

# Planar Calibration Standards



This series includes the Extended Alpha or Beta Standards (EAB) and the Large Decade Standards (LDS). These standards are used for the calibration of alpha, beta and wide area counters. EAB standards are typically disks and LDS standards are either large square or large rectangular standards. All sources are NIST traceable based on output or contained activity. NIST certification on contained activity is not available on some alpha and beta sources. The surface emission rate in  $2\pi$  is given on the certificate and is NIST traceable for most nuclides. Note that the emission rate for a given energy spectrum is a function of detector geometry, gas composition, pressure and material of construction, so that virtually every detector may have a different response. All electroplated sources are prepared +/- 30% of nominal activity.

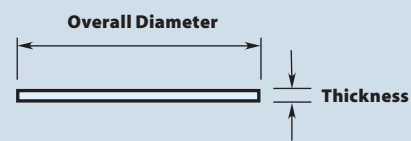
### EAB—Unmounted Foil

These are rugged sources designed primarily for the calibration of portable survey instruments in the plant or field.

These sources are annealed, so that the active surface of the source may be gently wiped or touched without removing activity from the surface.

**Figure 55-A: Unmounted Configuration**

**A14-6**



#### Overall Dimensions

X	Overall Diameter	Active Diameter	Thickness	Minimum	Maximum
25U	0.984" (25 mm)	0.787" (20 mm)	0.03" (0.762 mm)	5 nCi (185 Bq)	31 nCi (1.14 kBq)
32U	1.26" (32 mm)	0.984" (25 mm)	0.03" (0.762 mm)	5 nCi (185 Bq)	49 nCi (1.81 kBq)
47U	1.85" (47 mm)	1.73" (45 mm)	0.03" (0.762 mm)	5 nCi (185 Bq)	159 nCi (58.8 kBq)
50U	2.0" (50.8 mm)	1.85" (47 mm)	0.03" (0.762 mm)	5 nCi (185 Bq)	173 nCi (64.0 kBq)

#### Planar Calibration Standards—Unmounted Foil

Catalog Number	Nuclide	Half-Life	Principle Emissions (keV)	Nature of Active Material	Window
EAB-241-x	Americium-241	432.17 y	5388, 5443, 5486 $\alpha$	Electroplated onto Stainless Steel	None
EAB-239-x	Plutonium-239	$2.411 \times 10^4$ y	5105, 5143, 5156 $\alpha$	Electroplated onto Stainless Steel	None
EAB-099-x	Technetium-99	$2.13 \times 10^5$ y	294 $\beta_{max}$	Electroplated onto Stainless Steel	None
EAB-230-x	Thorium-230	$7.54 \times 10^4$ y	4621, 4688 $\alpha$	Electroplated onto Stainless Steel	None



# Planar Calibration Standards

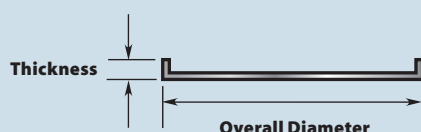
## Planchet—EAB-PL

These standards simulate cupped planchet samples and can be used as calibration or performance check standards.



**Figure 56-A: PL Style**

**A1410**



### Overall Dimensions

Overall Diameter	Active Diameter	Height
2.0"	1.77"	0.125"
50.8 mm	45 mm	3.18 mm

### Activities & Exceptions

#### Available Activities

5 nCi-100 nCi (185 Bq-3.7 kBq)

#### Exceptions

Cl-36	1 nCi-1.6 $\mu$ Ci (37 Bq-59.2 kBq)
U-235	1 nCi-25 nCi (37 Bq-925 Bq)
U-238	1 nCi-4 nCi (37 Bq-148 Bq)
U-238D	1 nCi-2 nCi (37 Bq-74 Bq)

