• Point & wide area sources • Alpha & multialpha •

Alpha and multialpha ray sources are used for energy and efficiency calibration of all α detectors and measuring assemblies.

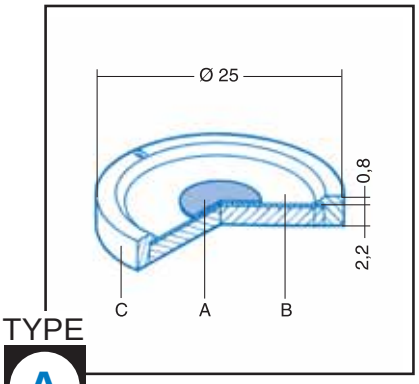
They are characterized in terms of:
- activity (Bq) (shown by a fading blue band in the table),
- α particle flux within a solid angle of 2π sr (s^{-1}).

• Technique

The radionuclides are electroplated,
- either on a stainless steel holder with a ring (type A or B),
- or on a polished stainless steel holder without ring (type C and D).

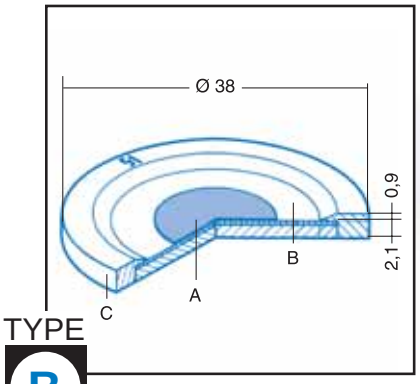
CERCA LEA also manufactures calibrated multialpha ray sources (comprising a mixture of three radionuclides: ^{241}Am, ^{244}Cm and ^{239}Pu) characterized in terms of α particle flux (s^{-1}) within a solid angle of 2π sr. The alpha particle flux of each radionuclide represents around one-third of the total flux.

• Available source holders



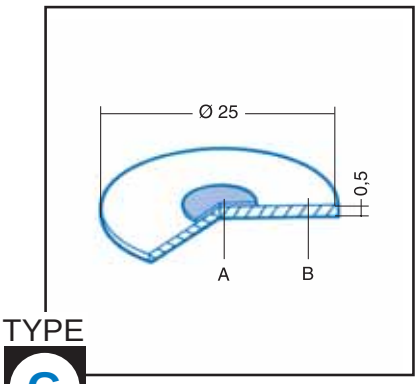
TYPE **A**

A*: *active area, diameter 15 mm*
B: *apparent diameter 19 mm*
C: *Duralinox ring, thickness 3 mm*



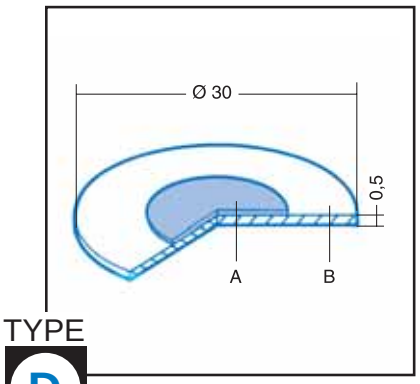
TYPE **B**

A*: *active area, diameter 15 mm*
B: *apparent diameter 26 mm*
C: *Duralinox ring, thickness 3 mm*



TYPE **C**

A*: *active area, diameter 15 mm*
B: *stainless steel disk*



TYPE **D**

A*: *active area, diameter 15 mm*
B: *stainless steel disk*

****A :*** *Better spectrum resolution than 8 mm active part - 8 mm is nevertheless available on request.*

• Made-to-measure sources upon request

Non-standard product references (not shown in the table):

Activity on request

Radionuclide — *Type of holder (holder C)*
AM241EATC1KBQ
Type of product (Alpha standard) — *Required activity (1 kBq)*

Flux on request

Radionuclide — *Type of holder (holder A)*
AM241EASA150
Type of product (Alpha standard) — *Required flux ($150\ s^{-1}$)*

Holder dimensions on request

Radionuclide — *Type of holder (non-standard)*
AM241EAHS4KBQ
Type of product (Alpha standard) — *Activity (see table)*

