UNCOMPROMISING **QUALITY**

The standard in dosimetry measurements for over 40 years.

EXRADIN DETECTORS

A Global **Reputation for Excellence**

For over 40 years top research institutes and standards laboratories world-wide have used Exradin Detectors for a broad range of dosimetry measurements in diverse radiation environments.

The Exradin line continues to build upon vetted ion chambers like the Exradin A12 and Exradin A5 with advanced microionization chambers. Our passion for metrology, expertise in engineering and dedication to durability ensures that each detector we produce embodies this tradition of quality workmanship and exacting precision.

The Exradin Advantage

Better Components

- Waterproof construction eliminates the need for sleeves or protective coatings.
- Robust materials are more durable than typical chambers (i.e. PMMA thimble tips), and therefore are more suitable for routine measurements.
- Excellent inherent conductivity negates the need for coatings found in other chambers, which can flake off and require careful handling.
- Collector, guard and shell are made of conductive material developed by Dr. Francis Shonka, the creator of A150 tissue-equivalent, C552 air-equivalent and D400 polystyrene-equivalent plastics.

Unmatched Durability

- An Exradin A12 farmer-type chamber survived three 1 meter drop tests onto a hard floor, in three different orientations, without a change in calibration.*

Superior Stability

- Advanced guard design creates a consistent collecting volume with uniform electric field lines, providing a stable, repeatable signal.
- Exradin detectors feature some of the quickest settling times of any manufacturer.
- Exceptionally wide guard rings on all parallel plate chambers eliminate perturbation volume effects.

Ideal Design for Improved Accuracy

- The collecting volumes of Exradin ion chambers are defined by the guard, not an insulator, creating a significantly more stable signal than competing detectors.
- Axially symmetric design ensures a uniform isotropic response.
- Collection efficiencies of 99.9% or greater.
- Chamber vents through a flexible tube surrounding the triaxial cable; ideal for use in water or plastic phantoms.

Superior Stability upon Connection

- Ionization currents can be read immediately after electrometer and extension cable transients subside because Exradin ion chambers stabilize immediately after applying a bias voltage and have minimal to no polarity effects.
- Leakage currents for Exradin chambers are nearly negligible; $+/- 10x10^{-15}$ A.

* *"Evaluation of a Water-proof, Homogeneous Farmer-Type Ion Chamber for Orthovoltage and High Energy X-Rays and Electron Beams". V.M. Tello, A. Lawyer, C. Chu, J.A. BenComo and W.F. Hanson, presented at AAPM July 1996*

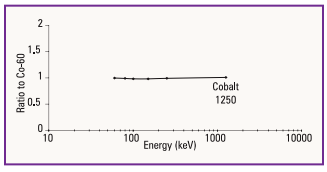
THIMBLE ION CHAMBERS

Strict manufacturing tolerances and waterproof construction make Exradin Thimble Ion Chambers ideal for dosimetry calibrations in water, air and other phantom materials.

EXRADIN A19 ION CHAMBER 0.62 cc

The A19 fits existing plastic phantom cavities and build-up caps, limiting perturbation and minimizing settling time in clinical dosimetry measurements. This chamber is characterized for TG-51 procedures.

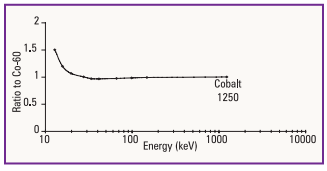
MR COMPATIBLE VERSION AVAILABLE

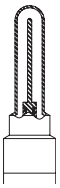


EXRADIN A12 ION CHAMBER 0.64 cc

Characterized in TG-51 and TRS-398, the A12 has fast settling time and a removable stem for superior absolute dosimetry measurements in water, air or phantoms.

MR COMPATIBLE VERSION AVAILABLE

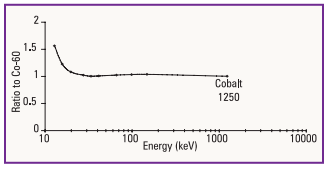


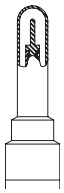


EXRADIN A12S ION CHAMBER 0.24 cc

The A12S is designed for absolute dosimetry calibrations in water, air or phantoms. The collector of the A12S is approximately one-third the size of the A12, allowing for finer resolution measurements.