### Planar Calibration Standards—PL Style

Catalog Number	Nuclide	Half-Life	Principle Emissions (keV)	Nature of Active Material	Window
EAB-241-PL	Americium-241 <sup>(4)</sup>	432.17 y	5388, 5443, 5486 $\alpha$	Electroplated onto Stainless Steel	None
EAB-014-PL	Carbon-14	5730 y	156 $\beta_{\max}$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-137-PL	Cesium-137	30.17 y	662, 1175 $\beta_{\max}$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-036-PL	Chlorine-36	3.01 x 10 <sup>5</sup> y	1142 $\beta_{\max}$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-060-PL	Cobalt-60	5.272 y	1173, 1332 ~300 $\beta_{\max}$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-125-PL	Iodine-125 <sup>(1)</sup>	59.43 d	35.5, 27-32 K x-rays $\gamma$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-129-PL	Iodine-129	1.57 x 10 <sup>7</sup> y	40, 29-35 K x-rays $\gamma$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-239-PL	Plutonium-239 <sup>(4)</sup>	2.411 x 10 <sup>4</sup> y	5105, 5143, 5156 $\alpha$	Electroplated onto Stainless Steel	None
EAB-210-PL	Polonium-210 <sup>(2)</sup>	138.376 d	5304 $\alpha$	Electroless Deposit onto Silver Substrate	None
EAB-147-PL	Promethium-147	2.6234 y	225 $\beta$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-131-PL	Simulated Iodine-131	~5 y	356, 662 $\gamma$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-090-PL	Strontium 90/Yttrium-90 <sup>(3)</sup>	28.5 y	Sr-90:546 $\beta$ , Y-90:2282	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-099-PL	Technetium-99 <sup>(4)</sup>	2.13 x 10 <sup>5</sup> y	294 $\beta$	Electroplated onto Stainless Steel	None
EAB-204-PL	Thallium-204	3.78 y	763 $\beta$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-230-PL	Thorium-230 <sup>(4)</sup>	7.54 x 10 <sup>4</sup> y	4621, 4688 $\alpha$	Electroplated onto Stainless Steel	None
EAB-235-PL	Uranium-235 (beta from Pa-231) <sup>(2)</sup>	7.037 x 10 <sup>8</sup> y	4215-4597 $\alpha$	Electroplated onto Aluminum Substrate	100 $\mu$ g/cm <sup>2</sup> Acrylic
EAB-238-PL	Uranium-238 (Natural) <sup>(2)</sup>	4.468 x 10 <sup>9</sup> y	4147, 4196 (beta from Pa-234) $\alpha$	Electroplated onto Aluminum Substrate	100 $\mu$ g/cm <sup>2</sup> Acrylic

1) See note on page 45 regarding I-125 sources.

2) 100  $\mu$ g/cm<sup>2</sup> acrylic cover available upon request.

3) See note on page 41 regarding Sr-90/Y-90 sources.

4) 100  $\mu$ g/cm<sup>2</sup> gold cover available upon request.

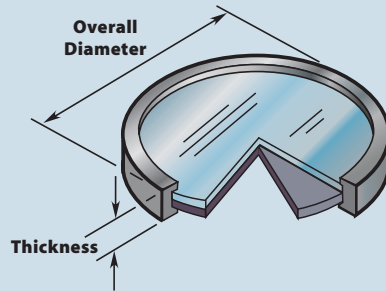
## Ring and Disk—EAB-LB

EAB-LB disk standards are designed to check the performance and to determine the efficiency of low level counting systems such as proportional counters. The stainless steel disk containing the active element is surrounded by an aluminum ring which holds the window assembly in place.



**Figure 57-A: LB Configuration**

**A1402**



### Overall Dimensions

X	Overall Diameter	Active Diameter	Height
47LB	1.85" (47 mm)	1.61" (41 mm)	0.125" (3.18 mm)
50LB	2.0" (50.8 mm)	1.77" (45 mm)	0.125" (3.18 mm)

### Activities & Exceptions

#### Available Activities

5 nCi–100 nCi (185 Bq–3.7 kBq)

#### Exceptions

Cl-36	1 nCi–1.6 $\mu$ Ci (37 Bq–59.2 kBq)
U-235	1 nCi–25 nCi (37 Bq–92.5 Bq)
U-238	1 nCi–4 nCi (37 Bq–148 Bq)
U-238D	1 nCi–2 nCi (37 Bq–74 Bq)

