



NATIONAL PHYSICAL LABORATORY

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# Certificate of Calibration

## Determination of the shielding properties of Lead vinyl samples

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**FOR:**

Kemmetech Ltd  
Unit 4 Arnold Business Park  
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Kent  
TN12 5LG

**DESCRIPTION:**

Determination of Lead equivalence of Lead vinyl samples in accordance with BS EN 61331-1:2014 using the inverse broad beam geometry.

**DATE OF MEASUREMENTS:** 27 April 2015 – 05 May 2015

**Reference:** 2015050150\_3

**Date of Issue:** 22 May 2015

**Checked by:** 

**Signed:** 

**Name:** G A Bass

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(Authorised signatory)

for Managing Director

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Continuation Sheet

## CONDITIONS:

Distance from x-ray tube to target sample: 0.8m  
Ionisation chamber used: Radcal 10x5-60E s/n 9088

All equipment associated with the measurements performed in this report has direct traceability to UK national standards or UKAS accredited calibration facilities.


**Table I**  
61331-1:2014 X-ray beam qualities

<u>X-ray Tube Voltage</u> kV	<u>Total filtration</u> mmAl*
50	2.5
70	2.5
90	2.5
110	2.5
120	2.5
150	2.5

\*The inherent filtration of the x-ray tube was determined to be 0.3mmAl equivalent

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I. [unclear]

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**RESULTS:**

Attenuation = 1 – attenuated/un-attenuated x 100

**Table II**  
Lightweight Lead vinyl sheet, 0.125mm nominal Lead equivalent

kV	Equivalent Lead thickness mm	Attenuation %	PASS/FAIL
50	0.1243	93.0	PASS
70	0.1331	85.0	PASS
90	0.1370	78.6	PASS
110	0.1425	74.0	PASS
120	0.1420	72.0	PASS
150	0.1427	67.3	PASS

**Table III**  
Lightweight Lead vinyl sheet, 0.167mm nominal Lead equivalent

kV	Equivalent Lead thickness mm	Attenuation %	PASS/FAIL
50	0.1627	96.3	PASS
70	0.1746	90.0	PASS
90	0.1784	84.4	PASS
110	0.1848	80.3	PASS
120	0.1843	78.6	PASS
150	0.1849	74.2	PASS

**Table IV**  
Lightweight Lead vinyl sheet, 0.175mm nominal Lead equivalent

kV	Equivalent Lead thickness mm	Attenuation %	PASS/FAIL
50	0.1712	96.8	PASS
70	0.1838	90.9	PASS
90	0.1879	85.4	PASS
110	0.1921	81.2	PASS
120	0.1916	79.5	PASS
150	0.1927	75.3	PASS

**UNCERTAINTIES**

The uncertainty in the Lead equivalence is  $\pm 5\%$ . The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.

Clause 5.5.3 of IEC 61331-1:2014 states that a relative standard uncertainty of 7% be taken into account in the decision of conformity in assigning the class of the Lead equivalent thickness to the material under test. If  $t_{pb}$  is the standard Lead equivalent thickness class (0.25mm, 0.35mm, 0.5mm or 1mm) and  $\delta_{IB}$  is the Lead equivalence of the material under test, the condition can be written as:

$$\delta_{IB} \geq 0.93t_{pb}$$

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