Alpha and multialpha ray sources (activity and particle flux)

Radionuclide *Half-life*	Radiation energy (MeV) α	Product code	α Flux within 2 π sr s^{-1}(*)	Activity/ *Approximate Activity* kBq(*)	Holder Diameter mm	Type	Measurement uncertainty %
^{241}Am *4,33 x 10^2 years*	5,388 5,443 5,486	**AM241EATC09**		3	25	C	2
		AM241EATD09		3	30	D	2
		AM241EATC12		3 x 10^1	25	C	3
		AM241EATD12		3 x 10^1	30	D	3
		AM241EASA20	1,5 x10^2	*3 x 10^{-1}*	25	A	1,5
		AM241EASA30	1,5 x10^3	*3*	25	A	1,5
		AM241EASA40	1,5 x10^4	*3 x 10^1*	25	A	4
		AM241EASB20	1,5 x10^2	*3 x 10^{-1}*	38	B	1,5
		AM241EASB30	1,5 x10^3	*3*	38	B	1,5
		AM241EASC20	1,5 x10^2	*3 x 10^{-1}*	25	C	1
		AM241EASC30	1,5 x10^3	*3*	25	C	1
		AM241EASD20	1,5 x10^2	*3 x 10^{-1}*	30	D	1
		AM241EASD30	1,5 x10^3	*3*	30	D	1
^{244}Cm *1,81 x 10^1 years*	5,763 5,805	**CM244EATC09**		3	25	C	2
		CM244EATD09		3	30	D	2
		CM244EASA20	1,5 x10^2	*3 x 10^{-1}*	25	A	1,5
		CM244EASA30	1,5 x10^3	*3*	25	A	1,5
		CM244EASB20	1,5 x10^2	*3 x 10^{-1}*	38	B	1,5
		CM244EASB30	1,5 x10^3	*3*	38	B	1,5
		CM244EASC20	1,5 x10^2	*3 x 10^{-1}*	25	C	1
		CM244EASC30	1,5 x10^3	*3*	25	C	1
		CM244EASD20	1,5 x10^2	*3 x 10^{-1}*	30	D	1
		CM244EASD30	1,5 x10^3	*3*	30	D	1
^{238}Pu *8,77 x 10^1 years*	5,456 5,499	**PU238EATC09**		3	25	C	2
		PU238EATD09		3	30	D	2
		PU238EASA20	1,5 x10^2	*3 x 10^{-1}*	25	A	1,5
		PU238EASA30	1,5 x10^3	*3*	25	A	1,5
		PU238EASB20	1,5 x10^2	*3 x 10^{-1}*	38	B	1,5
		PU238EASB30	1,5 x10^3	3	38	B	1,5
		PU238EASC20	1,5 x10^2	*3 x 10^{-1}*	25	C	1
		PU238EASC30	1,5 x10^3	*3*	25	C	1
		PU238EASD20	1,5 x10^2	*3 x 10^{-1}*	30	D	1
		PU238EASD30	1,5 x10^3	*3*	30	D	1
^{239}Pu *2,41 x 10^4 years*	5,105 5,143 5,156	**PU239EATC09**		3	25	C	2
		PU239EATD09		3	30	D	2
		PU239EASA20	1,5 x10^2	*3 x 10^{-1}*	25	A	1,5
		PU239EASA30	1,5 x10^3	*3*	25	A	1,5
		PU239EASB20	1,5 x10^2	*3 x 10^{-1}*	38	B	1,5
		PU239EASB30	1,5 x10^3	*3*	38	B	1,5
		PU239EASC20	1,5 x10^2	*3 x 10^{-1}*	25	C	1
		PU239EASC30	1,5 x10^3	*3*	25	C	1
		PU239EASD20	1,5 x10^2	*3 x 10^{-1}*	30	D	1
		PU239EASD30	1,5 x10^3	*3*	30	D	1
^{233}U *1,59 x 10^5 years*	4,783 4,824	**U233EASA20**	1,5 x10^2	*3 x 10^{-1}*	25	A	1,5
		U233EASB20	1,5 x10^2	*3 x 10^{-1}*	38	B	1,5
		U233EASC20	1,5 x10^2	*3 x 10^{-1}*	25	C	1
		U233EASD20	1,5 x10^2	*3 x 10^{-1}*	30	D	1
Alpha Mixture 9ML04 type **^{241}Am, ^{244}Cm, ^{239}Pu**		**9ML04EASC25**	4 x10^2	*8 x 10^{-1}*	25	C	3
		9ML04EASD25	4 x10^2	*8 x 10^{-1}*	30	D	3

