

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' SECONDARY STANDARD RADIONUCLIDE CALIBRATOR



CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

10R TYPE 1+ SCHOTT VIAL FACTORS [FOR VINTEN 671 (3 – 5) SYSTEM]						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
¹⁸ F	10R type1+ Schott vial	4 g	10.39	± 1.1 %		
²² Na	10R type1+ Schott vial	4 g	22.99	± 1.0 %		
²⁴ Na	10R type1+ Schott vial	4 g	31.60	± 1.0 %		
⁵¹ Cr	10R type1+ Schott vial	4 g	0.3341	± 0.75 %	0.002590	-0.000118
⁶⁴ Cu	10R type1+ Schott vial	4 g	1.955	± 0.9 %	0.002857	-0.000222
⁶⁷ Ga	10R type1+ Schott vial	4 g	1.565	± 1.4 %	0.002610	-0.000149
⁶⁸ Ga (+ ⁶⁸ Ge)	10R type1+ Schott vial	4 g	9.995	± 0.684 %		
⁸⁵ Sr	10R type1+ Schott vial	4 g	5.286	± 0.85 %		
^{99m} Tc	10R type1+ Schott vial	4 g	1.240	± 0.90 %	0.002541	-0.000141
^{110m} Ag	10R type1+ Schott vial	4 g	26.1 [†]	± 15.0 %		
¹¹¹ In	10R type1+ Schott vial	4 g	4.129	± 0.75 %	0.002894	-0.000158
¹²³ I	10R type1+ Schott vial	4 g	1.721	± 0.90 %	0.004444	-0.000299
¹²⁵ I	10R type1+ Schott vial	4 g	0.4079	± 2.1 %	0.013820	-0.001210
¹³¹ I	10R type1+ Schott vial	4 g	4.073	± 0.40 %	0.002746	-0.000126
¹⁷⁷ Lu	10R type1+ Schott vial	4 g	0.3420	± 0.50 %	0.002628	-0.000194
^{177m} Lu	10R type1+ Schott vial	4 g	10.36 [†]	± 10.00 %		
²⁰¹ Tl	10R type1+ Schott vial	4 g	0.886	± 0.80 %	0.002054	-0.000088
²²³ Ra	10R type1+ Schott vial	4 g	3.166	± 0.38 %		
These volume correction factors are valid only for samples containing between 2 g and 9 g of solution.						






[†] The calibration factor for this radionuclide has been derived theoretically from the theoretical response curve of this ionisation chamber and is not traceable to NPL absolute standards of activity and is only to be used for impurity corrections.

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10R TYPE 1+ SCHOTT VIAL FACTORS [FOR VINTEN 671 (3 – 5) SYSTEM]						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
³² P	10R type1+ Schott vial	4 g	0.03518	± 1.0 %	0.011494	-0.001268
⁸⁹ Sr	10R type1+ Schott vial	4 g	0.02840	± 1.0 %	0.015293	-0.001959
⁹⁰ Y	10R type1+ Schott vial	4 g	0.0734	± 2.17 %	0.016855	-0.002746

These volume correction factors are valid only for samples containing between 2 g and 8 g of solution.

NOTE: The calibration factors provided for 'pure beta' emitting radionuclides are highly geometry dependent and should be verified prior to use. Please contact NPL (radioactivity@npl.co.uk) for further information.

Type of Source	Container Type	Configuration in Jig	Capsule Picture	Calibration Factor (pA/MBq)	Uncertainty (k=1)
¹³¹ I GE Healthcare capsule	10 ml P6 vial	Standard P6 vial holder geometry		4.040	± 0.55 %
¹³¹ I GE Healthcare capsule	GE Healthcare plastic applicator	Vertical in vial holder		4.061	± 0.60 %
¹³¹ I GE Healthcare Capsule	10R type1+ Schott vial	Standard 10R vial holder geometry		4.053	± 0.60 %
¹³¹ I Mallinckrodt capsule	10 ml P6 vial	Standard P6 vial holder geometry		4.057	± 0.60 %
¹³¹ I Mallinckrodt capsule	Mallinckrodt plastic applicator	Vertical in vial holder		4.087	± 0.60 %