### Planar Calibration Standards—LB Configuration

Catalog Number	Nuclide	Half-Life	Principle Emissions (keV)	Nature of Active Material	Window
EAB-241-x	Americium-241 <sup>(4)</sup>	432.17 y	5388, 5443, 5486 $\alpha$	Electroplated onto Stainless Steel	None
EAB-014-x	Carbon-14	5730 y	156 $\beta_{\max}$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-137-x	Cesium-137	30.17 y	662, 1175 $\beta_{\max}$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-036-x	Chlorine-36	3.01 x 10 <sup>5</sup> y	1142 $\beta_{\max}$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-060-x	Cobalt-60	5.272 y	1173, 1332 ~300 $\beta_{\max}$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-125-x	Iodine-125 <sup>(1)</sup>	59.43 d	35.5, 27–32 K x-rays $\gamma$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-129-x	Iodine-129	1.57 x 10 <sup>7</sup> y	40, 29–35 K x-rays $\gamma$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-239-x	Plutonium-239 <sup>(4)</sup>	2.411 x 10 <sup>4</sup> y	5105, 5143, 5156 $\alpha$	Electroplated onto Stainless Steel	None
EAB-210-x	Polonium-210 <sup>(2)</sup>	138.376 d	5304 $\alpha$	Electroless Deposit onto Silver Substrate	None
EAB-147-x	Promethium-147	2.6234 y	225 $\beta$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-131-x	Simulated Iodine-131	~5 y	356, 662 $\gamma$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-090-x	Strontium 90/Yttrium-90 <sup>(3)</sup>	28.5 y	Sr-90:546 $\beta$ , Y-90:2282	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-099-x	Technetium-99 <sup>(4)</sup>	2.13 x 10 <sup>5</sup> y	294 $\beta$	Electroplated onto Stainless Steel	None
EAB-204-x	Thallium-204	3.78 y	763 $\beta$	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-230-x	Thorium-230 <sup>(4)</sup>	7.54 x 10 <sup>4</sup> y	4621, 4688 $\alpha$	Electroplated onto Stainless Steel	None
EAB-235-x	Uranium-235 (beta from Pa-231) <sup>(2)</sup>	7.037 x 10 <sup>8</sup> y	4215–4597 $\alpha$	Electroplated onto Aluminum Substrate	100 $\mu$ g/cm <sup>2</sup> Acrylic
EAB-238-x	Uranium-238 (Natural) <sup>(2)</sup>	4.468 x 10 <sup>9</sup> y	4147, 4196 (beta from Pa-234) $\alpha$	Electroplated onto Aluminum Substrate	100 $\mu$ g/cm <sup>2</sup> Acrylic

1) See note on page 45 regarding I-125 sources.

2) 100  $\mu$ g/cm<sup>2</sup> acrylic cover available upon request.

3) See note on page 41 regarding Sr-90/Y-90 sources.

4) 100  $\mu$ g/cm<sup>2</sup> gold cover available upon request.

# Planar Calibration Standards

## Planchet—EAB-PL-FP

Filter paper standards are designed to simulate surface smears and thus establish efficiencies for smear samples of similar construction. Since alpha and beta particles are easily attenuated by the filter paper, the actual surface emission may not appear to relate to the contained activity. Therefore, efficiencies derived with such standards have a large uncertainty caused by the inherent absorption. Filter paper standards are most useful in establishing action levels for smear samples. The calibration certificate provides both the contained activity and the surface emission rate of the standard.

Beta standards are covered with 0.9 mg/cm<sup>2</sup> aluminized Mylar. Alpha standards are covered with 100 - 200 µg/cm<sup>2</sup> of acrylic. In addition to the mounts described above, the active filter paper can be mounted in any of the EAB-LB or EAB-PL configurations.

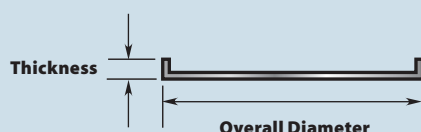


Overall Dimensions		
Overall Diameter	Active Diameter	Height
2.0"	1.77"	0.125"
50.8 mm	45 mm	3.18 mm

Activities & Exceptions	
Available Activities	
5 nCi-100 nCi (185 Bq-3.7 kBq)	
Exceptions	
Cl-36	1 nCi-1.6 µCi (37 Bq-59.2 kBq)
U-235	1 nCi-25 nCi (37 Bq-925 Bq)
U-238	1 nCi-5 nCi (37.5 Bq-185 Bq)
U-238D	1 nCi-2 nCi (37 Bq-74 Bq)

