

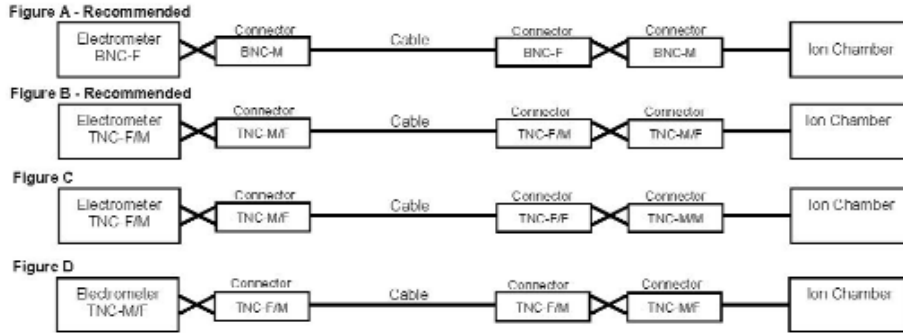
# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## REFERENCE GUIDE FOR ELECTROMETER - CABLE - CHAMBER CONNECTIONS

Capintec Electrometer uses TNC-F/M or BNC-F . . . . . (Figure A or C)  
 Capintec Triax Cable uses TNC-M/F and TNC-F/F . . . . . (Figure C)  
 Capintec Chamber uses TNC-M/M or BNC-M . . . . . (Figure A or C)  
 Wellhofer Electrometer uses TNC-F/M . . . . . (Figure C)  
 Wellhofer Triax Cable uses TNC-M/F and TNC-F/F . . . . . (Figure C)  
 Wellhofer Chamber uses TNC-M/M . . . . . (Figure C)  
 N.E. Electrometer uses TNC-F/M . . . . . (Figure B)  
 N.E. Chambers w/Triax Cable uses TNC-M/F or BNC-M . . . . . (Figure B)  
 Victoreen Electrometer uses TNC-M/F . . . . . (Figure D)

Victoreen Chamber with Triax Cable uses TNC-M/F . . . . . (Figure D)  
 Keithley Electrometer uses BNC-F . . . . . (Figure A)  
 Keithley Chamber with Triax Cable uses BNC-M . . . . . (Figure A)  
 PTW Chamber with 1 Meter Triax Cable uses BNC-M . . . . . (Figure A or B)  
 PTW Chamber with 10 Meters Triax Cable uses BNC-M . . . . . (Figure A)  
 PTW Extensions Triax Cable uses BNC-M and BNC-F . . . . . (Figure A)  
 PTW Electrometer uses M, TNC-F/M or BNC-F . . . . . (Figure A)  
 Standard Imaging Electrometer uses BNC-F . . . . . (Figure A)  
 CNMC Electrometer uses BNC-F . . . . . (Figure A)

### DIAGRAM FOR REFERENCE GUIDE CONNECTIONS



### CONNECTIONS ADAPTERS



Item	Triax Adapters
323-320	Triax BNC-M and Triax TNC-F/M Connectors
323-323	Triax BNC-M and Triax TNC-F/F Connectors
323-324	Triax BNC-F and Triax TNC-M/F Connectors
323-328	Triax BNC-F and Triax BNC-F Connectors
323-329	Triax BNC-M and Triax BNC-M Connectors
323-334	Triax BNC-M and Triax BNC-F Connectors
323-336	Triax PTW Type M-F to Triax BNC-M Connector with 1 Meter Cable

Item	Coax to Triax Adapters
323-339	Coax BNC-M and Triax BNC-F Connectors with 1 Meter Cable
323-340	Coax BNC-F and Triax BNC-M Connectors Diode to Electrometer Connector

Item	Coax Adapters
323-341	Coax BNC-F and BNC-F Connectors
323-342	Coax BNC-F and BNC-F Panel Mount Connectors
323-343	Coax BNC-M and BNC-M Connectors

Item	Custom Connector Adapter
323-350	Custom Adapters - Specify Connectors with 1 Meter Cable between connectors - Specify Length if another length is needed

See Connector Example Page

**Item 323-320** is able to modify the BNC-F Keithley Electrometer to the TNC M/F Capintec, Wellhofer or Nuclear Enterprises Triax Cable.

**Item 323-323** is able to modify the BNC-F Triax Cable to the TNC-F/M Wellhofer, Capintec and Nuclear Enterprises Electrometer.

**Item 323-324** is able to modify the BNC-M Chamber to the TNC-F/M Wellhofer, Capintec and Nuclear Enterprises Electrometer.

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# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## CABLE CONNECTOR REFERENCE



A. Triax BNC Plug  
(M/F) [2-Lug]



B. Triax BNC Jack  
(F/M) [2-Lug]



C. Triax TNC Plug  
(M/F)



D. Triax TNC Jack  
(F/M)



E. Triax TNC Jack  
(M/M)



F. Triax TNC Plug  
(F/F)



G. Coax BNC Plug  
(M/F) [2-Lug]



H. Coax BNC Jack  
(F/M) [2-Lug]



I. Coax SHV Plug  
(F/F) [2-Lug]



J. Coax MHV Plug  
(M/F) [2-Lug]



K. Triax Type M  
(M/M)



L. Triax Type M  
(F/F)



M. Triax BNC Plug  
(M/F) [3-Lug]



N. Banana Plug



O. Banana Jack



P. Triax LEMO Plug  
(F/M)



Q. Triax LEMO Plug  
(M/F)

Naming Standard: Connector Type (Center Pin Gender / Outer Housing Gender).  
Letters are for reference only.

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## CONNECTOR DUST CAPS



The Dust Caps with chains prevent dirt and dust from accumulating in the connectors. Dust and dirt accumulations will cause high leakage currents.

Item	Description
323-360	Male Dust Cap for BNC-F and Female Center Pin
323-361	Female Dust Cap for BNC-M and Male Center Pin
323-362	Male Dust Cap for TNC-F/M or TNC-M/M Connectors
323-363	Female Dust Cap for TNC-M/F or TNC-F/F Connector

## TRIAIX EXTENSION CABLES

The triaxial cable assemblies are made of Microdot flexible white, 3 mm diameter, shielded, low-noise, high impedance, radiation resistant cable, designed to carry the extremely small currents generated by ion chambers without signal degradation.

A standard extension cable has a male connector on one end to mate with the electrometer and a female connector on the other end to mate with the output connector of the ion chamber.

See reference guide and cable connector reference pages to determine correct connectors for triax cables.



For Keithly or PTW

Item	BNC Triax Cable with Dust Caps	Length
323-1303	BNC-F and BNC-M Connectors	33' (10 Meters)
323-1304	BNC-F and BNC-M Connectors	40' (12 Meters)
323-1305	BNC-F and BNC-M Connectors	50' (15 Meters)
323-1306	BNC-F and BNC-M Connectors	60' (18.5 Meters)



For NE America (Nuclear Enterprise)

Item	TNC Triax Cable	Length
323-1313	TNC-M/F and TNC-F/M Connector	33' (10 Meters)
323-1314	TNC-M/F and TNC-F/M Connector	40' (12 Meters)
323-1315	TNC-M/F and TNC-F/M Connector	50' (15 Meters)
323-1316	TNC-M/F and TNC-F/M Connector	60' (18.5 Meters)

Dust Caps Must Be Purchased Separately



For Capintec or Wellhofer

Item	TNC Triax Cable	Length
323-1323	TNC-M/F and TNC-F/F Connector	33' (10 Meters)
323-1324	TNC-M/F and TNC-F/F Connector	40' (12 Meters)
323-1325	TNC-M/F and TNC-F/F Connector	50' (15 Meters)
323-1326	TNC-M/F and TNC-F/F Connector	60' (18.5 Meters)

Dust Caps Must Be Purchased Separately

## CUSTOM TRIAX EXTENSION CABLES

These cables are made to order, no exchanges or refunds are available. When ordering, please specify the following:

- Connection 1 and Connection 2
- Length of the Cable in Meters
- Cable Type - 3mm Diameter White (Standard) or 5.3mm Diameter Suhner Swiss Gray (Heavy Duty)
- Cable on Reel - if Yes, Specify the Connection at the Hub

Item	Description
323-1300	Custom Cable

## COAX EXTENSION CABLES

Item	Description
322-891	32' (10M) Coax Cable, Diode, BNC-F to BNC-M
322-892	49' (15M) Coax Cable, Diode, BNC-F to BNC-M
322-893	65' (20M) Coax Cable, Diode, BNC-F to BNC-M

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# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## TRIAX EXTENSION CABLE ON SMALL REEL

Extended End (Ion Chamber Connection)



Hub End (Electrometer Connection)  
Normally connected to Electrometer  
outside of treatment room.