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

Type of Source	Container Type	Configuration in Jig	Capsule Picture	Calibration Factor (pA/MBq)	Uncertainty ($k=1$)
¹³¹ I Mallinckrodt capsule	10R type1+ Schott vial	Standard10R vial holder geometry		4.068	± 0.60 %

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty ($k=1$)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
³² P	2 ml BS ampoule	1 g	0.0368	± 0.8 %	0.0424	-0.0295
³² P	5 ml BS ampoule	3 g	0.0353	± 0.8 %	0.0122	-0.00594
³² P	10 ml P6 vial	4 g	0.0343	± 1.0 %	0.0162	-0.00226
⁸⁹ Sr	2 ml BS ampoule	1 g	0.0300	± 1.50 %	0.0481	-0.0315
⁸⁹ Sr	5 ml BS ampoule	3 g	0.0288	± 1.50 %	0.0132	-0.00442
⁸⁹ Sr	10 ml P6 vial	4 g	0.0279	± 1.0 %	0.0184	-0.00274
⁹⁰ Y	2 ml BS ampoule	1 g	0.137‡	± 4.00 %	0.16754	-0.155681
⁹⁰ Y	5 ml BS ampoule	3 g	0.0949	± 2.0 %	0.03909	-0.013233
⁹⁰ Y	10 ml P6 vial	4 g	0.0682	± 2.0 %	0.0169	-0.0054

NOTE: The calibration factors provided for 'pure beta' emitting radionuclides are highly geometry dependent and should be verified prior to use. Please contact NPL (radioactivity@npl.co.uk) for further information.

‡ The calibration factors for these radionuclides are to be verified for this ionisation chamber and are not traceable to NPL absolute standards of activity and are only to be used to derive indicative activity values.

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (<i>k</i> =1)	Volume Correction Factor [<i>a</i> ₁]	Volume Correction Factor [<i>a</i> ₂]
⁷ Be	2 ml BS ampoule	1 g	0.5253	± 1.17 %	0.00606	- 0.00511
⁷ Be	5 ml BS ampoule	3 g	0.5218	± 1.17 %	0.00291	-0.00058
⁷ Be	10 ml P6 vial	4 g	0.5182	± 1.17 %	0.00273	-0.00018
¹¹ C	2 ml BS ampoule	1 g	10.87	± 0.40 %		
¹⁸ F	2 ml BS ampoule	1 g	10.49	± 1.0 %	0.00512	-0.00263
¹⁸ F	5 ml BS ampoule	3 g	10.42	± 1.0 %	0.00502	-0.00060
¹⁸ F	10 ml P6 vial	4 g	10.35	± 1.0 %	0.00273	-0.00018
²² Na	2 ml BS ampoule	1 g	21.17	± 0.34 %	0.00536	-0.00275
²² Na	5 ml BS ampoule	3 g	21.05	± 0.34 %	0.00279	-0.00056
²² Na	10 ml P6 vial	4 g	20.94	± 0.34 %	0.00240	-0.00016
²⁴ Na	2 ml BS ampoule	1 g	31.83	± 0.34 %	0.00550	-0.00179
²⁴ Na	5 ml BS ampoule	3 g	31.70	± 0.34 %	0.00186	-0.00037
²⁴ Na	10 ml P6 vial	4 g	31.52	± 0.34 %	0.00207	-0.00014
⁴² K	2 ml BS ampoule	1 g	11.31	± 0.50 %	0.229	-0.167
⁴² K	5 ml BS ampoule	3 g	7.966	± 0.50 %	0.0726	-0.0254
⁴² K	10 ml P6 vial	4 g	4.094	± 0.50 %	0.0595	-0.0115
⁴⁶ Sc	2 ml BS ampoule	1 g	18.93	± 0.34 %	0.00512	-0.00263
⁴⁶ Sc	5 ml BS ampoule	3 g	18.83	± 0.34 %	0.00256	-0.00051
⁴⁶ Sc	10 ml P6 vial	4 g	18.73	± 0.34 %	0.00240	-0.00016
⁴⁷ Ca	2 ml BS ampoule	1 g	9.665	± 0.34 %	0.00419	-0.00215
⁴⁷ Ca	5 ml BS ampoule	3 g	9.617	± 0.34 %	0.00221	-0.00044
⁴⁷ Ca	10 ml P6 vial	4 g	9.558	± 0.34 %	0.00207	-0.00014
⁴⁷ Sc	2 ml BS ampoule	1 g	1.120	± 0.34 %	0.00573	-0.00191