Figure 58-A: PL-FP Style

A1410



## Planar Calibration Standards—PL-FP Style

Catalog Number	Nuclide	Half-Life	Principle Emissions (keV)	Nature of Active Material	Window
EAB-241-PL-FP	Americium-241	432.17 y	5388, 5443, 5486 α	Deposited onto Filter Paper	100 µg/cm <sup>2</sup> Acrylic
EAB-014-PL-FP	Carbon-14	5730 y	156 β <sub>max</sub>	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-137-PL-FP	Cesium-137	30.17 y	662, 1175 β <sub>max</sub>	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-036-PL-FP	Chlorine-36	3.01 x 10 <sup>5</sup> y	1142 β <sub>max</sub>	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-060-PL-FP	Cobalt-60	5.272 y	1173, 1332 ~300 β <sub>max</sub>	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-125-PL-FP	Iodine-125 <sup>(1)</sup>	59.43 d	35.5, 27-32 K x-rays γ	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-129-PL-FP	Iodine-129	1.57 x 10 <sup>7</sup> y	40, 29-35 K x-rays γ	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-239-PL-FP	Plutonium-239	2.411 x 10 <sup>4</sup> y	5105, 5143, 5156 α	Deposited onto Filter Paper	100 µg/cm <sup>2</sup> Acrylic
EAB-210-PL-FP	Polonium-210 (NIST, contained activity only)	138.376 d	5304 α	Deposited onto Filter Paper	100 µg/cm <sup>2</sup> Acrylic
EAB-147-PL-FP	Promethium-147	2.6234 y	225 β	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-131-PL-FP	Simulated Iodine-131	~5 y	356, 662 γ	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-090-PL-FP	Strontium 90/Yttrium-90 <sup>(2)</sup>	28.5 y	Sr-90:546 β, Y-90:2282	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-099-PL-FP	Technetium-99	2.13 x 10 <sup>5</sup> y	294 β	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-204-PL-FP	Thallium-204	3.78 y	763 β	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-230-PL-FP	Thorium-230	7.54 x 10 <sup>4</sup> y	4621, 4688 α	Deposited onto Filter Paper	100 µg/cm <sup>2</sup> Acrylic
EAB-235-PL-FP	Uranium-235 (beta from Pa-231)	7.037 x 10 <sup>8</sup> y	4215-4597 α	Deposited onto Filter Paper	100 µg/cm <sup>2</sup> Acrylic
EAB-238-PL-FP	Uranium-238 (Natural)	4.468 x 10 <sup>9</sup> y	4147, 4196 (beta from Pa-234) α	Deposited onto Filter Paper	100 µg/cm <sup>2</sup> Acrylic

1) See note on page 45 regarding I-125 sources.

2) See note on page 41 regarding Sr-90/Y-90 sources.

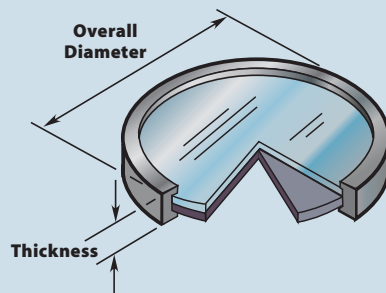
## Ring and Disk—EAB-LB-FP

The stainless steel disk containing the active element is surrounded by an aluminum ring which holds the window assembly in place.



**Figure 59-A: LB-FP Configuration**

**A1402**



### Overall Dimensions

X	Overall Diameter	Active Diameter	Height
47LB-FP	1.85" (47 mm)	1.61" (41 mm)	0.125" (3.18 mm)
50LB-FP	2.0" (50.8 mm)	1.77" (45 mm)	0.125" (3.18 mm)

### Activities & Exceptions

#### Available Activities

5 nCi-100 nCi (185 Bq-3.7 kBq)

#### Exceptions

Cl-36	1 nCi-1.6 $\mu$ Ci (37 Bq-59.2 kBq)
U-235	1 nCi-25 nCi (37 Bq-925 Bq)
U-238: 47LB	1 nCi-4 nCi (37 Bq-148 Bq)
U-238: 50LB	1 nCi-4 nCi (37 Bq-148 Bq)
U-238D	1 nCi-2 nCi (37 Bq-74 Bq)