Legend:

Values are stated in activity (Bq) on the calibration certificate

(*) Manufacturing tolerance ± 30%

• Accessories

Alpha source holders

Product	Ø (mm)	Type	Reference
Ring holder for stainless steel disk (22mm)	25	A	**9ACETAA**
Ring holder for stainless steel disk (22mm)	38	B	**9ACETAB**

***To order:* see Commercial Information on pages 1.1 – 1.6 of the INFORMATION section**

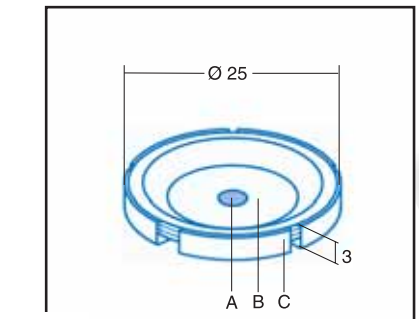
• Sources for calibration of beta detectors

Designed for efficiency calibration of β detectors and counting systems, beta point sources are characterized in terms of the emerging flux of β particles, expressed in s^{-1}, within a solid angle **of 4 π sr.**

• Technique

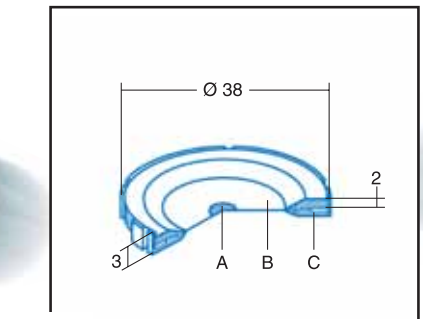
The sources are hot-sealed between two thin plastic foils and gold-coated. They are then mounted in a removable metal ring to ensure rigidity and ease of handling.
They can be used with or without the ring holder for calibration of all β detectors, including windowless 2 π or 4 π counters.

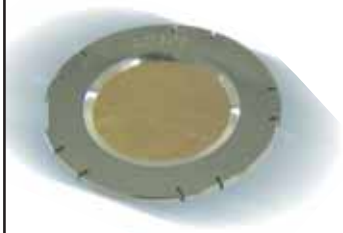
• Available source holders



TYPE **A**

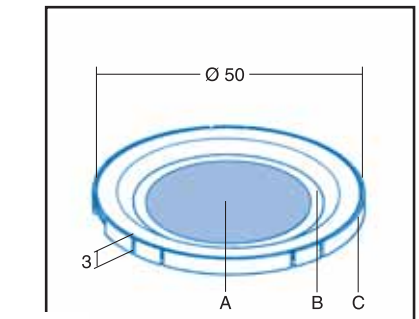
A: *active area, diameter 3 mm*
B: *diameter 15 mm*
C: *metal ring, thickness 3 mm*

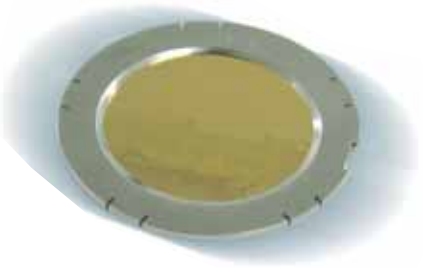




TYPE **B**

A: *active area, diameter 3 mm*
B: *diameter 22 mm*
C: *metal ring, thickness 3 mm*





TYPE **C**

A: *active area, diameter 30 mm*
B: *diameter 35 mm*
C: *metal ring, thickness 3 mm*

