

7500 and 7600 Type

The nine-nuclide gamma standard, routinely used to establish efficiency curves for gamma spectrometers, covers an energy range from 88 keV to 1836 keV. As options, Am-241 and/or Pb-210 can be added to extend the calibration curve down to 60 keV and 46 keV respectively. IPL offers two nine-nuclide gamma standards. Series 7500 contains Te-123m and Cr-51 for those customers who require a non-mercury containing standard.

Series 7600 contains Hg-203 and Ce-139. Please note that Hg-203 may leach out from polyethylene containers and may contaminate the entire container. Proper handling techniques must be observed. The component nuclides of each series have been chosen to minimize peak interference, and the activity ratios have been selected to yield similar count rates in all major peaks on typical coaxial germanium detectors.

These multinuclide standards are NIST traceable with each component certified with an uncertainty less than $\pm 5\%$ at the 99% confidence level except for Pb-210 when added. The multinuclide standards are prepared gravimetrically from calibrated solutions and then confirmed using a high purity germanium detector to ensure the highest possible quality.

Multinuclide standards are made to order and are available on a year-round basis in a variety of configurations. Standards can be supplied for special applications with nuclides, activities, containers and matrices manufactured to customer specifications.

Reference dates: 1st February, 1st April, 1st June, 1st August, 1st October, 1st December

Nuclides	Main Gamma Energies	7500	7501	7502	7503
		88 keV – 1,8 MeV	60 keV – 1,8 MeV	46 keV – 1,8 MeV	46 keV – 1,8 MeV
		37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq
		[%]	[%]	[%]	[%]
Am-241	60 keV	–	2,9	–	2,3
Cd-109	88 keV	28,7	27,8	22,0	21,5
Co-57	122 keV, 137 keV	1,1	1,1	0,8	0,8
Co-60	1,173 MeV, 1,333 MeV	5,6	5,4	4,3	4,2

Cr-51	320 keV	35,7	34,7	27,5	26,8
Cs-137	662 keV	4,8	4,7	3,7	3,6
Pb-210	46 keV	–	–	23,1	22,6
Sn-113	392 keV	5,2	5,0	4,0	3,9
Sr-85	514 keV	6,6	6,4	5,1	5,0
Te-123m	159 keV	1,4	1,4	1,1	1,1
Y-88	898 keV, 1,836 MeV	10,9	10,6	8,4	8,2
Total		100	100	100	100

Nuclides	Main Gamma Energies	7600	7601	7602	7603
		88 keV – 1,8 MeV	60 keV – 1,8 MeV	46 keV – 1,8 MeV	46 keV – 1,8 MeV
		37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq
		[%]	[%]	[%]	[%]
Am-241	60 keV	–	2,9	–	2,3
Cd-109	88 keV	42,0	40,8	32,5	31,5
Co-57	122 keV, 137 keV	1,6	1,6	1,2	1,2
Co-60	1,173 MeV, 1,333 MeV	8,2	8,0	6,3	6,2

Ce-139	166 keV	2,0	1,9	1,5	1,5
Cs-137	662 keV	7,0	6,8	5,4	5,3
Hg-203	279 keV	6,0	5,8	4,6	4,5
Pb-210	46 keV	–	–	23,0	22,6
Sn-113	392 keV	7,6	7,4	5,8	5,7
Sr-85	514 keV	9,6	9,3	7,4	7,2
Te-123m	159 keV	–	–	–	–
Y-88	898 keV, 1,836 MeV	16,0	15,5	12,3	12,0
Total		100	100	100	100

[Back to the top](#)

NG1 - NG7 (QCYB-Type) / Manufactured at Eckert & Ziegler Nuclitec/Braunschweig/DE

These nuclide mixtures are recommended by PTB (Germany) and cover the energy range 46-1836keV. The solutions are calibrated in our DAkkS accredited measurement laboratory and are traceable to national standards world-wide, including the USA, France, Germany and the United Kingdom.