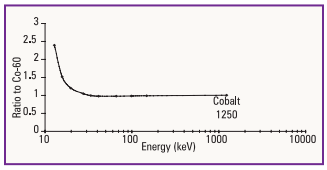
MR COMPATIBLE VERSION AVAILABLE

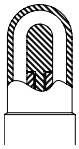




EXRADIN A2 ION CHAMBER 0.53 cc Spokas – *P2, T2 also available*

The A2 is ideal for precise measurement of exposure and air kerma in photon beams and absorbed dose in photon, electron, proton and other beams. This chamber is available in air, polystyrene and tissue equivalent plastic. It is also available in magnesium with gas flow capabilities.

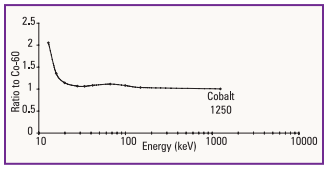




Rigorous one meter drop test proves ruggedness and reliability.

EXRADIN A1SL ION CHAMBER **0.053 cc** Slimline Miniature Shonka

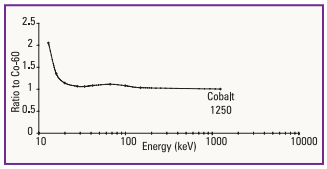
The A1SL, available in air or tissue equivalent plastic, provides a perfect balance between fast scanning and point-dose measurements within 1 cm in water, air or phantom materials. This chamber is characterized for TG-51 procedures.

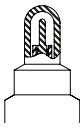


MR COMPATIBLE VERSION AVAILABLE

EXRADIN A1 ION CHAMBER **0.053 cc** Miniature Shonka – *T1 also available*

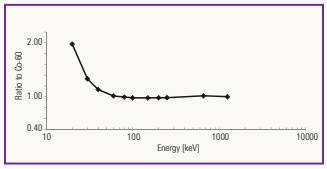
The Exradin A1 has the same internal dimensions and collecting volume as the A1SL, yet the larger diameter is ideal for use in solid phantoms. This chamber is characterized in TG-51 and TRS-398.





EXRADIN A28 ION CHAMBER **0.125 cc** Scanning

The Exradin A28 features exceptional omni-directional spatial resolution for relative dosimetry scanning in water phantoms and use in small field measurements.



MR COMPATIBLE VERSION AVAILABLE

Exradin Thimble Chambers provide a perfect balance between fast scanning and point dose measurements.

MICRO IONCHAMBERS

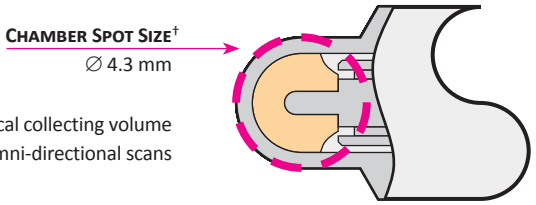
Superior small-field dosimetry to assess pinpoint radiation fields in IMRT, stereotactic, orthovoltage, and superficial skin treatments.

EXRADIN A26 ION CHAMBER 0.015 cc Micropoint

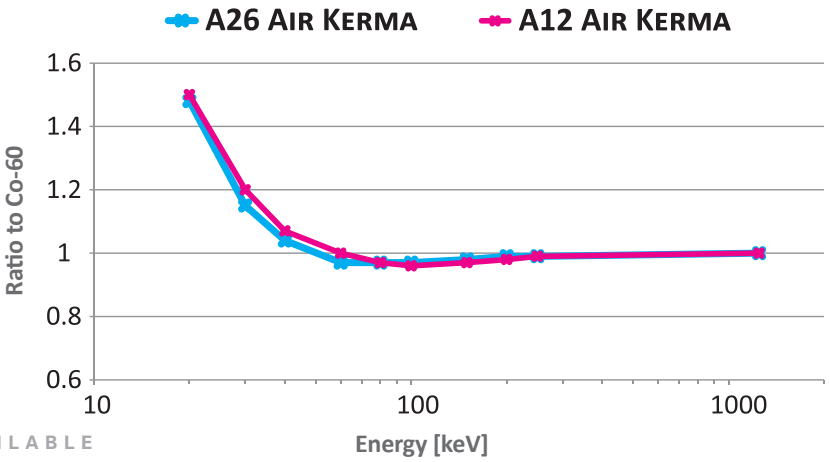
Uniform 4.3 mm diameter spot size reduces volume averaging effects and eliminates angular dependencies of volume averaging.