Cable reel assemblies offer a great convenience in winding and storage of extension cables. A cable reel will extend the life of a cable significantly by eliminating kinks and providing protection during storage. Reel out only as much cable as needed. The extended end is where the cable reels out. The hub end has 18" (45.7 cm) of fixed triax cable. Connector type and location is determined by where the reel will be used, inside or outside of room.

The reel can be purchased without a cable. The small reel can be used with cables 50' (15 meters) or less in length. This reel can not be used for cable lengths greater than 50' (15 meters).

See reference guide and cable connector reference pages to determine correct connectors for triax cable on reel.

Item	Description
323-2400	Small Cable Reel without Cable

For Keithly or PTW  
Connector Ends WILL Mate

Item	BNC Triax Cable Reel w/Dust Caps	Length
323-2402	Hub End - BNC-F Connector Extended End - BNC-M Connector	40' (12 Meters)
323-2403	Hub End - BNC-F Connector Extended End - BNC-M Connector	50' (15 Meters)
323-2412	Hub End - BNC-M Connector Extended End - BNC-F Connector	40' (12 Meters)
323-2413	Hub End - BNC-M Connector Extended End - BNC-F Connector	50' (15 Meters)

For NE America (Nuclear Enterprise) and (New) Wellhofer  
Connector Ends WILL Mate

Item	TNC Triax Cable Reel	Length
323-2424	Hub End - TNC-M/F Connector Extended End - TNC-F/M Connector	40' (12 Meters)
323-2423	Hub End - TNC-M/F Connector Extended End - TNC-F/M Connector	50' (15 Meters)
323-2432	Hub End - TNC-F/M Connector Extended End - TNC-M/F Connector	40' (12 Meters)
323-2433	Hub End - TNC-F/M Connector Extended End - TNC-M/F Connector	50' (15 Meters)

Dust Caps Must Be Purchased Separately

For Capintec and (Old) Wellhofer  
Connector Ends WILL NOT Mate

Item	TNC Triax Cable Reel	Length
323-2444	Hub End - TNC-M/F Connector Extended End - TNC-F/F Connector	40' (12 Meters)
323-2443	Hub End - TNC-M/F Connector Extended End - TNC-F/F Connector	50' (15 Meters)
323-2454	Hub End - TNC-F/F Connector Extended End - TNC-M/F Connector	40' (12 Meters)
323-2453	Hub End - TNC-F/F Connector Extended End - TNC-M/F Connector	50' (15 Meters)

Dust Caps Must Be Purchased Separately

## WALL PLATES FOR TRIAX CABLE CONNECTOR



These wall plates grip a standard BNC or TNC triax cable connector. The wall plates are made to replace a standard single or double electrical wall plate. There is an adjustable collar in the opening that can be tightened to the connector to prevent movement. An allen wrench for the collar adjustment is included with each wall plate.

### Specifications

Material: Stainless Steel

Item	Description
323-380	Wall Plate, Single for Triax Cable Connector
323-381	Wall Plate, Double for Triax Cable Connector

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## TRIAx EXTENSION CABLE ON LARGE REEL

### Hub End (Electrometer Connection)

Normally connected to Electrometer outside of treatment room.



Extended End (Ion Chamber Connection)

Cable reel assemblies offer a great convenience in winding and storage of extension cables. A cable reel will extend the life of a cable significantly by eliminating kinks and providing protection during storage. Reel out only as much cable as needed. The extended end is where the cable reels out. The hub end has 18" (45.7 cm) of fixed triax cable. Connector type and location is determined by where the reel will be used, inside or outside of room.

The reel can be purchased without a cable. The large reel can be used with cables 50' (15 meters) or more in length. This reel can not be used for cable lengths less than 50' (15 meters).

See reference guide and cable connector reference pages to determine correct connectors for triax cable on reel.

Item	Description
323-2401	Large Cable Reel without Cable

### For Keithly or PTW Connector Ends WILL Mate

Item	BNC Triax Cable Reel w/Dust Caps	Length
323-2404	Hub End - BNC-F Connector Extended End - BNC-M Connector	40' (12 Meters)
323-2405	Hub End - BNC-F Connector Extended End - BNC-M Connector	50' (15 Meters)
323-2406	Hub End - BNC-F Connector Extended End - BNC-M Connector	65' (20 Meters)
323-2414	Hub End - BNC-M Connector Extended End - BNC-F Connector	40' (12 Meters)
323-2415	Hub End - BNC-M Connector Extended End - BNC-F Connector	50' (15 Meters)
323-2416	Hub End - BNC-M Connector Extended End - BNC-F Connector	65' (20 Meters)

### For NE America (Nuclear Enterprise) and (New) Wellhofer Connector Ends WILL Mate

Item	TNC Triax Cable Reel	Length
323-2422	Hub End - TNC-M/F Connector Extended End - TNC-F/M Connector	40' (12 Meters)
323-2425	Hub End - TNC-M/F Connector Extended End - TNC-F/M Connector	50' (15 Meters)
323-2426	Hub End - TNC-M/F Connector Extended End - TNC-F/M Connector	65' (20 Meters)
323-2434	Hub End - TNC-F/M Connector Extended End - TNC-M/F Connector	40' (12 Meters)
323-2435	Hub End - TNC-F/M Connector Extended End - TNC-M/F Connector	50' (15 Meters)
323-2436	Hub End - TNC-F/M Connector Extended End - TNC-M/F Connector	65' (20 Meters)

**Dust Caps Must Be Purchased Separately**

### For Capintec and (Old) Wellhofer Connector Ends WILL NOT Mate

Item	TNC Triax Cable Reel	Length
323-2442	Hub End - TNC-M/F Connector Extended End - TNC-F/F Connector	40' (12 Meters)
323-2445	Hub End - TNC-M/F Connector Extended End - TNC-F/F Connector	50' (15 Meters)
323-2446	Hub End - TNC-M/F Connector Extended End - TNC-F/F Connector	65' (20 Meters)
323-2452	Hub End - TNC-F/F Connector Extended End - TNC-M/F Connector	40' (12 Meters)
323-2455	Hub End - TNC-F/F Connector Extended End - TNC-M/F Connector	50' (15 Meters)
323-2456	Hub End - TNC-F/F Connector Extended End - TNC-M/F Connector	65' (20 Meters)

**Dust Caps Must Be Purchased Separately**

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# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## PTW FARMER® IONIZATION CHAMBERS

Thimble chambers for measuring high-energy photon and electron radiation in air or in phantom material



- Fully guarded chamber
- Vented sensitive volumes of 0.6 cm<sup>3</sup>
- Suitable as therapy chambers for use in solid phantoms
- Flat energy response
- Correction factors needed to determine absorbed dose to water or air kerma are published in the pertinent dosimetry protocols
- The chambers are designed for the use in solid state phantoms and are not waterproof

The 0.6 cm<sup>3</sup> PTW Farmer chambers are designed for absolute photon and electron dosimetry with therapy dosimeters. Three chamber types for measurements in air or in solid state phantom material are available.

**Item 300-640:** The 30010 is a Classical therapy chamber. The 30010 Farmer chamber is a wide spread ionization chamber for absolute dose measurements in radiation therapy. The acrylic chamber wall ensures the ruggedness of the chamber. The wall material is graphite with a protective acrylic cover, and the electrode is made of Al. The nominal photon energy range is from 30 kV to 50 MV.