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
⁴⁷ Sc	5 ml BS ampoule	3 g	1.109	± 0.34 %	0.00209	-0.00042
⁴⁷ Sc	10 ml P6 vial	4 g	1.097	± 0.34 %	0.00240	-0.00016
⁴⁸ V	2 ml BS ampoule	1 g	27.2 [†]	± 10.0 %		
⁴⁸ V	5 ml BS ampoule	3 g	27.2 [†]	± 10.0 %		
⁵¹ Cr	2 ml BS ampoule	1 g	0.3376	± 0.67 %	0.00582	-0.00299
⁵¹ Cr	5 ml BS ampoule	3 g	0.3353	± 0.67 %	0.00502	-0.00060
⁵¹ Cr	2 ml ISO ampoule	1 g	0.3369	± 0.71 %		
⁵¹ Cr	5 ml ISO ampoule	3 g	0.3347	± 0.71 %	0.002621	-0.000816
⁵¹ Cr	10 ml P6 vial	4 g	0.3327	± 0.67 %	0.00273	-0.00018
⁵⁴ Mn	2 ml BS ampoule	1 g	8.248	± 0.34 %	0.00536	-0.00275
⁵⁴ Mn	5 ml BS ampoule	3 g	8.197	± 0.34 %	0.00244	-0.00048
⁵⁴ Mn	10 ml P6 vial	4 g	8.148	± 0.34 %	0.00251	-0.00017
⁵⁶ Mn	2 ml ISO ampoule	1 g	15.438	± 0.354 %	0.0203	-0.0149
⁵⁶ Mn	5 ml ISO ampoule	3 g	15.100	± 0.352 %	0.00539	-0.00158
⁵⁶ Mn	10 ml P6 vial	4 g	14.78	± 0.34 %	0.00278	-0.00027
⁵⁶ Co	5 ml BS ampoule	3 g	33.06 [†]	± 10.00 %		
⁵⁷ Co	2 ml ISO ampoule	1 g	1.198	± 0.71 %		
⁵⁷ Co	5 ml ISO ampoule	3 g	1.191	± 0.71 %		
⁵⁷ Co	10 ml P6 vial	4 g	1.174	± 0.67 %	0.00229	-0.00015
⁵⁸ Co	2 ml BS ampoule	1 g	9.747	± 0.67 %	0.00606	-0.00511