Experience the same measurement quality in a microchamber you have come to expect from your reference-class chamber.

- Rapid settling
- Stable, reproducible measurements
- Realistic and meaningful ion recombination corrections
- Minimal polarity dependence
- Minimal energy dependence
- The only microchamber that was designed to meet reference class criteria from IEC 60731 and TG-51



ENERGY RESPONSE



MR COMPATIBLE VERSION AVAILABLE

Example Reference Class Criteria*	Reference Class Performance	Exradin A26
P_{leak}: Leakage	< 0.1%	✓
P_{pol}: Polarity	< 0.4% correction	✓
P_{pol}: Polarity	< 0.5% max variation	✓
P_{ion}: ion recombination	Linear with dose per pulse	✓
Initial recombination	Within 0.3% of unity	✓
Polarity dependence of P_{ion}:	< 0.1% between positive and negative bias	✓
Chamber stability	within 0.3% change over 2 years	Chamber is not yet 2 years old

** per TG 51*

Experience the best performance and accuracy with the Exradin A26.

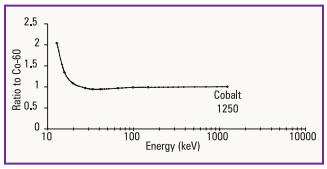
† not minimum field size

EXRADIN A16 ION CHAMBER **0.007 cc** Micropoint

The Model A16 microchamber can measure small field sizes (3.4 mm x 3.4 mm); allowing for exceptional spatial resolution and exact pinpoint beam profile characterization. These attributes make the A16 ideal for stereotactic radiosurgery and IMRT applications.

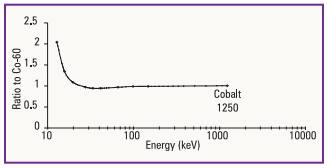
EXRADIN A14SL ION CHAMBERS **0.015 cc** Slimline Microchamber

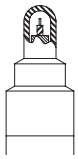
The Model A14SL is capable of measuring extremely small field sizes of 4 mm by 6 mm, allowing for exceptional spatial resolution and exact pinpoint beam profile characterization. This helps assess radiation fields during IMRT and stereotactic radiosurgery.



EXRADIN A14 ION CHAMBERS **0.015 cc** Microchamber – *T14, also available*

The Model A14 microchamber has the exact internal dimensions and collecting volume as the Model A14SL, yet a larger diameter is ideal for use in solid phantoms.





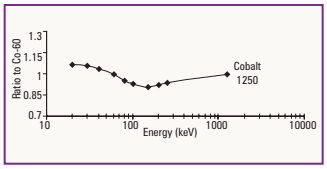
Exradin MicroChambers are ideal for small field size IMRT applications.

PARALLEL PLATE CHAMBERS

Exceptionally wide guard rings ensure precision in depth-dose measurement with no perturbation in field lines.

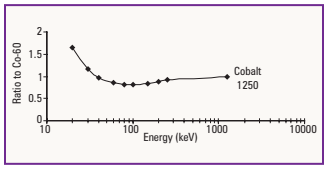
EXRADIN A10 ION CHAMBER 0.050 cc Parallel Plate

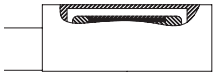
The A10 chamber provides excellent spatial resolution for dose distribution measurements in a water phantom. An acrylic waterproof cap is included with this chamber for use in TG-51 electron beam protocols.



EXRADIN A11 ION CHAMBER 0.62 cc Parallel Plate – *T11, P11 also available*

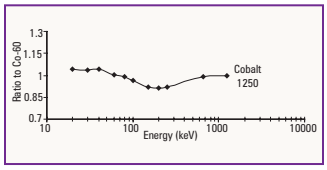
Waterproof A11 chamber may be operated while fully submerged without any protective sheath; ideal for repeated TG-51/TRS-398 dose distribution measurements in a water phantom.

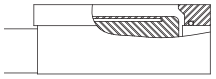




EXRADIN A11TW ION CHAMBER 0.93 cc Thin Window Parallel Plate – *T11TW, P11TW also available*

The A11TW is tailored for use in superficial therapy and low energy diagnostic beams. The thin-window design provides nearly constant response over the entire diagnostic energy range.

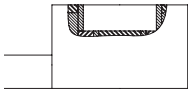




The Exradin P11 Parallel Plate Chamber is characterized for TG-51 and TRS-398.