**Item 300-645:** The 30011 is a pure graphite therapy chamber. The 30011 all graphite Farmer chamber is used for absolute dose measurements in radiation therapy in cases where a minimum of different materials in the radiation field is desired. Due to the sole use of graphite the energy response of the chamber at energies below <sup>60</sup>Co varies stronger than that of chambers with an aluminum electrode. The 30011 is used for therapy dosimetry, where a completely graphite-built chamber is required. The nominal photon energy range is from 140 kV to 50 MV.

**Item 300-650:** The 30012 is a Farmer chamber with graphite wall. The 30012 Farmer chamber is intended for absolute dose measurements in radiation therapy. The graphite wall makes the chamber almost water-equivalent, the aluminum central electrode improves the energy response at energies below <sup>60</sup>Co. used for therapy dosimetry. The 30012 is used where a chamber with graphite wall and Al electrode is required. The nominal photon energy range is from 60 kV to 50 MV.

The electron energy range of all chambers is from 10 MeV to 45 MeV. The chambers type 30011 and 30012 with their graphite caps are of delicate construction and should be handled with extreme care. The guard rings of all chamber types are designed up to the measuring volume. An acrylic build-up cap for in-air measurement in <sup>60</sup>Co beams is included with each chamber, as well as a calibration certificate.

Item	Description
300-640	PTW 30010, 0.6cc Farmer® Chamber
300-645	PTW 30011, 0.6cc Graphite Farmer® Chamber
300-650	PTW 30012, 0.6cc C/A1 Farmer® Chamber

Specify Connection

## WATERPROOF PTW FARMER® IONIZATION CHAMBER

Waterproof therapy chamber for absolute dosimetry in high-energy photon, electron and proton beams



- Waterproof, fully guarded chamber
- Vented sensitive volumes of 0.6 cm<sup>3</sup>
- Suitable as therapy chamber for use in water
- Flat energy response
- Correction factors needed to determine absorbed dose to water or air kerma are published in the pertinent dosimetry protocols

- The chamber is waterproof and can be used in water or solid state phantoms

**Item 300-655** has a nominal photon energy range from 30 kV to 50 MV, the electron energy range is from 10 MeV to 45 MeV. This chamber type is of rugged construction, since the wall material is graphite with a protective acrylic cover and the electrode is made of aluminum. The guard ring is designed up to the measuring volume. A calibration certificate for calibration in absorbed dose to water or air kerma is included with each chamber. Air density correction is required for each measurement

Item	Description
300-655	PTW 30013, 0.6cc Waterproof Farmer® Chamber

Specify Connection

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## PTW FARMER® IONIZATION CHAMBERS

Specifications	Item 300-640	Item 300-645	Item 300-650	Item 300-655 (Waterproof)
<b>PTW Model</b>	30010	30011	30012	30013
<b>Type of Product</b>	vented cylindrical ionization chamber acc. IEC 60731	vented cylindrical ionization chamber acc. IEC 60731	vented cylindrical ionization chamber acc. IEC 60731	vented cylindrical ionization chamber acc. IEC 60731
<b>Application</b>	absolute dosimetry in radiotherapy beams	absolute therapy dosimetry in solid state phantoms and air	absolute therapy dosimetry in solid state phantoms and air	absolute therapy dosimetry in water,
<b>Measuring Quantities</b>	absorbed dose to water, air kerma, exposure	absorbed dose to water, air kerma, exposure	absorbed dose to water, air kerma, exposure	absorbed dose to water, air kerma, exposure
<b>Reference Radiation Quality</b>	<sup>60</sup> Co	<sup>60</sup> Co	<sup>60</sup> Co	<sup>60</sup> Co
<b>Nominal Sensitive Volume</b>	0.6 cm <sup>3</sup>	0.6 cm <sup>3</sup>	0.6 cm <sup>3</sup>	0.6 cm <sup>3</sup>
<b>Design</b>	NOT waterproof, vented fully guarded	NOT waterproof, vented fully guarded	NOT waterproof, vented fully guarded	Waterproof, vented fully guarded
<b>Reference Point</b>	on chamber axis, 13mm from tip	on chamber axis, 13mm from tip	on chamber axis, 13mm from tip	on chamber axis, 13mm from tip
<b>Direction of Incidence</b>	radial	radial	radial	radial
<b>Nominal Response</b>	20 nC/Gy	20 nC/Gy	20 nC/Gy	20 nC/Gy
<b>Long-term Stability</b>	≤ 0.5 % per year	≤ 0.5 % per year	≤ 0.5 % per year	≤ 0.5 % per year
<b>Chamber Voltage</b>	400 V nominal ± 500 V maximal	400 V nominal ± 500 V maximal	400 V nominal ± 500 V maximal	400 V nominal ± 500 V maximal
<b>Polarity Effect at <sup>60</sup>Co</b>	< 0.5%	< 0.5%	< 0.5%	< 0.5%
<b>Photon Energy Response</b>	≤ ± 2% (70 kV to 280 kV) ≤ ± 4% (200 kV to <sup>60</sup> Co)	≤ ± 2% (70 kV to 280 kV) ≤ ± 4% (200 kV to <sup>60</sup> Co)	≤ ± 2% (70 kV to 280 kV) ≤ ± 4% (200 kV to <sup>60</sup> Co)	≤ ± 2% (70 kV to 280 kV) ≤ ± 4% (200 kV to <sup>60</sup> Co)
<b>Directional Response in Solid State Phantom</b>	≤ ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 5°	≤ ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 5°	≤ ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 5°	≤ ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 5°
<b>Directional Response in Water</b>				≤ ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 5°
<b>Leakage Current</b>	≤ ± 4 fA	≤ ± 4 fA	≤ ± 4 fA	≤ ± 4 fA
<b>Cable Leakage</b>	≤ 1 pC/(Gy·cm)	≤ 1 pC/(Gy·cm)	≤ 1 pC/(Gy·cm)	≤ 1 pC/(Gy·cm)
<b>Materials and Measures</b>				
<b>Wall of Sensitive Volume</b>	0.335 mm PMMA, 1.19 g/cm <sup>3</sup> 0.09 mm graphite, 1.85 g/cm <sup>3</sup>	0.425 mm graphite, 1.85 g/cm <sup>3</sup>	0.425 mm graphite, 1.85 g/cm <sup>3</sup>	0.335 mm PMMA, 1.19 g/cm <sup>3</sup> 0.09 mm graphite, 1.85 g/cm <sup>3</sup>
<b>Total Wall Area Density</b>	56.5 mg/cm <sup>2</sup>	79 mg/cm <sup>2</sup>	79 mg/cm <sup>2</sup>	56.5 mg/cm <sup>2</sup>
<b>Dimension of Sensitive Volume</b>	radius 3.05 mm length 23.0 mm	radius 3.05 mm length 23.0 mm	radius 3.05 mm length 23.0 mm	radius 3.05 mm length 23.0 mm
<b>Central Electrode</b>	Al 99.98, diameter 1.1 mm	Graphite, diameter 1.0 mm	Al 99.98, diameter 1.1 mm	Al 99.98, diameter 1.1 mm
<b>Build-up Cap</b>	PMMA, thickness 4.55 mm	PMMA, thickness 4.55 mm	PMMA, thickness 4.55 mm	PMMA, thickness 4.55 mm
<b>Ion Collection Efficiency at Nominal Voltage</b>				
<b>Ion collection time</b>	140µs	140µs	140µs	140µs
<b>Max. dose rate for &gt; 99.5 % saturation</b>	5 Gy/s	5 Gy/s	5 Gy/s	5 Gy/s
<b>&gt; 99.0 % saturation</b>	10 Gy/s	10 Gy/s	10 Gy/s	10 Gy/s
<b>Useful ranges</b>				
<b>Chamber voltage</b>	± 100 to 400 V	± 100 to 400 V	± 100 to 400 V	
<b>Radiation quality</b>	30 kV to 50 MV photons (10 to 45) MeV electrons (50 to 270) MeV protons	140 kV to 50 MV photons (10 to 45) MeV electrons (50 to 270) MeV protons	60 kV to 50 MV photons (10 to 45) MeV electrons (50 to 270) MeV protons	30 kV to 50 MV photons (10 to 45) MeV electrons (50 to 270) MeV protons
<b>Field size</b>	(5 x 5) cm <sup>2</sup> to (40 x 40) cm <sup>2</sup>	(5 x 5) cm <sup>2</sup> to (40 x 40) cm <sup>2</sup>	(5 x 5) cm <sup>2</sup> to (40 x 40) cm <sup>2</sup>	(5 x 5) cm <sup>2</sup> to (40 x 40) cm <sup>2</sup>
<b>Temperature</b>	50°-104°F (10°-40°C)	50°-104°F (10°-40°C)	50°-104°F (10°-40°C)	50°-104°F (10°-40°C)
<b>Humidity</b>	10 - 80%, max 20 g/m <sup>3</sup>	10 - 80%, max 20 g/m <sup>3</sup>	10 - 80%, max 20 g/m <sup>3</sup>	10 - 80%, max 20 g/m <sup>3</sup>
<b>Air pressure</b>	700 - 1060 hPa	700 - 1060 hPa	700 - 1060 hPa	700 - 1060 hPa