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CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
⁵⁸ Co	5 ml BS ampoule	3 g	9.708	± 0.67 %	0.00290	-0.00058
⁵⁸ Co	10 ml P6 vial	4 g	9.651	± 0.67 %	0.00251	-0.00017
⁵⁹ Fe	2 ml BS ampoule	1 g	10.78	± 0.34 %	0.00512	-0.00263
⁵⁹ Fe	5 ml BS ampoule	3 g	10.72	± 0.34 %	0.00233	-0.00046
⁵⁹ Fe	10 ml P6 vial	4 g	10.68	± 0.34 %	0.00218	0.00014
⁶⁰ Co	2 ml ISO ampoule	1 g	22.37	± 0.30 %		
⁶⁰ Co	5 ml ISO ampoule	3 g	22.25	± 0.30 %		
⁶⁰ Co	10 ml P6 vial	4 g	22.17	± 0.17 %	0.00218	0.00014
⁶⁴ Cu	2 ml BS ampoule	1 g	1.979	± 0.9 %		
⁶⁴ Cu	5 ml BS ampoule	3 g	1.960	± 0.9 %	0.002852	-0.000506
⁶⁵ Zn	2 ml BS ampoule	1 g	5.301	± 0.67 %	0.00512	-0.00263
⁶⁵ Zn	5 ml BS ampoule	3 g	5.274	± 0.67 %	0.00256	-0.00051
⁶⁵ Zn	10 ml P6 vial	4 g	5.243	± 0.67 %	0.00229	-0.00015
⁶⁷ Ga	2 ml BS ampoule	1 g	1.581	± 1.34 %	0.00466	-0.00239
⁶⁷ Ga	5 ml BS ampoule	3 g	1.564	± 1.34 %	0.00268	-0.00053
⁶⁷ Ga	10 ml P6 vial	4 g	1.547	± 1.34 %	0.00273	-0.00018
⁶⁸ Ga (+ ⁶⁸ Ge)	2 ml ISO ampoule	1 g	10.118	± 0.869 %		
⁶⁸ Ga (+ ⁶⁸ Ge)	5 ml ISO ampoule	3 g	10.037	± 0.687 %		
⁷⁵ Se	2 ml BS ampoule	1 g	3.987	± 1.67 %	0.00559	-0.00287
⁷⁵ Se	5 ml BS ampoule	3 g	3.962	± 1.67 %	0.00290	-0.00058
⁷⁵ Se	10 ml P6 vial	4 g	3.923	± 1.67 %	0.00262	-0.00017
⁸² Br	2 ml BS ampoule	1 g	25.69	± 0.67 %	0.00512	-0.00263
⁸² Br	5 ml BS ampoule	3 g	25.54	± 0.67 %	0.00269	-0.00053

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [mo]	Calibration Factor (pA/MBq)	Uncertainty ($k=1$)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
⁸² Br	10 ml P6 vial	4 g	25.39	± 0.67 %	0.00240	-0.00016
⁸⁵ Sr	2 ml BS ampoule	1 g	5.335	± 0.67 %	0.00652	-0.00335
⁸⁵ Sr	5 ml BS ampoule	3 g	5.293	± 0.67 %	0.00502	-0.00060
⁸⁵ Sr	2 ml ISO ampoule	1 g	5.350	± 0.71 %		
⁸⁵ Sr	5 ml ISO ampoule	3 g	5.316	± 0.71 %		
⁸⁵ Sr	10 ml P6 vial	4 g	5.258	± 0.67 %	0.00262	-0.00017
⁸⁶ Rb	2 ml BS ampoule	1 g	0.9132	± 0.34 %	0.00652	-0.00535
⁸⁶ Rb	5 ml BS ampoule	3 g	0.9076	± 0.34 %	0.00526	-0.00065
⁸⁶ Rb	10 ml P6 vial	4 g	0.9019	± 0.34 %	0.00251	-0.00017
^{87m} Sr	2 ml BS ampoule	1 g	3.411	± 0.67 %	0.00536	-0.00275
^{87m} Sr	5 ml BS ampoule	3 g	3.385	± 0.67 %	0.00256	-0.00051
^{87m} Sr	10 ml P6 vial	4 g	3.358	± 0.67 %	0.00251	-0.00017
⁸⁸ Y	2 ml BS ampoule	1 g	22.94	± 0.34 %	0.00586	-0.00141
⁸⁸ Y	5 ml BS ampoule	3 g	22.78	± 0.34 %	0.00233	-0.00046
⁸⁸ Y	10 ml P6 vial	4 g	22.67	± 0.34 %	0.00218	0.00014
^{95m} Tc	2 ml BS ampoule	1 g	7.24 [‡]	± 2.0 %		
^{95m} Tc	5 ml BS ampoule	3 g	7.19 [‡]	± 2.0 %		
⁹⁹ Mo	2 ml BS ampoule	1 g	2.751	± 1.0 %	0.00536	-0.00275
⁹⁹ Mo	5 ml BS ampoule	3 g	2.727	± 1.0 %	0.00268	-0.00053
⁹⁹ Mo	10 ml P6 vial	4 g	2.700	± 1.0 %	0.00251	-0.00017

[‡] The calibration factors for these radionuclides are to be verified for this ionisation chamber and are not traceable to NPL absolute standards of activity and are only to be used to derive indicative activity values. These calibration factors have been derived from standardisation by gamma spectrometry technique.