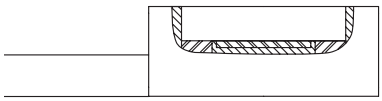
EXRADIN MAGNA A600 ION CHAMBER **1.50 cc** Diagnostic Parallel Plate

The A600 chamber is designed for consistent air kerma, absorbed dose and exposure measurements. Vented and fully-guarded, this chamber is perfectly suited for mammography and general diagnostic x-ray regions.



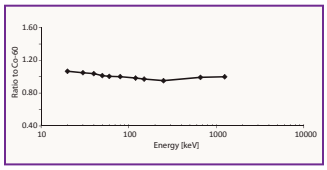
EXRADIN MAGNA A650 ION CHAMBER **3.46 cc** Diagnostic Parallel Plate

The A650 chamber is a vented and fully guarded ion chamber for use in mammography and general diagnostic energy x-ray regions.



EXRADIN A20 ION CHAMBER **0.074 cc** Low Energy X-Ray

The A20 is a low-energy x-ray chamber for assessing and calibrating pinpoint radiation fields for x-rays, stereotactic and TG-61 compliant superficial skin therapy.

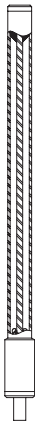


Exceptionally wide guard rings ensure precision in depth-dose measurement with no perturbation in field lines.

CT ION CHAMBERS

Exradin CT Chambers are durable detectors for performing the measurements necessary in the Computed Tomography Dose Index (CTDI) calculations described in TG-74.

EXRADIN A101 ION CHAMBER 4.54 cc



The A101 performs the measurements necessary for calculating the CTDI as described in TG-74. It has excellent response uniformity over the chamber length, with variation less than ±3%.

EXRADIN A17 ION CHAMBER 1.91 cc Slice Therapy

The A17 is tailored for tomotherapy applications such as weekly QA checks or patient dose verification with phantoms and water tanks. It has excellent response uniformity over the chamber length, with variation less than ±1.5%.

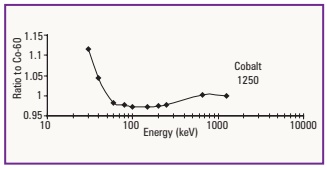
Exradin CT Ion Chambers combine robust design with uniform energy response.

SPHERICAL ION CHAMBERS

Exradin Spherical Ion Chambers are relied upon by standards laboratories worldwide for precise measurement of radiation exposure and exposure rates. They are easily positioned and are excellent for in-air measurements.

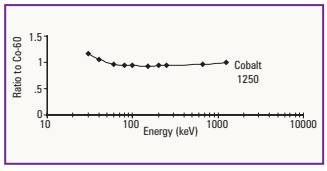
EXRADIN A3 ION CHAMBER **3.6 cc** Shonka-Wyckoff Spherical

3.6cc collecting volume is ideal for laboratory transfer standards and secondary standards for exposure measurements.



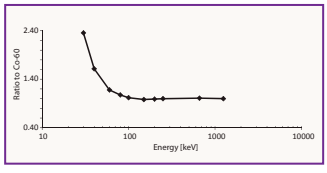
EXRADIN A4 ION CHAMBER **30 cc** Shonka-Wyckoff Spherical

30cc collecting volume is ideal for laboratory transfer standards, secondary standards for exposure measurement and integrating exposure over a large area.



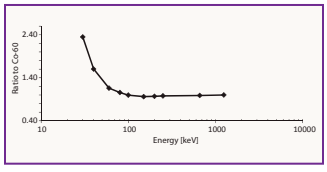
EXRADIN A5 ION CHAMBER **100 cc** Shonka-Wyckoff Spherical

100cc collecting volume is ideal for secondary standards for exposure measurement, integrating exposure over a large area and room scatter measurements.



EXRADIN A6 ION CHAMBER **800 cc** Shonka-Wyckoff Spherical

The 800 cc collecting volume of the Exradin A6 is ideal for exposure measurements, providing secondary standard quality measurements, integrating exposure over a large area such as room scatter measurements.



EXRADIN A8 ION CHAMBER **15.7 liter** Shonka-Wyckoff Spherical

The 15.7 L collecting volume of the Exradin A8 is ideal for extremely low exposure rate measurements, providing secondary standard quality measurements, integrating exposure over a large area such as room scatter measurements.

Spherical Chambers are relied upon by standards laboratories throughout the world.