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# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## PTW SEMIFLEX® IONIZATION CHAMBERS

Waterproof thimble chambers for measuring high-energy photon and electron radiation



- Vented sensitive volumes of 0.125 cm<sup>3</sup> and 0.3 cm<sup>3</sup>
- Suitable for use in water phantoms
- Flat energy response within a wide energy range

The semiflex chambers are designed for therapy dosimetry, mainly for dose distribution measurements in motorized water phantoms. They have a short stem for mounting and a flexible connection cable. The nominal useful energy range is from 30 kV to 50 MV photons and 6 MeV to 50 MeV electrons. The wall material is graphite with a protective acrylic cover. The guard rings are designed up to the measuring volume. An acrylic build-up cap for inair measurement in <sup>60</sup>Co beams is included with each chamber, as well as a calibration certificate for calibration in absorbed dose to water or in air kerma. Air density correction is required for each measurement. Both chambers are shaped cylindrically with an inner diameter of 5.5 mm; they differ only in the length of the measuring volume.

**Item 300-660:** The Model 31010, 0.125 cm<sup>3</sup> chamber is ideal for 3D dosimetry in a water phantom, since the measuring volume is approximately spherical resulting in a flat angular response over an angle of  $\pm 160^\circ$  and a uniform spatial resolution along all three axes of a water phantom. This chamber has a 31 mm rigid stem for mounting.

**Item 300-662:** The Model 31013, 0.3 cm<sup>3</sup> chamber is used as an alternative for the 31010 chamber in cases where increased signal levels are required and spatial resolution along the axis of the chamber can be compromised.

**Item 300-665:** The Model 31011 is a 0.125 cm<sup>3</sup> chamber and has shorter rigid stem length of 17.8 mm as compared to 31 mm rigid stem length of the Item 300-660.

Item	Description
300-660	PTW 31010, 0.125cc Semiflex® Chamber
300-665	PTW 31011, 0.125cc Short Stem Semiflex® Chamber
300-662	PTW 31013, 0.3cc Semiflex® Chamber

**Specify Connection**



# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

Specifications	Item 300-660	Item 300-665	Item 300-662
<b>PTW Model</b>	31010	31011	31013
<b>Type of Product</b>	vented cylindrical ionization chamber	vented cylindrical ionization chamber	vented cylindrical ionization chamber
<b>Application</b>	absolute dosimetry in radiotherapy beams	absolute dosimetry in radiotherapy beams	absolute dosimetry in radiotherapy beams
<b>Measuring Quantities</b>	absorbed dose to water, air kerma, exposure	absorbed dose to water, air kerma, exposure	absorbed dose to water, air kerma, exposure
<b>Reference Radiation Quality</b>	<sup>60</sup> Co	<sup>60</sup> Co	<sup>60</sup> Co
<b>Nominal Sensitive Volume</b>	0.125 cm <sup>3</sup>	0.125 cm <sup>3</sup>	0.3 cm <sup>3</sup>
<b>Design</b>	Waterproof, vented fully guarded	Waterproof, vented fully guarded	Waterproof, vented fully guarded
<b>Reference Point</b>	on chamber axis, 4.5mm from chamber tip	on chamber axis, 4.5mm from chamber tip	on chamber axis, 9.5mm from chamber tip
<b>Direction of Incidence</b>	radial	radial	radial
<b>Nominal Response</b>	3.3 nC/Gy	3.3 nC/Gy	10 nC/Gy
<b>Long-term Stability</b>	≤ 1% per year	≤ 1% per year	≤ 1% per year
<b>Chamber Voltage</b>	400 V nominal ± 500 V maximal	400 V nominal ± 500 V maximal	400 V nominal ± 500 V maximal
<b>Polarity Effect at <sup>60</sup>Co</b>	< 1%	< 1%	< 1%
<b>Photon Energy Response</b>	≤ ± 2% (140 kV to 280 kV) ≤ ± 4% (140 kV to <sup>60</sup> Co)	≤ ± 2% (140 kV to 280 kV) ≤ ± 4% (140 kV to <sup>60</sup> Co)	≤ ± 2% (140 kV to 280 kV) ≤ ± 4% (100 kV to <sup>60</sup> Co)
<b>Directional Response in Water</b>	≤ ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 10°	≤ ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 10°	≤ ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 10°
<b>Leakage Current</b>	≤ ± 4 fA	≤ ± 4 fA	≤ ± 4 fA
<b>Cable Leakage</b>	≤ 1 pC/(Gy·cm)	≤ 1 pC/(Gy·cm)	≤ 1 pC/(Gy·cm)
<b>Materials and Measures</b>			
<b>Wall of Sensitive Volume</b>	0.55 mm PMMA, 1.19 g/cm <sup>3</sup> 0.15 mm graphite, 0.82 g/cm <sup>3</sup>	0.55 mm PMMA, 1.19 g/cm <sup>3</sup> 0.15 mm graphite, 0.82 g/cm <sup>3</sup>	0.55 mm PMMA, 1.19 g/cm <sup>3</sup> 0.15 mm graphite, 0.82 g/cm <sup>3</sup>
<b>Total Wall Area Density</b>	78 mg/cm <sup>2</sup>	78 mg/cm <sup>2</sup>	78 mg/cm <sup>2</sup>
<b>Dimension of Sensitive Volume</b>	radius 2.75 mm length 6.5 mm	radius 2.75 mm length 6.5 mm	radius 2.75 mm length 16.25 mm
<b>Central Electrode</b>	Al 99.98, diameter 1.1 mm	Al 99.98, diameter 1.1 mm	Al 99.98, diameter 0.9 mm
<b>Build-up Cap</b>	PMMA, thickness 3mm	PMMA, thickness 3mm	PMMA, thickness 3mm
<b>Ion Collection Efficiency at Nominal Voltage</b>			
<b>Ion collection time</b>	100µs	100µs	80µs
<b>Max. dose rate for &gt; 99.5 % saturation</b>	6 Gy/s	6 Gy/s	14 Gy/s
<b>&gt; 99.0 % saturation</b>	12 Gy/s	12 Gy/s	28 Gy/s
<b>Max. dose per pulse for &gt; 99.5 % saturation</b>	0.5 mGy	0.5 mGy	0.8 mGy
<b>&gt; 99.0 % saturation</b>	1.0 mGy	1.0 mGy	1.5 mGy
<b>Useful ranges</b>			
<b>Chamber voltage</b>	± 100 to 400 V	± 100 to 400 V	± 100 to 400 V
<b>Radiation quality</b>	140 kV to 50 MV photons (10 to 45) MeV electrons (50 to 270) MeV protons	140 kV to 50 MV photons (10 to 45) MeV electrons (50 to 270) MeV protons	100 kV to 50 MV photons (10 to 45) MeV electrons (50 to 270) MeV protons
<b>Field size</b>	(3 x 3) cm <sup>2</sup> to (40 x 40) cm <sup>2</sup>	(3 x 3) cm <sup>2</sup> to (40 x 40) cm <sup>2</sup>	(4 x 4) cm <sup>2</sup> to (40 x 40) cm <sup>2</sup>
<b>Temperature</b>	50°-104°F (10°-40°C)	50°-104°F (10°-40°C)	50°-104°F (10°-40°C)
<b>Humidity</b>	10 - 80%, max 20 g/m <sup>3</sup>	10 - 80%, max 20 g/m <sup>3</sup>	10 - 80%, max 20 g/m <sup>3</sup>
<b>Air pressure</b>	700 - 1060 hPa	700 - 1060 hPa	700 - 1060 hPa