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (<i>k</i> =1)	Volume Correction Factor [<i>a</i> ₁]	Volume Correction Factor [<i>a</i> ₂]
^{99m} Tc	2 ml BS ampoule	1 g	1.253	± 0.84 %	0.00512	-0.00263
^{99m} Tc	5 ml BS ampoule	3 g	1.241	± 0.84 %	0.00268	-0.00053
^{99m} Tc	2 ml ISO ampoule	1 g	1.252	± 0.88 %		
^{99m} Tc	5 ml ISO ampoule	3 g	1.243	± 0.88 %	0.001942	-0.000868
^{99m} Tc	10 ml P6 vial	4 g	1.227	± 0.84 %	0.00251	-0.00017
¹⁰⁶ Ru	2 ml BS ampoule	1 g	9.01	± 0.22 %	0.244	-0.179
¹⁰⁶ Ru	5 ml BS ampoule	3 g	6.13	± 0.33 %	0.0756	-0.0259
¹⁰⁶ Ru	10 ml P6 vial	4 g	3.27	± 0.31 %	0.0540	-0.0104
¹⁰⁹ Cd	2 ml BS ampoule	1 g	0.1912	± 1.67 %	0.0154	-0.0104
¹⁰⁹ Cd	5 ml BS ampoule	3 g	0.1651	± 1.67 %	0.0163	-0.00444
¹⁰⁹ Cd	10 ml P6 vial	4 g	0.1176	± 1.67 %	0.00826	-0.00102
¹¹¹ In	2 ml BS ampoule	1 g	4.221	± 0.67 %	0.00629	-0.00523
¹¹¹ In	5 ml BS ampoule	3 g	4.164	± 0.67 %	0.00537	-0.00067
¹¹¹ In	10 ml P6 vial	4 g	4.088	± 0.67 %	0.00505	-0.00020
^{113m} In	2 ml BS ampoule	1 g	2.781	± 0.67 %	0.00699	-0.00559
^{113m} In	5 ml BS ampoule	3 g	2.754	± 0.67 %	0.00537	-0.00067
^{113m} In	10 ml P6 vial	4 g	2.720	± 0.67 %	0.00284	0.00019
¹¹⁴ In (+ ^{114m} In)	2 ml BS ampoule	1 g	0.9440 [†]	± 10.0 %		
¹¹⁴ In (+ ^{114m} In)	5 ml BS ampoule	3 g	0.9447 [†]	± 10.0 %		
¹¹⁴ In (+ ^{114m} In)	10 ml P6 vial	4 g	0.9447 [†]	± 10.0 %		
¹²¹ Te	2 ml BS ampoule	1 g	6.086 [†]	± 10.0 %		

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CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
¹²¹ Te	5 ml BS ampoule	3 g	6.011 [†]	± 10.0 %		
¹²¹ Te	10 ml P6 vial	4 g	5.932 [†]	± 10.0 %		
¹²³ I	2 ml ISO ampoule	1 g	1.806	± 0.86 %	0.00759	-0.00603
¹²³ I	5 ml ISO ampoule	3 g	1.781	± 0.85 %	0.00299	-0.00130
¹²³ I	10 ml P6 vial	4 g	1.685	± 0.84 %	0.00530	-0.00030
¹²⁴ I	2 ml BS ampoule	1 g	10.822	± 0.50 %		
¹²⁴ I	5 ml BS ampoule	3 g	10.730	± 0.50 %		
¹²⁴ I	10 ml P6 vial	4 g	10.604	± 0.50 %		
¹²⁵ I	2 ml ISO ampoule	1 g	0.5363	± 2.02 %	0.011856	-0.007869
¹²⁵ I	5 ml ISO ampoule	3 g	0.5037	± 2.02 %	0.005649	-0.003299
¹²⁵ I	10 ml P6 vial	4 g	0.3706	± 2.00 %	0.00717	-0.00077
¹²⁵ Sb	2 ml BS ampoule	1 g	4.5659	± 0.46 %		
¹³¹ I	5 ml BS ampoule	3 g	4.030	± 0.34 %	0.00502	-0.00060
¹³¹ I	2 ml ISO ampoule	1 g	4.0474	± 0.42 %		
¹³¹ I	5 ml ISO ampoule	3 g	4.0201	± 0.42 %		
¹³¹ I	10 ml P6 vial	4 g	3.999	± 0.34 %	0.00284	-0.00019
¹³³ Ba	2 ml BS ampoule	1 g	4.362	± 0.67 %	0.00606	-0.00511
¹³³ Ba	5 ml BS ampoule	3 g	4.298	± 0.67 %	0.00290	-0.00058
¹³³ Ba	2 ml ISO ampoule	1 g	4.379	± 0.70 %		
¹³³ Ba	5 ml ISO ampoule	3 g	4.330	± 0.70 %		
¹³³ Ba	10 ml P6 vial	4 g	4.188	± 0.67 %	0.00295	-0.00019
¹³⁴ Cs	2 ml BS ampoule	1 g	15.72	± 0.67 %	0.00606	-0.00511
¹³⁴ Cs	5 ml BS ampoule	3 g	15.63	± 0.67 %	0.00290	-0.00058