EXRADIN W1 SCINTILLATOR

The Exradin W1 Scintillator is a near-water equivalent detector that achieves paramount precision by significantly decreasing beam disturbance.

Minimize Beam Perturbation and Corrections

The unprecedented characteristics of the W1 Scintillator closely mimic water, easing data collection by negating many measurement corrections required with other detectors.

- Near water equivalence (within 5% of physical density)
- Linear dose response
- Dose rate independence
- Energy independence within the MV range
- Minimal temperature dependence

SuperMAX Electrometer

Ideal for Measurement and Characterization of Small Fields

1mm spatial resolution makes the W1 a perfect tool for stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT) QA. This includes compatibility with the Lucy 3D QA Phantom and use in the following systems:

- Gamma Knife®
- CyberKnife®
- BrainLab®

Automatically Correct for Cherenkov Effect

Pair the W1 Scintillator with the SuperMAX Electrometer to effectively eliminate Cherenkov effect without the need for extraneous hand calculations.

Consistent, Convenient Setup

Integration with the Exradin Scintillator Calibration Slab and solid water phantoms allows for easy, repeatable measurements.

Unparalleled water-equivalent characteristics.

EXRADIN D1H & D1V DIODES

The Exradin D1V and D1H Diodes maximize spatial resolution and minimize angular dependence, allowing for consistent, accurate small-field stereotactic measurements.

Why use an Exradin Diode?

Exradin diodes produce flatter profiles and sharper resolution with a smaller active measurement area than traditional ion chambers. This allows for the precise measurement of minute fields while still achieving high visibility of the beam's penumbra.

Specialized for Small Fields

The Exradin D1V and D1H Diodes facilitate several measurement modalities in small fields.

- The diode face of the D1V is perpendicular to the beam when upright, making it ideal for photon scanning applications and use in water phantoms.
- The diode face of the D1H is perpendicular to the beam when flat, for use inside traditional plastic phantoms.

Both the D1V and D1H provide superior measurement of field sizes up to 20 x 20 cm^2 with excellent spatial resolution and minimal noise.

Minimize Angular Dependence

A common problem when performing measurements using diode-based detectors is angular dependence or significant variation in signal depending on the orientation of the detector. Exradin diodes help minimize this concern with less than 0.5% angular dependence when tilted up to 20˚ to the beam, providing more confidence in your results when measuring the penumbra or edge of the beam.

Sharper resolution with a smaller active measurement area.

EXRADIN ION CHAMBERS Product Matrix

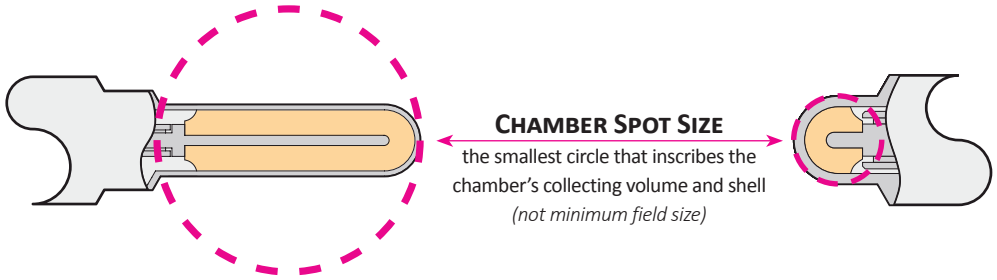
	THIMBLE ION CHAMBERS								MICRO ION CHAMBERS			
MODEL	**1**	**A1SL**	**2**	**A18**	**A28**	**A19**	**A12**	**A12S**	**14**	**A14SL**	**A16**	**A26**
Collecting Volume (cc)	0.053	0.053	0.53	0.123	0.125	0.62	0.64	0.24	0.015	0.015	0.007	0.015
Spot Size (mm)	8.0	8.0	14.0	10.8	8.0	26.2	26.5	13.1	6.4	6.4	3.5	4.3
Centroid of Collecting Volume from exterior tip of shell (mm)	3.86	4.06	6.96	5.26	4.47	13.0	12.9	5.79	2.21	2.39	1.65	1.98
Centroid of Collecting Volume from exterior surface of window (mm)												
Outside Diameter of Shell (mm)	6.0	6.35	11.4	6.9	8	7.1	7.1	7.1	6.0	6.35	3.4	4.3
Inside Diameter of Shell (mm) Collecting Volume Outer Diameter	4.0	4.0	9.5	4.9	5.8	6.1	6.1	6.1	4.0	4.0	2.4	3.3
Window Collector Gap (mm)												
Shell Wall Thickness (mm)	1.0	1.1	1.0	1.0	1.1	0.5	0.5	0.5	1.0	1.1	0.5	0.5
Collector Diameter (mm)	1.0	1.0	4.6	1.0	1.0	1.0	1.0	1.0	0.3	0.3	0.3	0.75
Guard Ring Width (Radial) (mm)												
Collector Length (mm)	4.4	4.4	8.4	6.4	6.4	21.6	21.6	7.5	1.5	1.5	1.27	1.78
Window Material*												
Window Thickness												
MR Compatibility Available		MR			MR	MR	MR	MR				MR
Shell/Entry Window, Collector and Guard Material*	A, T	A	A, T	A	A	A	A	A	SHELL ONLY A	SHELL ONLY A	SHELL ONLY A	A
Nominal Air Kerma Calibration Factor†	5.4E+8 Gy/C	5.4E+8 Gy/C	5.4E+7 Gy/C	2.3E+8 Gy/C	2.3E+8 Gy/C	4.5E+7 Gy/C	4.4E+7 Gy/C	1.2E+8 Gy/C	1.9E+9 Gy/C	1.9E+9 Gy/C	4.1E+9 Gy/C	1.85E+9 Gy/C
Recommended Polarizing Voltage (V)	300	300	300	300	300	300	300	300	300	300	300	300
Nominal Leakage (amp)	$\pm$ 10 x 10^{-15}											
Maximum Polarizing Voltage (V)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Waterproof	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Included Buildup Cap	None	None	None	Co-60	Co-60	Co-60	Co-60	Co-60	None	None	Co-60	Co-60