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## PTW PINPOINT® IONIZATION CHAMBERS

Ultra small-sized therapy chambers for dosimetry in high-energy photon beams



- Small-sized cylindrical ion chambers with vented sensitive volumes of only 0.015cm<sup>3</sup>/0.03cm<sup>3</sup> and 2mm/2.9mm in diameter
- Ideal for dose measurements in small fields as e.g. in IORT, IMRT and stereotactic beams
- Very high spatial resolution when used for scans perpendicular to the chamber axis
- Suitable for field sizes from 2x2cm to 30x30cm
- Aluminum central electrode

The PinPoint chambers are ideal for dose measurements in small fields as encountered e.g. in IORT, IMRT and stereotactic beams. Relative dose distributions can be measured with very high spatial resolution when the chambers are moved perpendicular to the chamber axis. The waterproof, fully guarded chambers can be used in air, solid state phantoms and in water.

Item	Description
300-672	PTW 31014, 0.015 cc Waterproof PinPoint Chamber
300-673	PTW 31015, 0.03 cc Waterproof PinPoint Chamber

Specify Connection

## PTW PINPOINT® IONIZATION 3D CHAMBER

Ultra small-sized therapy chamber with 3D characteristics for dosimetry in high-energy photon beams



- Small-sized sensitive volume 0.016 cm<sup>3</sup> , vented to air
- Minimized directional response
- Aluminum central electrode

The 3D PinPoint chamber is ideal for dose measurements in small fields as encountered e.g. in IORT, IMRT and stereotactic beams. Relative dose distributions can be measured with high spatial resolution in any direction. The waterproof, fully guarded chamber can be used in air, solid state phantoms and in water.

Item	Description
300-674	PTW 31016, 0.016 cc Waterproof PinPoint Chamber

Specify Connection

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# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

Specifications	Item 300-672	Item 300-673	Item 300-674
<b>PTW Model</b>	31014	31015	31016
<b>Type of Product</b>	vented cylindrical ionization chamber	vented cylindrical ionization chamber	vented cylindrical ionization chamber
<b>Application</b>	dosimetry in high-energy photon beams with high spatial resolution	dosimetry in high-energy photon beams with high spatial resolution	dosimetry in high-energy photon beams
<b>Measuring Quantities</b>	absorbed dose to water, air kerma, exposure	absorbed dose to water, air kerma, exposure	absorbed dose to water, air kerma, exposure
<b>Reference Radiation Quality</b>	<sup>60</sup> Co	<sup>60</sup> Co	<sup>60</sup> Co
<b>Nominal Sensitive Volume</b>	0.015 cm <sup>3</sup>	0.03 cm <sup>3</sup>	0.016 cm <sup>3</sup>
<b>Design</b>	Waterproof, vented fully guarded	Waterproof, vented fully guarded	Waterproof, vented fully guarded
<b>Reference Point</b>	on chamber axis, 3.4mm from chamber tip	on chamber axis, 3.4mm from chamber tip	on chamber axis, 2.4mm from chamber tip
<b>Direction of Incidence</b>	radial, axial	radial	radial
<b>Pre-Irradiation Dose</b>	2Gy	2Gy	2Gy
<b>Nominal Response</b>	400 pC/Gy	800 pC/Gy	400 pC/Gy
<b>Long-term Stability</b>	≤ 1% per year	≤ 1% per year	≤ 1% per year
<b>Chamber Voltage</b>	400 V nominal ± 500 V maximal	400 V nominal ± 500 V maximal	400 V nominal ± 500 V maximal
<b>Polarity Effect at <sup>60</sup>Co</b>	< ± 2%	< ± 2%	< ± 2%
<b>Directional Response in Water</b>	≤ ± 0.5% for rotation around the chamber axis ≤ ± 1% for tilting of the axis up to ± 20° (radial incidence) ± 15° (axial incidence)	≤ ± 0.5% for rotation around the chamber axis ≤ ± 1% for tilting of the axis up to ± 20° (radial incidence)	≤ ± 0.5% for rotation around the chamber axis ≤ ± 1% for tilting of the axis up to ± 110°
<b>Leakage Current</b>	≤ ± 4 fA	≤ ± 4 fA	≤ ± 4 fA
<b>Cable Leakage</b>	≤ 1 pC/(Gy·cm)	≤ 1 pC/(Gy·cm)	≤ 1 pC/(Gy·cm)
<b>Materials and Measures</b>			
<b>Wall of Sensitive Volume</b>	0.57 mm PMMA, 1.19 g/cm <sup>3</sup> 0.09 mm graphite, 1.85 g/cm <sup>3</sup>	0.57 mm PMMA, 1.19 g/cm <sup>3</sup> 0.09 mm graphite, 1.85 g/cm <sup>3</sup>	0.57 mm PMMA, 1.19 g/cm <sup>3</sup> 0.09 mm graphite, 1.85 g/cm <sup>3</sup>
<b>Total Wall Area Density</b>	85 mg/cm <sup>2</sup>	85 mg/cm <sup>2</sup>	85 mg/cm <sup>2</sup>
<b>Dimension of Sensitive Volume</b>	radius 1 mm length 5 mm	radius 1.45 mm length 5 mm	radius 1.45 mm length 2.9 mm
<b>Central Electrode</b>	Al 99.98, diameter 0.3 mm	Al 99.98, diameter 0.3 mm	Al 99.98, diameter 0.3 mm
<b>Build-up Cap</b>	PMMA, thickness 3mm	PMMA, thickness 3mm	PMMA, thickness 3mm
<b>Ion Collection Efficiency at Nominal Voltage</b>			
<b>Ion collection time</b>	20μs	50μs	60μs
<b>Max. dose rate for &gt; 99.5 % saturation</b>	265 Gy/s	29 Gy/s	19 Gy/s
<b>&gt; 99.0 % saturation</b>	580 Gy/s	55 Gy/s	38 Gy/s
<b>Max. dose per pulse for &gt; 99.5 % saturation</b>	3.5 mGy	1.2 mGy	1.0 mGy
<b>&gt; 99.0 % saturation</b>	7.0 mGy	2.3 mGy	1.9 mGy
<b>Useful ranges</b>			
<b>Chamber voltage</b>	± 100 to 400 V	± 100 to 400 V	± 100 to 400 V
<b>Radiation quality</b>	<sup>60</sup> Co - 50 MV photons	<sup>60</sup> Co - 50 MV photons	<sup>60</sup> Co - 50 MV photons
<b>Field size</b>	2x2 cm <sup>2</sup> to 30x30 cm <sup>2</sup>	2x2 cm <sup>2</sup> to 30x30 cm <sup>2</sup>	2x2 cm <sup>2</sup> to 30x30 cm <sup>2</sup>
<b>Temperature</b>	50°-104°F (10°-40°C)	50°-104°F (10°-40°C)	50°-104°F (10°-40°C)
<b>Humidity</b>	10 - 80%, max 20 g/m <sup>3</sup>	10 - 80%, max 20 g/m <sup>3</sup>	10 - 80%, max 20 g/m <sup>3</sup>
<b>Air pressure</b>	700 - 1060 hPa	700 - 1060 hPa	700 - 1060 hPa

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## MARKUS® ELECTRON CHAMBER

Classic plane parallel chamber for absolute dosimetry in high-energy electron beams



- Thin entrance window and waterproof protection cap
- Small-sized for high spatial resolution
- Sensitive volume 0.055 cm<sup>3</sup>, vented to air

The 23343 Markus chamber is manufactured in the original famous Markus design. Absorbed dose to water can be measured by applying correction factors for perturbation effects as published in pertinent dosimetry protocols. The thin entrance window allows measurements in solid state phantoms up to the surface. The protection cap makes the chamber waterproof for measurements in water phantoms.