	Nuclide mixture	NG1	NG2	NG3	NG4
	Energy range	80 keV – 1836 keV	88 keV – 1836 keV	60 keV – 1836 keV	46 keV – 136 keV
	Available activity range	370 Bq – 1,85 MBq	370 Bq – 1,85 MBq	370 Bq – 1,85 MBq	370 Bq – 1,85 MBq
Nuclides	Main gamma energies				
Am-241	60 keV			3,4	4
Ba-133	81 keV, 303 keV, 356 keV	2			
Cd-109	88 keV		15,6	15,4	20
Ce-139	166 keV	2	0,8	0,8	
Co-57	122 keV, 137 keV	2	0,6	0,6	2
Co-60	1,173 MeV, 1,333 MeV		3	3	
Cs-137	662 keV	4	2,6	2,6	
Hg-203	279 keV		2,2	2,2	
Mn-54	835 keV	4			

Pb-210	46 keV				20
Sn-113	392 keV		2,8	2,7	
Sr-85	514 keV	10	3,6	3,6	
Y-88	898 keV, 1,836 MeV	10	5,8	5,7	
Zn-65	1,116 MeV	10			
Standard activity aliquote		44	37	40	46

	Nuclide mixture	NG5	NG6	NG7
	Energy range	88 keV – 1836 keV	60 keV – 1836 keV	60 keV – 1836 keV
	Available activity range	370 Bq – 1,85 MBq	370 Bq – 1,85 MBq	370 Bq – 1,85 MBq
Nuclides	Main gamma energies			
Am-241	60 keV		3,4	3,4
Ba-133	81 keV, 303 keV, 356 keV			

Cd-109	88 keV	17,1	17	15,5
Ce-139	166 keV	0,8	0,8	0,8
Co-57	122 keV, 137 keV	0,6	0,6	0,6
Co-60	1,173 MeV, 1,333 MeV	3,4	3,4	3
Cr-51	320 keV	30,7	30,4	
Cs-137	662 keV	2,8	2,8	2,6
Hg-203	279 keV			2,2
Mn-54	835 keV			2,8
Pb-210	46 keV			
Sn-113	392 keV	3	3	2,7
Sr-85	514 keV	4	4	3,6
Y-88	898 keV, 1,836 MeV	6,6	6,6	5,8
Zn-65	1,116 MeV			6
Standard activity aliquote		69	72	49

Notes

Nuclide mixture 1 (**NG1**): The half lives of the component radionuclides are relatively long (shortest is 65 days, Sr-85). At close source-detector distances, summation effects become important.

Nuclide mixture 2 (**NG2**): The shortest half life is 47 days (Hg-203). The Hg should be precipitated as a sulphide if the solution is dried, to avoid loss of the radioactivity. Summation effects are less important than for NG1.

Nuclide mixture 3 (**NG3**): As NG2, but extends the calibration down to 60keV.

Nuclide mixture 4 (**NG4**): Intended for low energy calibration only.

Nuclide mixture 5 (**NG5**): The shortest half life is 28 days (Cr-51).Preparation of solid standards is easier than for NG2 and NG3, as the Cr-51 replaces the Hg-203.

Nuclide mixture 6 (**NG6**): As NG5, but extends the calibration down to 60keV.

Nuclide mixture 7 (**NG7**): As NG3, but with Mn-54 and Zn-65 for high accuracy calibration.

Reference Dates

NG1: 1st January, 1st April, 1st July, 1st October

NG2: 1st March, 1st June, 1st September, 1st December

NG3: 1st March, 1st June, 1st September, 1st December

NG4: 1st January and 1st July

NG5: 1st March, 1st June, 1st September, 1st December

NG6: 1st March, 1st June, 1st September, 1st December

NG7: 1st March, 1st June, 1st September, 1st December

Containers

Container Configuration	Material	Volume	Drawing
V-Vial	Glass	5 mL	VZ-4339-001
Flame Sealed Ampoule (FSA)	Glass	5 mL	VZ-1719-002
P6-Vial	Glass	10 mL	VZ-1725-001