* ***MATERIAL:*** ***A*** *– C552 Shonka air-equivalent plastic* ***P*** *– D400 polystyrene-equivalent plastic* ***T*** *– A150 Shonka tissue-equivalent plastic* ***K*** – 3.86 mg/cm^2 Kapton

† *Nominal calibration factor for Co-60 at 22° C*

(1) comes included with an acrylic sleeve to adapt chamber to fit Ø0.50 in (12.7 mm) phantom holes

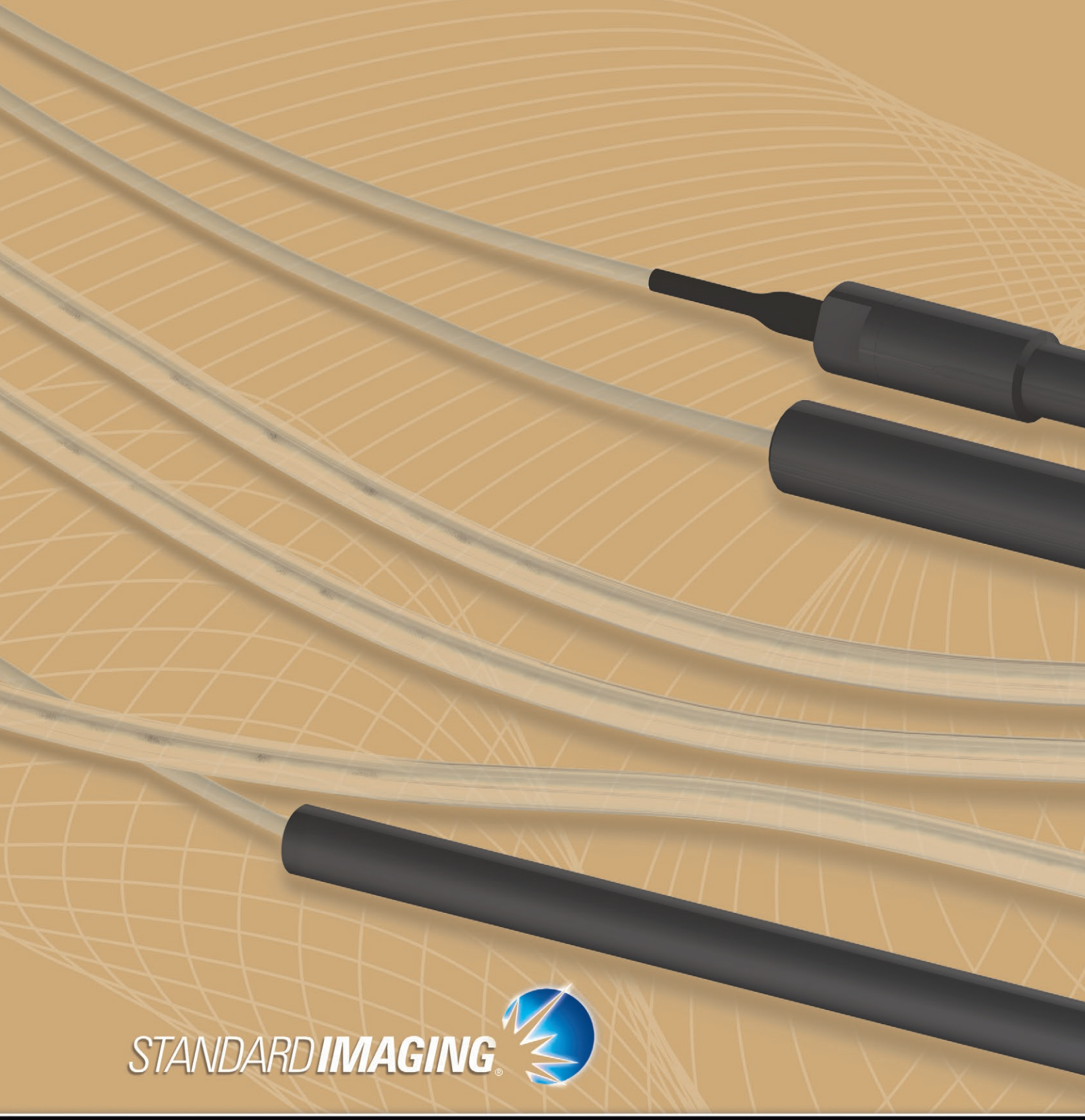
(2) included waterproofing cap is PMMA, 1.0mm entry window, TG-51 compliant