Item	Description
300-625	PTW 23343 - Markus (0.055cc) Chamber

Specify Connection

## ADVANCED MARKUS® ELECTRON CHAMBER

Perturbation-free version of the famous classic Markus chamber for absolute dosimetry in high-energy electron beams



- Perturbation-free electron chamber
- Thin entrance window and waterproof protection cap
- Small-sized for high spatial resolution
- Sensitive volume 0.02 cm<sup>3</sup>, vented to air
- Suitable for relative and absolute electron dosimetry

The Advanced Markus features a wide guard ring design to avoid perturbation effects by reducing the influence of scattered radiation from the housing. Since the outer shape is identical with the Markus chamber, all existing Markus chamber phantom plates and adapters can be used with the Advanced Markus chamber. The small sensitive volume makes the chamber ideal for dose distribution measurements in a water phantom, giving a good spatial resolution. The chamber features a flat energy response within the nominal energy range from 2 MeV to 45 MeV. With the very thin membrane of only 0.03 mm polyethylene, the chamber is suitable for use in solid state phantoms. The chamber comes with a protective acrylic cover of 0.87 mm thickness (1 mm water equivalence) for use in water. A calibration certificate with a <sup>60</sup>Co calibration factor given in absorbed dose to water is included. Air density correction is required for each measurement. The chamber cable length is 1.05 m.

Item	Description
300-626	PTW 34045 - Advanced Markus Electron Chamber

Specify Connection



# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## MARKUS® ELECTRON CHAMBER PTW 23343



Plane-parallel ion chamber with thin membrane for high-energy electron measurements in water and solid state phantoms

### Features

- Suitable for use in solid state and water phantoms
- Vented measuring volume
- Fully guarded up to measuring volume
- Touchable parts free of high voltage.
- Chamber is **waterproof when used with protective cap**.

The Markus chamber is the first chamber specifically designed for electron dosimetry. A PMMA waterproofing cap, equivalent to 1 mm of water, and an annulus, for solid state phantom measurements, are included. The chamber's small measuring volume makes it ideal for electron measurements when very high spatial resolution is required. The diaphragm front allows measurements in the build-up region of electron fields to a depth of virtually zero.

**Nominal Useful Range:** 2 MeV to 45 MeV  
**Cable Length:** 1.05 m  
**Standard Connection:** BNC-M Triax  
 If non standard connection is needed - specify connection.

### Specifications

**Volume:** 0.055 cm<sup>3</sup>  
**Response:**  $2 \cdot 10^{-9}$  C/Gy  
**Leakage:**  $\pm 2 \cdot 10^{-16}$  A  
**Polarizing Voltage:** 300 V recommended, 400 V maximum  
**Cable Leakage:**  $3.5 \cdot 10^{-12}$  C/(Gy · cm)  
**Wall Material:** Polyethylene CH2  
**Membrane Thickness:** 0.03 mm  
**Area Thickness:** 2.5 mg/cm<sup>2</sup>  
**Electrode:** Acrylic, graphite coated, 5.3 mmØ  
**Range of Temperature:** 10° C to 40° C  
**Range of Relative Humidity:** 10% to 80%  
**Ion Collection Time:**  
 150 V: 0.20 ms  
 300 V: 0.09 ms  
 400 V: 0.07 ms

**Specs. - Info. - MSDS: Visit [www.rpdinc.com](http://www.rpdinc.com) or call.**

A calibration certificate with a <sup>60</sup>Co calibration factor given in absorbed dose to water is included. Air density correction is required for each measurement.

Item #	Description
300-625	Markus Ion Chamber - PTW 23343

## ADVANCED MARKUS® ELECTRON CHAMBER PTW 34045



Plane-parallel chamber for high-energy electron measurements in water and solid state phantoms.

### Features

- Vented sensitive volume of 0.02 cm<sup>3</sup>
- Same outer dimensions as the Markus chamber
- Suitable for relative and absolute electron dosimetry
- Wide guard ring design
- The chamber is **waterproof when used with protective cap**

The Advanced Markus chamber<sup>1</sup> is a further development of the Markus chamber, featuring a wide guard ring design to avoid perturbation effects by reducing the influence of scattered radiation from the housing. Since the outer shape is identical to the Markus chamber, all existing Markus chamber phantom plates and adapters can be used with the Advanced Markus chamber.

The small sensitive volume makes the chamber ideal for dose distribution measurements in a water phantom, giving a good spatial resolution. The chamber features a flat energy response within the nominal energy range. The membrane material is polyethylene of 0.03 mm thickness. The Advanced Markus chamber comes with a protective acrylic cover of 0.87 mm thickness (1 mm water equivalence) for use in water.

<sup>1</sup>The Advanced Markus chamber was developed in cooperation with Prof. Rosenow, Göttingen University, Germany.

**Nominal Useful Range:** 2 MeV to 45 MeV  
**Cable Length:** 1.05 m  
**Standard Connection:** BNC-M Triax  
 If non standard connection is needed - specify connection.

**Specs. - Info. - MSDS: Visit [www.rpdinc.com](http://www.rpdinc.com) or call.**

A calibration certificate with a <sup>60</sup>Co calibration factor given in absorbed dose to water is included. Air density correction is required for each measurement.

Item #	Description
300-626	Advanced Markus® Electron Chamber - PTW 34045

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## ROOS® ELECTRON CHAMBER

PTW 34001



Precision plane-parallel chamber for absolute dosimetry of high-energy electron radiation in water and solid state phantoms.

### Features

- Vented sensitive volume of 0.35 cm<sup>3</sup>
- Reference chamber for precise absolute electron dosimetry
- **Completely Waterproof.**
- Suitable for use in water and in solid state phantoms
- Perturbation free design and minimal polarity effect

The Roos electron chamber<sup>1</sup> is used as a reference electron chamber. It is recommended by the IAEA<sup>2</sup> for high precision electron dosimetry in radiation therapy.

The chamber has a 4 mm wide guard ring to exclude any perturbation effect even at low electron energies. The polarity effect is negligible (< 0.5% at 10 MeV). The energy response is only influenced by the stopping power ratios water/air. The acrylic entrance window has a thickness of 1 mm.

<sup>1</sup>The Roos Electron chamber was developed in cooperation with Dr. Roos, PTB-Braunschweig, German Federal Institutes of Physics and Metrology (National Laboratory of Germany).

<sup>2</sup>Technical Report No. TRS-381. The use of Plane Parallel Ionization Chambers in High Energy Electron and Photon Beams. IAEA (International Atomic Energy Agency), Vienna 1997.

**Nominal Useful Energy Range:** 2 MeV to 45 MeV

**Cable Length:** 1.08 m

**Standard Connection:** BNC-M Triax

If non standard connection is needed - specify connection.

### Specifications

**Volume:** 0.35 cm<sup>3</sup>

**Response:** 1 · 10<sup>-8</sup> C/Gy

**Leakage:** ± 4 · 10<sup>-15</sup> A

**Polarizing Voltage:** 100 V recommended, maximum 400 V

**Cable Leakage:** 3.5 · 10<sup>-12</sup> C/(GY · cm)

**Wall Material:** Acrylic, (C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>)

**Wall Density:** 1.19 g/cm<sup>3</sup>

**Wall Thickness:** 1.0 mm

**Area Density:** 119 mg/cm<sup>2</sup>

**Electrode:** Acrylic, graphite coated; 15 mm Ø

**Guard Ring:** 4 mm wide

**Range of Temperature:** 10° C to 40° C

**Range of Relative Humidity:** 10% to 80%

**Ion Collection Time:**

100 V: 0.37 ms

200 V: 0.13 ms

300 V: 0.07 ms

**Specs. - Info. - MSDS:** Visit [www.rpdinc.com](http://www.rpdinc.com) or call.

A calibration certificate with a <sup>60</sup>Co calibration factor given in absorbed dose to water is included. Air density correction is required for each measurement.