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• Made-to-measure sources upon request

Activity on request

Radionuclide — *Type of holder (holder A)*

C14EBSA[1KBQ]

Type of product (Beta standard) — *Required activity (kBq)*

Sources for calibration of beta detectors

Radionuclide *Half-life*	Radiation energy (MeV) β max	Product code	β particle flux within 4 π sr s^{-1}(*)	Equivalent activity Bq(*)	Holder Diameter mm	Type	Measurement uncertainty %
^{14}C *5,73 x 10^3 years*	0,156	C14EBSA20	8 x 10^1	8 x 10^1	25	A	1
		C14EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		C14EBSB20	8 x 10^1	8 x 10^1	38	B	1
		C14EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		C14EBSC20	8 x 10^1	8 x 10^1	50	C	1
		C14EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
^{36}Cl *3,01 x 10^5 years*	0,709	CL36EBSA20	8 x 10^1	8 x 10^1	25	A	1
		CL36EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		CL36EBSB20	8 x 10^1	8 x 10^1	38	B	1
		CL36EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		CL36EBSC20	8 x 10^1	8 x 10^1	50	C	1
		CL36EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
^{60}Co *1,93 x 10^3 days*	0,318	CO60EBSA20	8 x 10^1	8 x 10^1	25	A	1
		CO60EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		CO60EBSB20	8 x 10^1	8 x 10^1	38	B	1
		CO60EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		CO60EBSC20	8 x 10^1	8 x 10^1	50	C	1
		CO60EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
^{134}Cs *7,55 x 10^2 days*	0,089 0,415 0,658	CS134EBSA20	8 x 10^1	8 x 10^1	25	A	1
		CS134EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		CS134EBSB20	8 x 10^1	8 x 10^1	38	B	1
		CS134EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		CS134EBSC20	8 x 10^1	8 x 10^1	50	C	1
		CS134EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
$^{137}Cs + {}^{137}Ba^m$ *3,02 x 10^1 years*	0,511 1,173	CS137EBSA20	8 x 10^1	8 x 10^1	25	A	1
		CS137EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		CS137EBSB20	8 x 10^1	8 x 10^1	38	B	1
		CS137EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		CS137EBSC20	8 x 10^1	8 x 10^1	50	C	1
		CS137EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
^{22}Na *9,50 x 10^2 days*	0,545	NA22EBSA20	8 x 10^1	9 x 10^1	25	A	1
		NA22EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		NA22EBSB20	8 x 10^1	9 x 10^1	38	B	1
		NA22EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		NA22EBSC20	8 x 10^1	9 x 10^1	50	C	1
		NA22EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
^{147}Pm *9,58 x 10^2 days*	0,225	PM147EBSA20	8 x 10^1	8 x 10^1	25	A	1
		PM147EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		PM147EBSB20	8 x 10^1	8 x 10^1	38	B	1
		PM147EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		PM147EBSC20	8 x 10^1	8 x 10^1	50	C	1
		PM147EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
^{89}Sr *5,06 x 10^1 days*	1,492	SR89EBSA20	8 x 10^1	8 x 10^1	25	A	1
		SR89EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		SR89EBSB20	8 x 10^1	8 x 10^1	38	B	1
		SR89EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		SR89EBSC20	8 x 10^1	8 x 10^1	50	C	1
		SR89EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
$^{90}Sr + {}^{90}Y$ *2,82 x 10^1 years* *Beta flux given in $^{90}Sr + {}^{90}Y$ total*	0,546 2,284	SR90EBSA20	8 x 10^1	8 x 10^1	25	A	1
		SR90EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		SR90EBSB20	8 x 10^1	8 x 10^1	38	B	1
		SR90EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		SR90EBSC20	8 x 10^1	8 x 10^1	50	C	1
		SR90EBSC30	3 x 10^3	3 x 10^3	50	C	0,7
^{204}Tl *1,38 x 10^3 days*	0,763	TL204EBSA20	8 x 10^1	8 x 10^1	25	A	1
		TL204EBSA30	3 x 10^3	3 x 10^3	25	A	0,7
		TL204EBSB20	8 x 10^1	8 x 10^1	38	B	1
		TL204EBSB30	3 x 10^3	3 x 10^3	38	B	0,7
		TL204EBSC20	8 x 10^1	8 x 10^1	50	C	1
		TL204EBSC30	3 x 10^3	3 x 10^3	50	C	0,7

(*) Manufacturing tolerance ± 30%

Equivalent activity: measured flux of emergent particles divided by the emission intensity.