### Planar Calibration Standards—LB-FP Configuration

Catalog Number	Nuclide	Half-Life	Principle Emissions (keV)	Nature of Active Material	Window
EAB-241-x-FP	Americium-241	432.17 y	5388, 5443, 5486 $\alpha$	Deposited onto Filter Paper	100 $\mu$ g/cm <sup>2</sup> Acrylic
EAB-014-x-FP	Carbon-14	5730 y	156 $\beta_{\max}$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-137-x-FP	Cesium-137	30.17 y	662, 1175 $\beta_{\max}$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-036-x-FP	Chlorine-36	3.01 x 10 <sup>5</sup> y	1142 $\beta_{\max}$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-060-x-FP	Cobalt-60	5.272 y	1173, 1332 ~300 $\beta_{\max}$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-125-PL-FP	Iodine-125 <sup>(1)</sup>	59.43 d	35.5, 27-32 K x-rays $\gamma$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-129-x-FP	Iodine-129	1.57 x 10 <sup>7</sup> y	40, 29-35 K x-rays $\gamma$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-239-x-FP	Plutonium-239	2.411 x 10 <sup>4</sup> y	5105, 5143, 5156 $\alpha$	Deposited onto Filter Paper	100 $\mu$ g/cm <sup>2</sup> Acrylic
EAB-210-x-FP	Polonium-210 (NIST, contained activity only)	138.376 d	5304 $\alpha$	Deposited onto Filter Paper	100 $\mu$ g/cm <sup>2</sup> Acrylic
EAB-147-x-FP	Promethium-147	2.6234 y	225 $\beta$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-131-x-FP	Simulated Iodine-131	~5 y	356, 662 $\gamma$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-090-x-FP	Strontium 90/Yttrium-90 <sup>(2)</sup>	28.5 y	Sr-90:546 $\beta$ , Y-90:2282	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-099-x-FP	Technetium-99	2.13 x 10 <sup>5</sup> y	294 $\beta$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-204-x-FP	Thallium-204	3.78 y	763 $\beta$	Deposited onto Filter Paper	0.9 mg/cm <sup>2</sup> Aluminized Mylar
EAB-230-x-FP	Thorium-230	7.54 x 10 <sup>4</sup> y	4621, 4688 $\alpha$	Deposited onto Filter Paper	100 $\mu$ g/cm <sup>2</sup> Acrylic
EAB-235-x-FP	Uranium-235 (beta from Pa-231)	7.037 x 10 <sup>8</sup> y	4215-4597 $\alpha$	Deposited onto Filter Paper	100 $\mu$ g/cm <sup>2</sup> Acrylic
EAB-238-x-FP	Uranium-238 (Natural)	4.468 x 10 <sup>9</sup> y	4147, 4196 (beta from Pa-234) $\alpha$	Deposited onto Filter Paper	100 $\mu$ g/cm <sup>2</sup> Acrylic

# Planar Calibration Standards

## Large Area Standards—LDS Sources

The Large Area Standards (LDS Series) are intended for the calibration of large area survey probes currently used for area and personnel monitoring.

A comprehensive range of alpha and beta energies is listed in the tables on pages 76–77. Requirements for other nuclides, activity levels and larger geometries can be accommodated upon request.

Active elements are prepared by electroplating or by evaporative deposition. Available activity levels for each nuclide are listed in the tables on pages 61–65.

Sources may be supplied with aluminum or Mylar windows or as uncovered sources depending on the nature of the active deposit and the emitted energy.

Electroplated standards are supplied on an aluminum or stainless steel backing plate. Deposited standards employing Mylar covers are supplied with a plastic backing plate. All standards are supplied in plastic storage boxes.