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VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
¹³⁴ Cs	10 ml P6 vial	4 g	15.53	± 0.67 %	0.00251	-0.00017
¹³⁷ Cs	2 ml ISO ampoule	1 g	5.826	± 0.71 %		
¹³⁷ Cs	5 ml ISO ampoule	3 g	5.782	± 0.71 %	0.00268	-0.00053
¹³⁷ Cs	10 ml P6 vial	4 g	5.751	± 0.67 %	0.00262	-0.00017
¹³⁹ Ce	2 ml BS ampoule	1 g	1.747	± 0.84 %	0.00606	-0.00511
¹³⁹ Ce	5 ml BS ampoule	3 g	1.714	± 0.84 %	0.00502	-0.00060
¹³⁹ Ce	10 ml P6 vial	4 g	1.652	± 0.84 %	0.00505	-0.00020
¹⁴¹ Ce	2 ml BS ampoule	1 g	0.7901	± 1.00 %	0.00466	-0.00239
¹⁴¹ Ce	5 ml BS ampoule	3 g	0.7802	± 1.00 %	0.00279	-0.00056
¹⁴¹ Ce	10 ml P6 vial	4 g	0.7641	± 0.99 %	0.00505	-0.00020
¹⁴⁴ Ce (+ ¹⁴⁴ Pr)	2 ml BS ampoule	1 g	2.435	± 0.67 %	0.255	-0.193
¹⁴⁴ Ce (+ ¹⁴⁴ Pr)	5 ml BS ampoule	3 g	1.583	± 0.67 %	0.0650	-0.0234
¹⁴⁴ Ce (+ ¹⁴⁴ Pr)	10 ml P6 vial	4 g	0.7609	± 0.67 %	0.0438	-0.0101
¹⁵² Eu	2 ml BS ampoule	1 g	11.25	± 0.67 %	0.00559	-0.00287
¹⁵² Eu	5 ml BS ampoule	3 g	11.19	± 0.67 %	0.00279	-0.00056
¹⁵² Eu	10 ml P6 vial	4 g	11.08	± 0.67 %	0.00240	-0.00016
¹⁵³ Sm	2 ml BS ampoule	1 g	0.677	± 0.25 %	-0.00947	0.00503
¹⁵³ Sm	5 ml BS ampoule	3 g	0.654	± 0.18 %	-0.00201	0.00076
¹⁵³ Sm	10 ml P6 vial	4 g	0.625	± 0.18 %	0.00100	0
¹⁵⁴ Eu	2 ml BS ampoule	1 g	11.71	± 0.67 %	0.00489	-0.00251
¹⁵⁴ Eu	5 ml BS ampoule	3 g	11.63	± 0.67 %	0.00256	-0.00051
¹⁵⁴ Eu	10 ml P6 vial	4 g	11.55	± 0.67 %	0.00229	-0.00015
¹⁶⁰ Tb	2 ml BS ampoule	1 g	10.81	± 0.84 %	0.00745	-0.00583