Kits of beta sources

Contents of kit	Product code	β particle flux within 4 π sr (*) for each sources s^{-1}	Holder Diameter for each sources mm	Type	Measurement uncertainty %
6 EBSA20 sources	9CD02EBSA20	8 x 10^1	25	A	1
6 EBSA30 sources	9CD03EBSA30	3 x 10^3	25	A	0.7
6 EBSB20 sources	9CD05EBSB20	8 x 10^1	38	B	1
6 EBSB30 sources	9CD06EBSB30	3 x 10^3	38	B	0.7
6 EBSC20 sources	9CD08EBSC20	8 x 10^1	50	C	1
6 EBSC30 sources	9CD09EBSC30	3 x 10^3	50	C	0.7

Each kit includes six sources of your choice selected from the ten β emitters shown in the table on p. 2.4.

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• Empty Kits

Product	∅ (mm)	Type	Reference
Empty kits for ß sources	25	A	9ACETCR
Empty kits for ß sources	38	B	9ACETCS
Empty kits for ß sources	50	C	000074

(*) Manufacturing tolerance ± 30%

Radiation protection

Standard sources for calibrating instruments

Alpha or beta wide area standard sources

These wide area sources are especially designed for calibration of contamination detectors used for radiation protection as Hand and Foot Monitors, Planchet Counters or portable alpha/beta detectors

• Radionuclides

- Reception control of the radiochemical purity of the isotope used
- Alpha radionuclides ^{238}**Pu,** ^{239}**Pu,** ^{241}**Am - Activity: 400 Bq**
- Beta-emitting ^{14}**C,** ^{147}**Pm,** ^{60}**Co,** ^{137}**Cs,** ^{36}**Cl,** ^{90}**Sr - Activity on catalogue: 4 kBq**
- Target activity for a **surface emission flux between 200 s^{-1} to 10 000 s^{-1} (other values on request).**

• Sources with aluminium substrate

CERCA LEA has optimized an efficient process for wide area sources manufacturing on an aluminium substrate in accordance with ISO 8769.

- Category 2 reference sources, and working sources.
- References sources are calibrated in total emerging particles flux, expressed in s^{-1} within 2π sr.
- Measurement uncertainty on emission particles flux 6% at 95% of confidence level.
- Uniformity ± 10%
- Activity calculated to ± 10%
- Source efficiency : the very fine radioactive layer and the high backscatter with the anodised aluminium substrate enables fabrication of highly efficient sources
- No contamination on contact.
- Stainless steel holders.

• Calibration certificates

These sources are certified as reference sources for calibration of surface contamination monitors.

The emerging flux is certified COFRAC (ISO 17025) and linked to the National Primary Laboratory of Metrology (BNM) as category 1 standards :

- Reference and ID number of source
- Radionuclide and half-life
- Source category
- Active area of source
- Surface emission flux, uncertainty and reference date
- Activity calculated at reference date

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These sources are delivered with a COFRAC calibration certificate, which is equivalent to the European Cooperation for Accredistaion (ISO17025).