Item #	Description
300-675	Roos Ion Chamber - PTW 34001

## PTW 23323 SEALED MICRO CHAMBER

Therapy chamber for in-vivo measurements



### Features:

- Sealed ionization chamber for in-vivo measurements
- Waterproof, flexible design for intracavitary use
- Sensitive volume 0.1 cm<sup>3</sup>, fully guarded

The 23323 micro chamber is used for patient in-vivo measurements in conjunction with an electrometer classified for this purpose. Applications are external beam and brachytherapy dose measurements on the patient's surface or in body cavities such as the rectum. for the use in body cavities the chamber should be protected by a rubber sleeve. The micro chamber is to be used with a radioactive check device and features a stable response even if the chamber temperature changes.

### Specifications

**Outer diameter:** 7 mm

**Measuring quantities:** absorbed dose to water

**Reference radiation quality:** <sup>60</sup>Co

**Nominal sensitive volume:** 0.1 cm<sup>3</sup>

**Design:** waterproof, fully guarded

**Reference point:** on chamber axis, 8 mm from chamber tip

**Direction of incidence:** radial

**Nominal response:** 3.8 nC/Gy

**Long-term stability:** ≤ 1% per year

**Chamber voltage:** 400 V nominal, ± 500 V maximal

**Photon energy response:** ≤ ± 2% (140 kV ... <sup>60</sup>Co)

**Directional response in water:** < ± 0.5% for rotation around the chamber axis and for tilting of the axis up to ± 30° (280 kV)

**Temperature dependence:** ≤ ± 5% within the useful range

**Temperature equilibrium time:** (2 ... 3) min/°C

**Leakage current:** ≤ ± 4 fA

**Cable leakage:** ≤ 1 pC/(Gy·cm)

**Wall of sensitive volume:**

0.61 mm PMMA,

1.19 g/cm<sup>3</sup>

0.13 mm graphite,

0.82 g/cm<sup>3</sup>

rubber

**Total wall area density:** 197 mg/cm<sup>2</sup>

**Dimension of sensitive volume:** radius 1.625 mm, length 11.875 mm

**Central electrode:** Al 99.5, diameter 0.8 mm

**Build-up cap:** PMMA, thickness 3 mm

**Ion collection efficiency at nominal voltage**

Ion collection time: 28 μs

**Max dose rate for**

≥ 99.5% saturation: 107 Gy/s

≥ 99.0% saturation: 213 Gy/s

**Max dose per pulse for**

≥ 99.5% saturation: 2.1 mGy

≥ 99.0% saturation: 4.2 mGy

**Useful ranges:**

Chamber voltage: ± (100 ... 400) V

Radiation quality: 66 keV ... 50 MV photons

Field size: (4 x 4)cm<sup>2</sup> ... (40 x 40)cm<sup>2</sup>

Temperature: (10 ... 40)°C, (50 ... 104)°F

Humidity: (20 ... 75)%, max 20 g/m<sup>3</sup>

Air pressure: (700 ... 1060) hPa

*Note: A calibration certificate is included with each chamber.*

Item #	Description
300-605-BNC-M	Micro Chamber 0.1 cm <sup>3</sup> - PTW 23323

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# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## PTW SEMIFLEX IONIZATION CHAMBERS



### Specifications - Item 300-660 (PTW 31002 / 31010) - 0.125 cm<sup>3</sup> Chamber - 36 mm Rigid Stem

**Cable Length:** 1.3 m  
**Volume:** 0.125 cm<sup>3</sup>  
**Response:**  $4 \cdot 10^{-9}$  C/Gy  
**Leakage:**  $\pm 4 \cdot 10^{-15}$  A  
**Polarizing Voltage:** Max 500 V  
**Cable Leakage:**  $1 \cdot 10^{-12}$  C/(Gy · cm)  
**Wall Material:** PMMA (C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>)<sub>n</sub>  
**Wall Density:** 1.18 g/cm<sup>3</sup>  
**Wall Thickness:** 0.7 mm  
**Area Density:** 82.6 mg/cm<sup>2</sup>  
**Electrode:** Aluminum; 1 mm Ø, 5 mm long  
**Range of Temperature:** 10° C to 40° C  
**Range of Relative Humidity:** 20% to 75%  
**Ion Collection Time:**  
 300 V: 0.15 ms  
 400 V: 0.10 ms  
 500 V: 0.08 ms

Item #	Description
300-660	0.125 cm <sup>3</sup> Semiflex Chamber - 31002 / 31010 - BNC-M

### Specifications - Item 300-662 (PTW 31003 / 31013) - 0.3 cm<sup>3</sup> Chamber

**Cable Length:** 1.3 m  
**Volume:** 0.3 cm<sup>3</sup>  
**Response:**  $1 \cdot 10^{-8}$  C/Gy  
**Leakage:**  $\pm 4 \cdot 10^{-15}$  A  
**Polarizing Voltage:** Max 500 V  
**Cable Leakage:**  $1 \cdot 10^{-12}$  C/(Gy · cm)  
**Wall Material:** PMMA (C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>)<sub>n</sub>  
**Wall Density:** 1.18 g/cm<sup>3</sup>  
**Wall Thickness:** 0.7 mm  
**Area Density:** 82.6 mg/cm<sup>2</sup>  
**Electrode:** Aluminum, graphite coated; 1.5 mm Ø; 14.25 mm long  
**Range of Temperature:** 10° C to 40° C  
**Range of Relative Humidity:** 20% to 75%  
**Ion Collection Time:**  
 300 V: 0.10 ms  
 400 V: 0.08 ms  
 500 V: 0.06 ms

Item #	Description
300-662	0.3 cm <sup>3</sup> Semiflex Chamber - 31003 / 31013 - BNC-M

### Specifications - Item 300-665 (PTW 31005 / 31011) - 0.125cm<sup>3</sup> Short Stem - 18.75 mm Rigid Stem

**Cable Length:** 1.3 m  
**Volume:** 0.125 cm<sup>3</sup>  
**Sensitivity:** 0.04 nC/R  
**Sensitive Length:** 6.5 mm  
**Electrode Dimensions:** 1 mm Ø x 5 mm  
**Aluminum Stem Length:** 19 mm  
**Electrode Material:** Aluminum graphite coated  
**Outside Diameter:** 6.9 mm thimble, 7 mm stem  
**Wall Thickness:** 0.7 mm, 82.6 mg/cm<sup>2</sup>, acrylic/graphite  
**Leakage:**  $4 \times 10^{-15}$  A  
**Polarizing Voltage:** Max 500 V

Item #	Description
300-665	0.125 cm <sup>3</sup> Short Stem Semiflex - 31005 / 31011 - BNC-M

### PTW CROSS REFERENCE FROM OLD TO NEW MODEL NUMBERS

PTW#S OLD TO NEW	CHAMBER DESCRIPTION
233642 / 31002 / 31010	0.125 cc Semiflex
23332 / 233641 / 31003 / 31013	0.3 cc Semiflex
233643 / 31005 / 31011	0.125 cc Short Stem Semiflex

**Waterproof thimble chambers** for measuring high-energy photon and electron radiation in air, water and phantom material.

#### Item 300-660 Semiflex™ 0.125 cm<sup>3</sup> ion chamber

Designed for measurements in the useful beam of high energy photon and electron fields in a water phantom, this chamber can also be used for IMRT measurements.

#### Item 300-662 Semiflex™ 0.3cm<sup>3</sup> ion chamber

This chamber is mainly used for relative measurements in a water phantom of high energy photon and electron beams.