Glass Bottle	Glass	20 mL	VZ-4415-001
Glass Bottle	Glass	50 mL	VZ-4409-001
Kautex Bottle	Plastic	100 mL	VZ-2028-001

[Back to the top](#)

8300, 8400, 8500 and 8600 Type

The mixed nuclide gamma standards, routinely used to establish efficiency curves for gamma spectrometers, cover an energy range from 88 keV to 1836 keV. The component nuclides of each series have been chosen to minimize peak interference, and the activity ratios have been selected to yield similar count rates in all major peaks on typical coaxial germanium detectors. The mixtures minimize coincident summing effects, which is particularly important when counting close to large, high-efficiency, germanium detectors.

Three mixed nuclide gamma standards are offered.

- Series 8400 contains Hg-203.
- Series 8500 contains Hg-203 and adds Sr-85
- For those customers who require a non-mercury containing standard, Series 8600 replaces Hg-203 with Cr-51 and adds Sr-85.

These mixed nuclide standards are NIST traceable with each component certified with an uncertainty less than $\pm 5\%$ at the 95% confidence level. The mixed nuclide standards are prepared gravimetrically from calibrated solutions and then confirmed using a high purity germanium detector to ensure the highest possible quality.

As options, Am-241 and/or Pb-210 can be added to extend the calibration curve down to 60 keV and 46 keV respectively. In order to measure coincidence-summing effects Mn-54 and/or Zn-65 can also be added upon request.

Reference dates: 1st January, 1st April, 1st July, 1st October

Nuclides	Main Gamma Energies	8400 (former Option 1)	8401 (former Option 2)	8402	8403
		88 keV – 1,8 MeV	60 keV – 1,8 MeV	46 keV – 1,8 MeV	46 keV – 1,8 MeV
		37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq
		[%]	[%]	[%]	[%]
Am-241	60 keV	–	5,0	–	3,1
Cd-109	88 keV	72,7	69,1	43,6	42,2
Ce-139	166 keV	2,6	2,5	1,6	1,5
Co-57	122 keV	1,8	1,7	1,1	1,0
Co-60	1,173 MeV, 1,332 MeV	3,4	3,2	2,0	2,0
Cs-137	662 keV	2,2	2,1	1,3	1,3
Hg-203	279 keV	5,6	5,3	3,4	3,3
Pb-210	46 keV	–	–	40,0	38,8
Sn-113	392 keV	4,4	4,2	2,6	2,6
Y-88	898 keV, 1,836 MeV	7,3	6,9	4,4	4,2
Total		100	100	100	100

Nuclides	Main Gamma Energies	8500 (former Option 3)	8501 (former Option 4)	8502	8503
		88 keV – 1,8 MeV	60 keV – 1,8 MeV	46 keV – 1,8 MeV	46 keV – 1,8 MeV
		37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq
		[%]	[%]	[%]	[%]
Am-241	60 keV	–	4,8	–	3,0
Cd-109	88 keV	69,1	65,7	42,2	40,7
Co-57	122 keV	1,7	1,6	1,0	1,0
Co-60	1,173 MeV, 1,332 MeV	3,2	3,1	2,0	1,9
Ce-139	166 keV	2,5	2,4	1,5	1,5
Cs-137	662 keV	2,1	2,0	1,3	1,2
Hg-203	279 keV	5,3	5,1	3,3	3,1
Pb-210	46 keV	–	–	38,8	38,0
Sn-113	392 keV	4,2	4,0	2,6	2,5
Sr-85	514 keV	5,0	4,8	3,1	3,0
Y-88	898 keV, 1,836 MeV	6,9	6,6	4,2	4,1
Total		100	100	100	100