European co-operation for Accreditation

• Made to measure flux

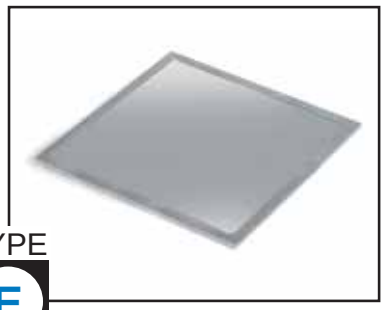
Emission flux on request

Radionuclide — *Dimensions of active area (type E)*

AM241ESAE1KBQ

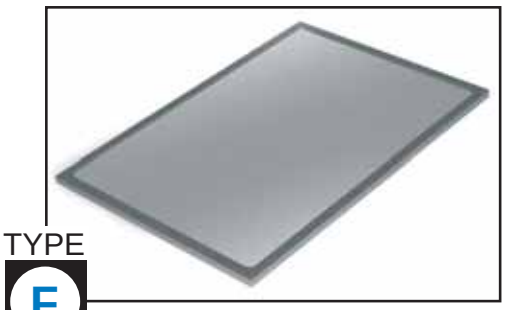
Type of source (Anodised aluminium substrate) — *Required activity*

• Available source configurations



TYPE **E**

Substrate: *Aluminium*
Holder: *110 x 110 mm - Stainless steel*
Active area: *100 x 100 mm*
Total thickness: *3 mm*



TYPE **F**

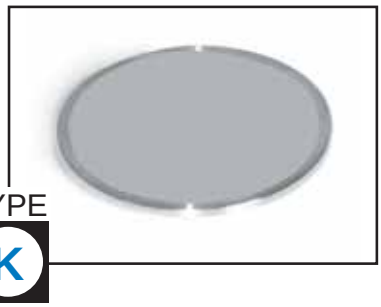
Substrate: *Aluminium*
Holder:*120 x 170 mm - Stainless steel*
Active area:*100 x 150 mm*
Total thickness: *3 mm*

TYPE **I**

Substrate: *Aluminium*
Tray with retaining ring
Active diameter: *35.5 mm*
Outside diameter: *53 mm*

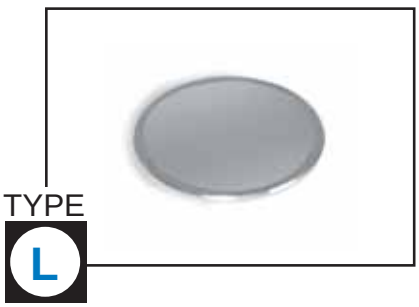
TYPE **J**

Substrate: *Aluminium*
Simple tray
Active diameter: *51 mm*
Outside diameter: *53 mm*



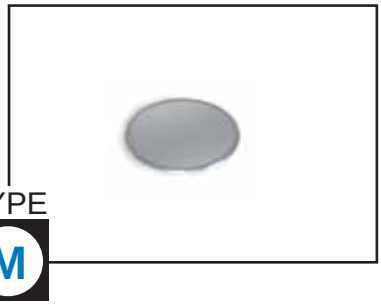
TYPE **K**

Substrate: *Aluminium thickness 0.3 mm*
Holder: *Stainless steel*
Active diameter: *110 mm*
Outside diameter: *120 mm*
Total thickness: *3 mm*



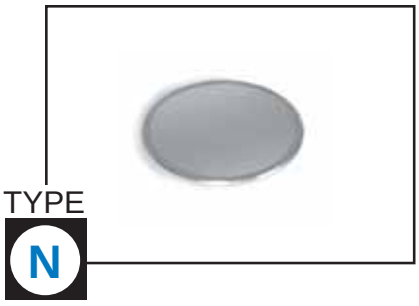
TYPE **L**

Substrate:*Aluminiumthickness 0.3 mm*
Holder: *Stainless steel*
Active diameter: *44 mm*
Outside diameter: *50 mm*
Total thickness: *2,6 mm*



TYPE **M**

Substrate: *Aluminium thickness 0.3 mm*
Holder: *Stainless steel*
Active diameter: *15 mm*
Outside diameter: *30 mm*
Total thickness: *2,6 mm*



TYPE **N**

Substrate: *Aluminium thickness 0.3 mm*
Holder: *Stainless steel*
Active diameter: *36 mm*
Outside diameter: *47 mm*
Total thickness: *2,6 mm*