### Two Standard Sizes are Available

**Model 1620:** 3.94" x 3.94"  
(100 mm x 100 mm) active area

**Model 1621:** 3.94" x 5.91"  
(100 mm x 150 mm) active area

### Calibration

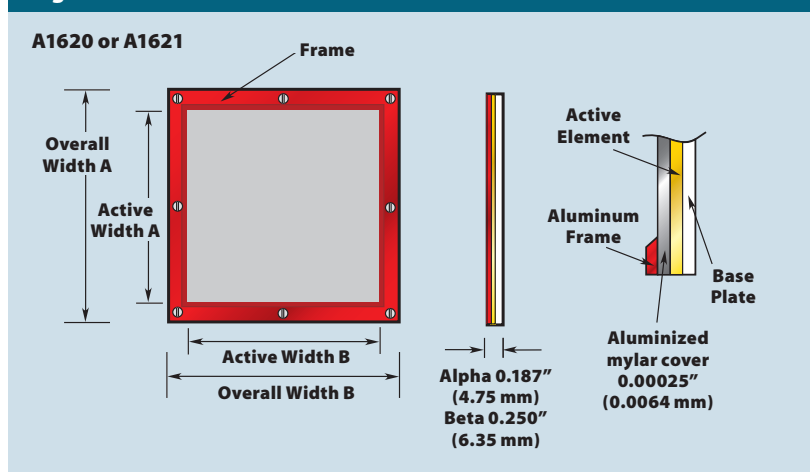
The contained activity is certified in nanocuries or microcuries and becquerels or kilobecquerels and is NIST traceable  $\pm 5\%$ .

The surface emission rate in  $2\pi$  is given on the certificate and is NIST traceable for most nuclides.

## Standard Sets for Specialized Applications

Decade Standard Sets (LDS-300) are designed to routinely check the tracking of G.M. and proportional counters from scale to scale. They may be supplied as an alpha, low energy beta, or high energy beta/gamma set. Each set is supplied as 3 standards with activities at 1,000 dpm, 10,000 dpm and 100,000 dpm (16.7 Bq, 166.7 Bq and 1.67 kBq). Each source is NIST traceable  $\pm 5\%$  on contained activity.

**Figure 60-A: LDS Planar Standard**



Overall Dimensions				
Model	Overall Width "A"	Active Width "A"	Overall Width "B"	Active Width "B"
LDS-XXX-100 mm	4.75" (121 mm)	3.94" (100 mm)	4.75" (121 mm)	3.94" (100 mm)
LDS-XXX-150 mm	4.75" (121 mm)	3.94" (100 mm)	6.73" (171 mm)	5.91" (150 mm)

<b>Americium-241</b>						
Half-Life: <b>432.17 y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>5388, 5443, 5486</b>			Other Significant Radiations: <b>Gamma</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-241-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-30% of Nominal Activity.
LDS-241-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	

<b>Carbon-14</b>						
Half-Life: <b>5730 y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>156</b>			Other Significant Radiations: <b>None</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-014-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-15% of Nominal Activity.
LDS-014-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	

<b>Cesium-137</b>						
Half-Life: <b>432.17 y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>5388, 5443, 5486</b>			Other Significant Radiations: <b>Gamma</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-137-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5nCi-100 nCi 185 Bq-3.7 kBq	+/-15% of Nominal Activity.
LDS-137-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	

<b>Chlorine-36</b>						
Half-Life: <b>3.01 x 10<sup>5</sup> y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>1142</b>			Other Significant Radiations: <b>None</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-036-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-15% of Nominal Activity.
LDS-036-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	

<b>Cobalt-60</b>						
Half-Life: <b>5.272 y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>~300 keV</b>			Other Significant Radiations: <b>Gamma</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-060-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-15% of Nominal Activity.
LDS-060-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	



# Planar Calibration Standards

## Iodine-129

Half-Life: **1.57 x 10<sup>7</sup> y**

**E<sub>MAX</sub> b (keV) or E<sub>a</sub>(keV): 154**

Other Significant Radiations: **None**

Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-129-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	Simulates I-125. Refer to note on page 45 regarding "Simulated I-125" standards.
LDS-129-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	

## Plutonium-238

Half-Life: **87.74 y**

**E<sub>MAX</sub> b (keV) or E<sub>a</sub>(keV): 5456, 5499**

Other Significant Radiations: **None**

Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-238-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	+/- 30% of Nominal Activity.
LDS-238-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	

## Plutonium-239

Half-Life: **2.411 x 10<sup>4</sup> y**

**E<sub>MAX</sub> b (keV) or E<sub>a</sub>(keV): 5105, 5143, 5156**

Other Significant Radiations: **None**

Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-239-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	+/- 30% of Nominal Activity.
LDS-239-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	



<b>Promethium-147</b>						
Half-Life: <b>2.6234 y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>225</b>			Other Significant Radiations: <b>None</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-147-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-15% of Nominal Activity.
LDS-147-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	