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
¹⁶⁰ Tb	5 ml BS ampoule	3 g	10.75	± 0.84 %	0.00256	-0.00051
¹⁶⁰ Tb	10 ml P6 vial	4 g	10.68	± 0.84 %	0.00229	-0.00015
^{166m} Ho	2ml BS ampoule	1 g	16.33	± 0.30 %		
¹⁶⁹ Yb	2 ml BS ampoule	1 g	3.328	± 0.67 %	0.00466	-0.00239
¹⁶⁹ Yb	5 ml BS ampoule	3 g	3.271	± 0.67 %	0.00244	-0.00048
¹⁶⁹ Yb	10 ml P6 vial	4 g	3.182	± 0.67 %	0.00273	-0.00018
¹⁷⁷ Lu	2 ml BS ampoule	1 g	0.3456	± 0.41 %	0.006309	-0.003508
¹⁷⁷ Lu	5 ml BS ampoule	3 g	0.3424	± 0.50 %	0.00312	-0.000639
¹⁷⁷ Lu	2 ml ISO ampoule	1 g	0.3474	± 0.48 %	0.00383	-0.003591
¹⁷⁷ Lu	5 ml ISO ampoule	3 g	0.3447	± 0.48 %	0.00186	-0.000552
^{177m} Lu	2 ml BS ampoule	1 g	10.57 [†]	± 10.00 %		
^{177m} Lu	5ml BS ampoule	3 g	10.36 [†]	± 10.00 %		
¹⁸⁶ Re	2 ml BS ampoule	1 g	0.2194 [‡]	± 0.40 %	0.000796	-0.00624
¹⁸⁶ Re	5 ml BS ampoule	3 g	0.2157 [‡]	± 0.40 %	0.002808	-0.000977
¹⁸⁶ Re	10 ml P6 vial	4 g	0.2114 [‡]	± 0.40 %	0.002895	-0.000206
¹⁸⁸ Re	2 ml BS ampoule	1 g	0.665	± 0.60 %	0.0154	-0.0134
¹⁸⁸ Re	5 ml BS ampoule	3 g	0.655	± 0.60 %	0.00411	-0.00139
¹⁸⁸ Re	10 ml P6 vial	4 g	0.644	± 0.60 %	0.00566	-0.00040
¹⁹² Ir	2 ml BS ampoule	1 g	8.576	± 0.67 %	0.00606	-0.00511
¹⁹² Ir	5 ml BS ampoule	3 g	8.504	± 0.67 %	0.00502	-0.00060

[†] The calibration factors for these radionuclides have been derived theoretically from the theoretical response curve of this ionisation chamber and are not traceable to NPL absolute standards of activity and are only to be used for impurity corrections.

[‡] The calibration factors for these radionuclides are to be verified for this ionisation chamber and are not traceable to NPL absolute standards of activity and are only to be used to derive indicative activity values.

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
¹⁹² Ir	10 ml P6 vial	4 g	8.438	± 0.67 %	0.00262	-0.00017
¹⁹⁷ Hg	2 ml BS ampoule	1 g	0.7018	± 1.00 %	0.00573	-0.00191
¹⁹⁷ Hg	5 ml BS ampoule	3 g	0.6923	± 1.00 %	0.00209	-0.00042
¹⁹⁷ Hg	10 ml P6 vial	4 g	0.6758	± 1.00 %	0.00262	-0.00017
¹⁹⁸ Au	2 ml BS ampoule	1 g	4.318	± 0.34 %	0.00745	-0.00583
¹⁹⁸ Au	5 ml BS ampoule	3 g	4.283	± 0.34 %	0.00529	-0.00064
¹⁹⁸ Au	10 ml P6 vial	4 g	4.250	± 0.34 %	0.00284	-0.00019
¹⁹⁹ Au	2 ml BS ampoule	1 g	0.9731 [‡]	± 0.84 %		
¹⁹⁹ Au	5 ml BS ampoule	3 g	0.9647 [‡]	± 0.84 %		
¹⁹⁹ Au	10 ml P6 vial	4 g	0.9501 [‡]	± 0.84 %		
²⁰⁰ Tl	2 ml BS ampoule	1 g	12.7 [†]	± 10.0 %		
²⁰⁰ Tl	5 ml BS ampoule	3 g	12.6 [†]	± 10.0 %		
²⁰⁰ Tl	10 ml P6 vial	4 g	12.5 [†]	± 10.0 %		
²⁰¹ Tl	2 ml BS ampoule	1 g	0.8953	± 0.50 %	0.00419	-0.00215
²⁰¹ Tl	5 ml BS ampoule	3 g	0.8860	± 0.50 %	0.00233	-0.00046
²⁰¹ Tl	10 ml P6 vial	4 g	0.8557	± 0.50 %	0.00240	-0.00016
²⁰² Tl	2 ml BS ampoule	1 g	4.34 [†]	± 10.0 %		
²⁰² Tl	5 ml BS ampoule	3 g	4.32 [†]	± 10.0 %		