Reference alpha and beta sources for radiation protection

Radionuclide *Half-life*	Radiation energy(MeV) α / β	Product code	α/β flux within 2 π sr s^{-1} (*)	Approximate activity kBq	Active diameter/ active area mm	Type	Measurement uncertainty %
^{241}Am	5,443	AM241ESAE20	200	4 x 10^{-1}	100 x 100	E	6
4,33 x 10^{2} years	5,486	AM241ESAF20	200	4 x 10^{-1}	100 x 150	F	6
		AM241ESAI20	200	4 x 10^{-1}	35,5	I	6
		AM241ESAJ20	200	4 x 10^{-1}	51	J	6
		AM241ESAK20	200	4 x 10^{-1}	110	K	6
		AM241ESAL20	200	4 x 10^{-1}	44	L	6
		AM241ESAN20	200	4 x 10^{-1}	36	N	6
^{14}C	0,156	C14ESAE20	1500	4	100 x 100	E	6
5,73 x 10^{3} years		C14ESAF20	1500	4	100 x 150	F	6
		C14ESAI20	1500	4	35,5	I	6
		C14ESAJ20	1500	4	51	J	6
		C14ESAK20	1500	4	110	K	6
		C14ESAL20	1500	4	44	L	6
^{36}Cl	0,709	CL36ESAE20	2500	4	100 x 100	E	6
3,01 x 10^{5} years		CL36ESAF20	2500	4	100 x 150	F	6
		CL36ESAI20	2500	4	35,5	I	6
		CL36ESAJ20	2500	4	51	J	6
		CL36ESAK20	2500	4	120	K	6
		CL36ESAL20	2500	4	50	L	6
^{60}Co	0,318	CO60ESAE20	1900	4	100 x 100	E	6
1,93 x 10^{3} days		CO60ESAF20	1900	4	100 x 150	F	6
		CO60ESAI20	1900	4	35,5	I	6
		CO60ESAJ20	1900	4	51	J	6
		CO60ESAK20	1900	4	110	K	6
		CO60ESAL20	1900	4	44	L	6
^{137}Cs + ^{137}Ba^{m}	0,511	CS137ESAE20	2400	4	100 x 100	E	6
3,02 x 10^{1} years	1,173	CS137ESAF20	2400	4	100 x 150	F	6
		CS137ESAI20	2400	4	35,5	I	6
		CS137ESAJ20	2400	4	51	J	6
		CS137ESAK20	2400	4	110	K	6
		CS137ESAL20	2400	4	44	L	6
^{147}Pm	0,225	PM147ESAE20	1900	4	100 x 100	E	6
9,58 x 10^{2} days		PM147ESAF20	1900	4	100 x 150	F	6
		PM147ESAI20	1900	4	35,5	I	6
		PM147ESAJ20	1900	4	51	J	6
		PM147ESAK20	1900	4	110	K	6
		PM147ESAL20	1900	4	44	L	6
^{238}Pu	5,456	PU238ESAE20	200	4 x 10^{-1}	100 x 100	E	6
8,77 x 10^{1} years	5,499	PU238ESAM20	200	4 x 10^{-1}	15	M	6
^{239}Pu	5,105	PU239ESAE20	200	4 x 10^{-1}	100 x 100	E	6
2,41 x 10^{4} years	5,143	PU239ESAF20	200	4 x 10^{-1}	100 x 150	F	6
	5,156	PU239ESAI20	200	4 x 10^{-1}	35,5	I	6
		PU239ESAJ20	200	4 x 10^{-1}	51	J	6
		PU239ESAK20	200	4 x 10^{-1}	110	K	6
		PU239ESAL20	200	4 x 10^{-1}	44	L	6
^{90}Sr + ^{90}Y	0,546	SR90ESAE20	2500	4	100 x 100	E	6
2,82 x 10^{1} years	2,284	SR90ESAF20	2500	4	100 x 150	F	6
Values given in ^{90}Sr only on calibration certificate		SR90ESAJ20	2500	4	51	J	6
		SR90ESAI20	2500	4	35,5	I	6
		SR90ESAI1KBQ	600	1	35,5	I	6
		SR90ESAK20	2500	4	110	K	6
		SR90ESAL20	2500	4	44	L	6
		SR90ESAN20	2500	4	36	N	6

(*) Manufacturing tolerance ± 30%

Legend:

Alpha sources