Nuclides	Main Gamma Energies	8600 (former Option 5)	8601	8602	8603
		88 keV – 1,8 MeV	60 keV – 1,8 MeV	46 keV – 1,8 MeV	46 keV – 1,8 MeV
		37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq
		[%]	[%]	[%]	[%]
Am-241	60 keV	–	3,2	–	2,3
Cd-109	88 keV	42,0	40,7	29,8	29,3
Ce-139	166 keV	1,5	1,5	1,1	1,0
Co-57	122 keV	1,0	1,0	0,7	0,7
Co-60	1,173 MeV, 1,332 MeV	2,0	1,9	1,4	1,4
Cr-51	320,1 keV	42,3	40,9	30,0	29,5
Cs-137	662 keV	1,2	1,2	0,9	0,8
Pb-210	46 keV	–	–	29,0	28,0
Sn-113	392 keV	2,5	2,4	1,8	1,7
Sr-85	514 keV	3,3	3,2	2,3	2,3
Y-88	898 keV, 1,836 MeV	4,2	4,1	3,0	2,9

Total	100	100	100	100
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[Back to the top](#)

8700 Type - True Coincidence Correction Mixture (TCC)

The True Coincidence Correction (TCC) mixture is used with special software to correct for coincidence summing effects. As an option, Pb-210 can be added to extend the calibration curve down to 46 keV.

The TCC mixed nuclide standards are NIST traceable with each component certified with an uncertainty less than $\pm 5\%$ at the 95% confidence level. The mixed nuclide standards are prepared gravimetrically from calibrated solutions and then confirmed using a high purity germanium detector to ensure the highest possible quality.

Reference dates: 1st February and 1st August

Nuclides	Main Gamma Energies	8700	8701 (former Option 6)	8702	8703
		60 keV – 1,8 MeV	60 keV – – 1,8 MeV	46 keV – 1,8 MeV	46 keV – – 1,8 MeV
		37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq	37 Bq – 185 kBq
		[%]	[%]	[%]	[%]
Am-241	60 keV	6,0	5,7	4,0	3,8
Cd-109	88 keV	54,2	51,1	36,3	34,8
Co-57	122 keV	1,4	1,3	0,9	0,9

Ce-139	166 keV	1,9	1,8	1,3	1,2
Cs-134	604,7 keV, 795,9 keV	6,7	6,3	4,5	4,3
Cs-137	662 keV	1,6	1,5	1,1	1,0
Hg-203	279 keV	4,5	4,2	3,0	2,9
Mn-54	834,9 keV	3,8	3,6	2,5	2,4
Pb-210	46 keV	–	–	33,0	32,0
Sn-113	392 keV	3,0	2,8	2,0	1,9
Sr-85	514 keV	–	5,7	–	3,9
Y-88	898 keV, 1,836 MeV	6,9	6,5	4,6	4,4
Zn-65	1,1156 MeV	10,0	9,4	6,7	6,4
Total		100	100	100	100

[Back to the top](#)

Inactive Diluents

Inactive diluents for mixed nuclide reference solutions:

Product code	To be used for	Carrier element concentration	Volume	Remarks
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DIL7500-5	7500 series	10 µg/ml of Cs and Cr 20 µg/ml of Co 50 µg/ml of Sn, Sr, Te and Y 500 µg/ml of Cd	5ml in 2 M HCl- Solution in a 5ml glass ampoule	maximum volume 50ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7500-50	7500 series	10 µg/ml of Cs and Cr 20 µg/ml of Co 50 µg/ml of Sn, Sr, Te and Y 500 µg/ml of Cd	50ml in 2 M HCl- Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7501-5	7501 series	10 µg/ml of Cs, Cr and Eu (for Am) 20 µg/ml of Co 50 µg/ml of Sn, Sr, Te and Y 500 µg/ml of Cd	5ml in 2 M HCl- Solution in a 5ml glass ampoule	maximum volume 50ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7501-50	7501 series	10 µg/ml of Cs, Cr and Eu (for Am) 20 µg/ml of Co 50 µg/ml of Sn, Sr, Te and Y 500 µg/ml of Cd	50ml in 2 M HCl- Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7502-5	7502 series	10 µg/ml of Cs, Cr and Pb 20 µg/ml of Co 50 µg/ml of Sn, Sr, Te and Y 500 µg/ml of Cd	5ml in 2 M HCl- Solution in a 5ml glass ampoule	maximum volume 50ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7502-50	7502 series	10 µg/ml of Cs, Cr and Pb 20 µg/ml of Co 50 µg/ml of Sn, Sr, Te and Y 500 µg/ml of Cd	50ml in 2 M HCl- Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 2 M HCl

