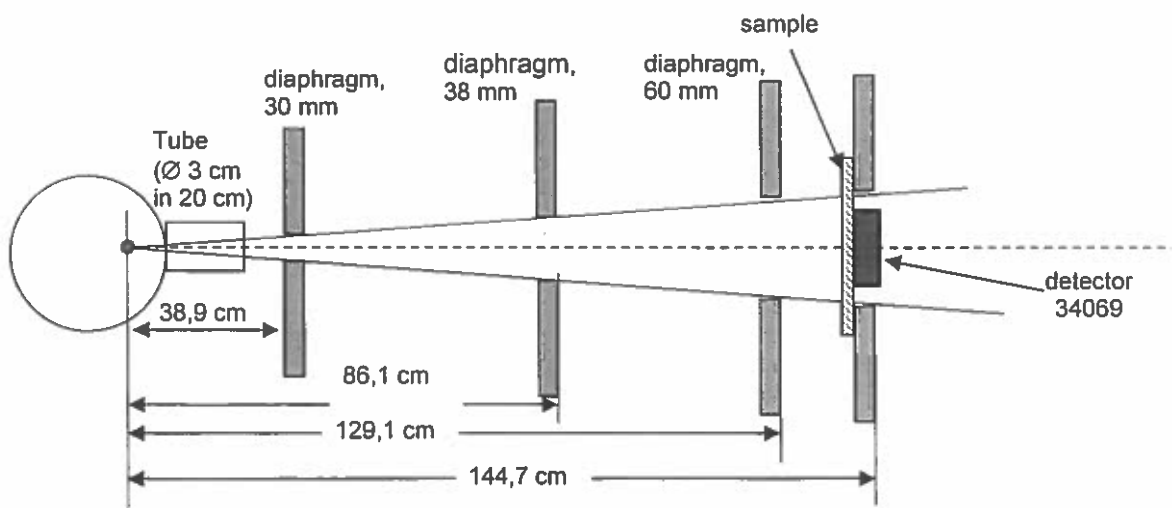
## 3. Description of the measuring arrangement:

### 3.1 Applied testing method

The LEAD EQUIVALENT was determined in the modified broad beam geometry according to:

*Heinrich Eder, Helmut Schlattl: IEC 61331-1: A new setup for testing lead free X-ray protective clothing, Physica Medica 45 (2018) 6–11.*

#### Measuring arrangement:



### 3.2 Measuring devices:

- Dosimeter mod. UNIDOS with detector TM34069, LNr: 97
- Lead diaphragm, LNr. 125 (thickness 6 mm, diameter of the wholes are 20 mm and 38 mm)
- Set of Al-filters, LNr. 176
- Set of lead-films, LNr. 126 and LNr. 157
- Balance SARTORIUS, LNr. 84
- Tape measure, LNr. 194
- Thermometer, LNr. 49
- Barometer, LNr. 67
- X-ray equipment for therapy with HF-generator CP-225 (Fa. X-STRAHL) and X-ray-tube MIR-226 (Fa. COMET) with an inherent filtration of 0,8 mm Be and an anode-angle of 30° (LNr. 196)

#### **4. Test procedure:**

- Date of measurement: 28.02.2019 (for the samples AmRay Light Lead and AmRay Light Plus) and 04.06.2019 for the samples AmRay Supreme Lead
- Execution of the measurements: Dr. Thomas Schöpf
- Location of the measurements: conventional X-ray-therapy equipment, Dept. of Radiotherapy and Radiation Oncology at Innsbruck Univ. Hospital

In accordance with the order, the ATTENUATION RATIO F and the ATTENUATION EQUIVALENT were determined with x-ray tube voltages of 60 kV, 70 kV, 90 kV, 110 kV and 150 kV. According to IEC 61331-1 a filter of 2,5 mm Al for all x-ray tube voltages were used.

With the set of lead films the attenuation curves, the so called "lead-curves", was taken up first. After measuring the attenuation due to the test sample, the corresponding "lead curve" was applied on the attenuation factor in order to determine the LEAD EQUIVALENT.

#### **5. Results:**

Results for 60 kV, 70 kV and 90 kV:

Sample	Area density (g/m <sup>2</sup> )	F (60 kV)	mm Pb (60 kV)	F (70 kV)	mm Pb (70 kV)	F (90 kV)	mm Pb (90 kV)
AmRay Light Lead 0.25 mm Pb	3359	45,1	0,252	25,3	0,254	11,8	0,257
AmRay Light Lead 0.35 mm Pb	4648	106	0,347	49,5	0,349	18,9	0,353
AmRay Light Lead 0.50 mm Pb	6747	355	0,500	126	0,504	36,1	0,508
AmRay Light Plus 0.25 mm Pb	3408	40,9	0,242	23,5	0,244	11,1	0,246
AmRay Light Plus 0.35 mm Pb	4508	112	0,354	51,9	0,357	19,4	0,359
AmRay Light Plus 0.50 mm Pb	6462	362	0,502	127	0,505	36,1	0,508
AmRay Supreme Lead Free 0.25 mm Pb	2762	45,5	0,253	26,3	0,259	12,1	0,263
AmRay Supreme Lead Free 0.35 mm Pb	3785	121	0,364	56,7	0,370	20,5	0,372
AmRay Supreme Lead Free 0.50 mm Pb	5267	408	0,518	149	0,534	40,1	0,536

Results for 110 kV and 150 kV:

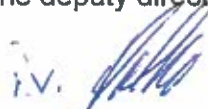
Sample	Area density (g/m <sup>2</sup> )	F (110 kV)	mm Pb (110 kV)	F (150 kV)	mm Pb (150 kV)
AmRay Light Lead 0.25 mm Pb	3359	8,24	0,258	5,47	0,254
AmRay Light Lead 0.35 mm Pb	4648	12,7	0,354	8,08	0,349
AmRay Light Lead 0.50 mm Pb	6747	23,4	0,509	14,3	0,503
AmRay Light Plus 0.25 mm Pb	3408	7,74	0,245	---	---
AmRay Light Plus 0.35 mm Pb	4508	12,7	0,353	---	---
AmRay Light Plus 0.50 mm Pb	6462	22,6	0,499	---	---
AmRay Supreme Lead Free 0.25 mm Pb	2762	7,94	0,251	---	---
AmRay Supreme Lead Free 0.35 mm Pb	3785	12,2	0,344	---	---
AmRay Supreme Lead Free 0.50 mm Pb	5267	20,4	0,472	---	---

F attenuation ratio  
mm Pb LEAD EQUIVALENT compared to pure lead foils

The total measurement uncertainty (for k = 2) are


- for the LEAD EQUIVALENT: 5%
- for the area density: 1,5%

The deputy director:

  
(Ing. J. Felderer)



The examiner and director:

  
(Dr. T. Schöpf)

<PPb\_2019\_10\_eng>