CHAMBER SPOT SIZE
the smallest circle that inscribes the chamber's collecting volume and shell
(not minimum field size)

CT IONCHAMBERS		PARALLEL PLATE ION CHAMBERS						SPHERICAL ION CHAMBERS				
A101	**A17**	**A10**	**11**	**11TW**	**A20**	**Magna A600**	**Magna A650**	**A3**	**A4**	**A5**	**A6**	**A8**
4.54	1.91	0.050	0.62	0.93	0.074	1.50	3.46	3.6	30	100	800	15.7 L
		1.0	2.0	1.5	1.8	4.0	4.0					
10.0	12.7							19.6	39.1	63.1	120.4	323.2
8.0	6.0							19.1	38.1	57.2	114.4	311.2
		2.0	2.0	3.0	5.0	7.95	7.95					
1.0	3.3							0.25	0.5	3.0	3.0	6.0
2.5	2.5	5.4	20.0	20.0	1.93	12.7	21.9	2.1	4.1	6.5	11.6	22.4
		4.3	4.4	4.4	1.2	3.9	7.6					
100	80							13.3	24.9	37.3	74.0	166.7
		K	1.0 mm, A, P, or T	K	2K	K	K					
		0.05 mm	1.0 mm	0.05 mm	0.09 mm	0.05 mm	0.05 mm					
A	A	A	A, P, T	A, P, T	A	A	A	A	A	A	A	A
6.2E+6 Gy/C	1.5E+7 Gy/C	5.6E+8 Gy/C	4.6E+7 Gy/C	3.0E+7 Gy/C	3.8E+8 Gy/C	1.9E+7 Gy/C	8.2E+6 Gy/C	9.0E+8 R/C	1.1E+8 R/C	3.3E+7 R/C	4.2E+6 R/C	2.1E+5 R/C
300	300	300	300	300	300	300	300	300	500	800	1000	1000
$\pm$ 10 x 10^{-15}												
1000	1000	1000	1000	1000	1000	400	400	1000	1000	1000	1000	1000
No	Yes	Yes (2)	Yes	Yes (2)	No	No	No	No	No	No	No	No
None (1)	Co-60 integral	None	None	None	None	None	None	None	None	Co-60 integral	Co-60 integral	Co-60 integral

2K – 7.72 mg/cm^2 Kapton



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www.**standardimaging**.com
800-261-4446 . PH 608-831-0025 . FAX 608-831-2202
3120 Deming Way Middleton WI 53562-1461 USA

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