<b>Silicon-32 / Phosphorus-32</b>						
Half-Life: <b>104 y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>225, 1710</b>			Other Significant Radiations: <b>None</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-032-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.002" Aluminum Window	5 nCi-100 nCi 185 Bq-3.7 kBq	This long-lived P-32 standard is the beta emitting P-32 daughter of the long-lived Si-32 parent. The standard mounting for this source includes a 0.002" (0.051 mm) Al window. This window will absorb more than 60% of the Si-32 225 keV betas and less than 5% of the P-32 betas. Standards are prepared with the P-32 in equilibrium with the parent Si-32.  +/-15% of Nominal Activity.
LDS-032-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.002" Aluminum Window	5 nCi-100 nCi 185 Bq-3.7 kBq	

<b>Strontium-90 / Yttrium-90</b>						
Half-Life: <b>28.5 y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>546, 2282</b>			Other Significant Radiations: <b>None</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-090-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	Refer to note on page 41 regarding Sr-90 sources.
LDS-090-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-15% of Nominal Activity.

<b>Technetium -99</b>						
Half-Life: <b>2.13 x 10<sup>5</sup> y</b>		$E_{MAX}$ b (keV) or $E_a$ (keV): <b>294</b>			Other Significant Radiations: <b>None</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-099-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-30% of
LDS-099-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	Nominal Activity.

# Planar Calibration Standards

<b>Thallium -204</b>						
Half-Life: <b>3.78 y</b>		$E_{MAX}$ $\beta$ (keV) or $E_a$ (keV): <b>763</b>			Other Significant Radiations: <b>None</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-204-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-15% of Nominal Activity.
LDS-204-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Deposited onto Polymeric Membrane	0.9 mg/cm <sup>2</sup> Aluminized Mylar	5 nCi-100 nCi 185 Bq-3.7 kBq	

<b>Thorium-230</b>						
Half-Life: <b>7.54 x 10<sup>4</sup> y</b>		$E_{MAX}$ $\beta$ (keV) or $E_a$ (keV): <b>4621, 4688</b>			Other Significant Radiations: <b>None</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-230-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	+/-30% of Nominal Activity.
LDS-230-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Electroplated onto Stainless Steel	None	5 nCi-100 nCi 185 Bq-3.7 kBq	



<b>Uranium-235</b>						
Half-Life: <b>7.037 x 10<sup>8</sup> y</b>		<b>E<sub>MAX</sub> b (keV) or Ea(keV): 4215-4597</b>			Other Significant Radiations: <b>Gamma</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-235-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Electroplated onto Aluminum	None	5 nCi-200 nCi 185 Bq-7.4 kBq	+/-30% of Nominal Activity.
LDS-235-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Electroplated onto Aluminum	None	5 nCi-200 nCi 185 Bq-7.4 kBq	

<b>Uranium-238</b>						
Half-Life: <b>4.468 x 10<sup>9</sup> y</b>		<b>E<sub>MAX</sub> b (keV) or Ea(keV): 4147, 4196</b>			Other Significant Radiations: <b>Gamma</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-238U-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Electroplated onto Aluminum	None	5 nCi-30 nCi 185 Bq-1.11 kBq	+/-30% of Nominal Activity.
LDS-238U-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Electroplated onto Aluminum	None	5 nCi-30 nCi 185 Bq-1.11 kBq	

<b>Uranium-238D</b>						
Half-Life: <b>4.468 x 10<sup>9</sup> y</b>		<b>E<sub>MAX</sub> b (keV) or Ea(keV): 4147, 4196</b>			Other Significant Radiations: <b>Gamma</b>	
Catalog Number	Overall Dimensions	Active Dimensions	Nature of Active Material	Window	Available Activities	Additional Information
LDS-238D-100 mm	4.75" x 4.75" 121 mm x 121 mm	3.94" X 3.94" 100 mm x 100 mm	Electroplated onto Aluminum	None	5 nCi-15 nCi 185 Bq-555 Bq	+/-30% of Nominal Activity.
LDS-238D-150 mm	4.75" x 6.725" 121 mm x 171 mm	3.94" x 5.91" 100 mm x 150 mm	Electroplated onto Aluminum	None	5 nCi-15 nCi 185 Bq-555 Bq	