DIL7503-5	7503 series	10 µg/ml of Cs, Cr, Pb and Eu (for Am) 20 µg/ml of Co 50 µg/ml of Sn, Sr, Te and Y 500 µg/ml of Cd	5ml in 2 M HCl- Solution in a 5ml glass ampoule	maximum volume 50ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7503-50	7503 series	10 µg/ml of Cs, Cr, Pb and Eu (for Am) 20 µg/ml of Co 50 µg/ml of Sn, Sr, Te and Y 500 µg/ml of Cd	50ml in 2 M HCl- Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7600-5	7600 series	10 µg/ml of Ce and Cs 20 µg/ml of Co 50 µg/ml of Sn, Sr and Y 500 µg/ml of Cd	5ml in 2 M HCl- Solution in a 5ml glass ampoule	maximum volume 50ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7600-50	7600 series	10 µg/ml of Ce and Cs 20 µg/ml of Co 50 µg/ml of Sn, Sr and Y 500 µg/ml of Cd	50ml in 2 M HCl- Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7601-5	7601 series	10 µg/ml of Ce, Cs and Eu (for Am) 20 µg/ml of Co 50 µg/ml of Sn, Sr and Y 500 µg/ml of Cd contains no Hg	5ml in 2 M HCl- Solution in a 5ml glass ampoule	maximum volume 50ml per ampoule of diluent, acid to be used for dilution: 2 M HCl

DIL7601-50	7601 series	10 µg/ml of Ce, Cs and Eu (for Am) 20 µg/ml of Co 50 µg/ml of Sn, Sr and Y 500 µg/ml of Cd contains no Hg	50ml in 2 M HCl- Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7602-5	7602 series	10 µg/ml of Ce, Cs and Pb 20 µg/ml of Co 50 µg/ml of Sn, Sr and Y 500 µg/ml of Cd contains no Hg	5ml in 2 M HCl- Solution in a 5ml glass ampoule	maximum volume 50ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7602-50	7602 series	10 µg/ml of Ce, Cs and Pb 20 µg/ml of Co 50 µg/ml of Sn, Sr and Y 500 µg/ml of Cd contains no Hg	50ml in 2 M HCl- Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7603-5	7603 series	10 µg/ml of Ce, Cs, Pb and Eu (for Am) 20 µg/ml of Co 50 µg/ml of Sn, Sr and Y 500 µg/ml of Cd contains no Hg	5ml in 2 M HCl- Solution in a 5ml glass ampoule	maximum volume 50ml per ampoule of diluent, acid to be used for dilution: 2 M HCl
DIL7603-50	7603 series	10 µg/ml of Ce, Cs, Pb and Eu (for Am) 20 µg/ml of Co 50 µg/ml of Sn, Sr and Y 500 µg/ml of Cd contains no Hg	50ml in 2 M HCl- Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 2 M HCl

DIL8600-500	8600 series	30 µg/g of each element except Am	500ml in 4 M HCl-Solution in a 500ml glass ampoule	
NKA8192	8701 series	300 µg/ml of Cd, Ce, Co, Cs, Hg, Mn, Sn, Sr, Y and Zn	50ml in 4 M HCl-Solution in a 50ml glass ampoule	maximum volume 500ml per ampoule of diluent, acid to be used for dilution: 4 M HCl
NQB2392	QCYB40 and QCYB400	contains 4 mg element/ml solution	5ml in 0,5 M HNO ₃ solution in a 5ml glass ampoule	max. volume 1000ml per ampoule of diluent, acid to be used for dilution: 0,5 M HNO ₃
NQB2393	QCYB41, QCYB410, QCYB9120	contains 4 mg element/ml solution	5ml in 0,5 M HCl solution in a 5ml glass ampoule	max. volume 1000ml per ampoule of diluent, acid to be used for dilution: 0,5 M HCl