[‡] The calibration factors for these radionuclides are to be verified for this ionisation chamber and are not traceable to NPL absolute standards of activity and are only to be used to derive indicative activity values.

[†] The calibration factors for these radionuclides have been derived theoretically from the theoretical response curve of this ionisation chamber and are not traceable to NPL absolute standards of activity and are only to be used for impurity corrections.

[†] The calibration factors for these radionuclides have been derived theoretically from the theoretical response curve of this ionisation chamber and are not traceable to NPL absolute standards of activity and are only to be used for impurity corrections.

CALIBRATION FACTORS FOR THE NPL 'FIDELIS' RADIONUCLIDE CALIBRATOR

VINTEN 671 (3 – 5) SYSTEM						
Radionuclide	Container Type	Normalising mass [m ₀]	Calibration Factor (pA/MBq)	Uncertainty (k=1)	Volume Correction Factor [a ₁]	Volume Correction Factor [a ₂]
²⁰² Tl	10 ml P6 vial	4 g	4.29 [†]	± 10.0 %		
²⁰³ Hg	2 ml BS ampoule	1 g	2.562	± 0.67 %	0.00512	-0.00263
²⁰³ Hg	5 ml BS ampoule	3 g	2.501	± 0.67 %	0.00268	-0.00053
²⁰³ Hg	10 ml P6 vial	4 g	2.496	± 0.67 %	0.00251	-0.00017
²⁰³ Pb	2 ml BS ampoule	1 g	3.194	± 0.67 %	0.00512	-0.00263
²⁰³ Pb	5 ml BS ampoule	3 g	3.168	± 0.67 %	0.00268	-0.00053
²⁰³ Pb	10 ml P6 vial	4 g	3.134	± 0.67 %	0.00251	-0.00017
²²³ Ra	2 ml ISO ampoule	1 g	3.201	± 0.34 %		
²²³ Ra	5 ml ISO ampoule	3 g	3.181	± 0.34 %		
²²³ Ra	5ml NBS ampoule	5 g	3.165	± 0.35 %		
²²³ Ra	5ml NBS ampoule	3.6 g	3.170	± 0.40 %		
²⁴¹ Am	2 ml ISO ampoule	1 g	0.2533	± 0.43 %		
²⁴¹ Am	5 ml ISO ampoule	3 g	0.2496	± 0.42 %		
²⁴¹ Am	10 ml P6 vial	4 g	0.2280	± 0.34 %	0.00240	-0.00016

Method for applying volume corrections:

Volume correction: $I_0/I_m = a_2(m - m_0)^2 + a_1(m - m_0) + 1$; Where: $I_0 =$ current expected at the nominal mass of “ m_0 ”
 $I_m =$ measured current at an individual mass “ m ”

APPENDIX 1 – SOURCE HOLDER AND BRACHYTHERAPY JIG



Jig

Vial Holder

Designated jig /holder format (with the jig positioned inside the 212 mm long vial holder) for measurements of (LDR) ^{192}Ir brachytherapy wires as well as (LDR) ^{125}I single seeds and RAPID strands in the NPL radionuclide calibrator.