#### Features

- Vented sensitive volumes of 0.125 cm<sup>3</sup> and 0.3 cm<sup>3</sup>
- Suitable for use in water phantoms
- Flat energy response within a wide energy range

The semiflex chambers are designed for therapy dosimetry, mainly for dose distribution measurements in motorized water phantoms. They have a short stem for mounting and a flexible connection cable.

The guard ring borders the measuring volume. An acrylic build-up cap for in-air measurement in <sup>60</sup>Co beams is included with each chamber.

All Semiflex chambers are shaped cylindrically with an inner diameter of 5.5 mm; they differ only in the length of the measuring volume. The 0.125 cm<sup>3</sup> chamber is ideal for a 3D dosimetry in a water phantom, since the measuring volume is approximately spherical resulting in a flat angular response over an angle of  $\pm 160^\circ$  and a uniform spatial resolution along all three axes of a water phantom.

**Nominal useful range:** 30 Kev to 50 MeV photons.

**Standard Connection:** BNC-M Triax

If non standard connection is needed - specify connection

**Specs. - Info. - MSDS:** Visit [www.rpdinc.com](http://www.rpdinc.com) or call.

A calibration certificate for calibration in absorbed dose to water or in air kerma is included. Air density correction is required for each measurement.



# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## PTW RIGID STEM IONIZATION CHAMBERS



300-615



300-610

### PTW CROSS REFERENCE FROM OLD TO NEW MODEL NUMBERS

<u>PTW#S OLD TO NEW</u>	<u>CHAMBER DESCRIPTION</u>
23332 / 30016	0.3 cc Rigid Stem
23331 / 30015	1.0 cc Rigid Stem

Thimble chambers for measuring high-energy photon and electron radiation in air and in phantom material.

#### Features

- Very flat energy response within a wide range
- Guard ring up to measuring volume
- Suitable as reference chambers for use in solid state phantoms
- Guard ring at potential of the collecting electrode. Touchable parts free of high voltage
- Open measuring volume, without check device air density correction is necessary
- High voltage to be connected only with active current-limiting device ( $I_{max} < 0.5mA$ )

These Rigid Stem Chambers are designed as reference chambers for absolute dosimetry to be used in radiation therapy or by secondary standard dosimetry laboratories. These chambers have very small variations of response with radiation quality from low X-ray energies up to high-energy photon and electron radiation. Both chambers are constructed with a 25 cm long rigid stem for easy mounting in the radiation field.

**Item 300-615** the 0.3cm<sup>3</sup> chamber has a smaller volume in comparison to **Item 300-610** the 1 cm<sup>3</sup> chamber which makes this chamber more suitable for use with pulsed radiation because of its better saturation.

Each chamber includes an acrylic build-up cap for measurement in <sup>60</sup>Co beams and a calibration certificate for calibration in absorbed dose to water or in air kerma. Air density correction is required for each measurement.

**Nominal Useful Energy Range:** 30 keV to 50 MeV.

**Standard Connection:** BNC-M Triax

If non standard connection is needed - specify connection.

**Specs. - Info. - MSDS:** Visit [www.rpdinc.com](http://www.rpdinc.com) or call.

### Specifications - Item 300-615 (PTW 23332 / 30016) 0.3 cm<sup>3</sup> Chamber

**Volume:** 0.3 cm<sup>3</sup>

**Response:**  $1 \cdot 10^{-8}$  C/Gy

**Leakage:**  $\pm 4 \cdot 10^{-15}$  A

**Polarizing Voltage:** max 500 V

**Cable Leakage:**  $1 \cdot 10^{-12}$  C/(Gy · cm)

**Wall Material:** PMMA (C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>)<sub>n</sub>

**Wall Density:** 1.18 g/cm<sup>3</sup>

**Wall Thickness:** 0.5 mm

**Area Density:** 59 mg/cm<sup>2</sup>

**Electrode:** Aluminum, graphite coated; 2 mm Ø; 16.5 mm long

**Range of Temperature:** 10° C to 40° C

**Range of Relative Humidity:** 20% to 75%

**Ion Collection Time:**

300 V: 0.05 ms

400 V: 0.04 ms

500 V: 0.03 ms

Item #	Description
300-615	Ionization Chamber, Rigid Stem 0.3 cm <sup>3</sup>

### Specifications - Item 300-610 (PTW 23331 / 30015) - 1 cm<sup>3</sup> Chamber

**Volume:** 1 cm<sup>3</sup>

**Response:**  $3.3 \cdot 10^{-8}$  CGy

**Leakage:**  $\pm 4 \cdot 10^{-15}$  A

**Polarizing Voltage:** max 500 V

**Cable Leakage:**  $1 \cdot 10^{-12}$  C/(Gy · cm)

**Wall Material:** PMMA (C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>)<sub>n</sub>

**Wall Density:** 1.18 g/cm<sup>3</sup>

**Wall Thickness:** 0.55 mm

**Area Density:** 64.9 mg/cm<sup>2</sup>

**Electrode:** Aluminum, graphite coated; 1.5 mm Ø; 20 mm long

**Range of Temperature:** 10° C to 40° C

**Range of Relative Humidity:** 20% to 75%

**Ion Collection Time:**

300 V: 0.3 ms

400 V: 0.2 ms

500 V: 0.2 ms

Item #	Description
300-610	Ionization Chamber, Rigid Stem 1 cm <sup>3</sup>

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# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## PTW 60016 DOSIMETRY DIODE P - PHOTONS

Waterproof Silicon Detector for Dosimetry in High-Energy Photon Beams Up to Field Size 40cm x 40cm



- Useful for measurements in small and large photon fields
- Excellent spatial resolution
- Minimized energy response for field size independent measurements up to 40 cm x 40 cm

The Dosimetry Diode P is ideal for dose measurements in small photon fields as encountered in IORT, IMRT and stereotactic beams. The excellent spatial resolution makes it possible to measure very precisely beam profiles even in the penumbra region of small fields. The superior energy response enables the user to perform accurate percentage depth dose measurements which are field size independent up to field sizes of (40 x 40) cm<sup>2</sup>. The waterproof detector can be used in air, solid state phantoms and in water.

### Useful Ranges

**Radiation Quality:** <sup>60</sup>Co ... 25 MV photons

**Field Size:** 1 x 1 cm<sup>2</sup> ... 40 x 40 cm<sup>2</sup>

**Temperature:** 50 ... 104 °F (10 ... 40 °C)

**Humidity:** 10 ... 80 %, max 20 g/m<sup>3</sup>

### Specifications

**Type of Product:** p-type silicon diode

**Application:** Dosimetry in radiotherapy beams

**Measuring Quantity:** Absorbed dose to water

**Reference Radiation Quality:** <sup>60</sup>Co

**Nominal Sensitive Volume:** 0.03 mm<sup>3</sup>

**Design:** Waterproof, disk-shaped sensitive volume perpendicular to detector axis

**Reference Point:** On detector axis, 2 mm from detector tip

**Direction of Incidence:** Axial

**Nominal Response:** 9 nC/Gy

**Dose Stability:**  $\leq 0.5\%$  /kGy at 6 MV;  $\leq 1\%$  /10 kGy at 15 MV

**Temperature Response:**  $\leq 0.4\%$  /K

**Energy Response:** At higher depths than  $d_{max}$ , the percentage depth dose curves match curves measured with ionization chambers within  $\pm 0.5\%$

**Detector Bias Voltage:** 0 V

**Signal Polarity:** Negative

**Directional Response in Water:**  $\leq \pm 0.5\%$  for rotation around the chamber axis,  $\leq \pm 1\%$  for tilting  $\leq \pm 20^\circ$

**Leakage Current:**  $\leq 100$  fA

**Cable Leakage:**  $\leq 1$  pC/(Gy·cm)

### Materials and Measures

**Entrance Window:** 1 mm RW3, 1.045 g/cm<sup>3</sup>, 1 mm epoxy

**Total Window Area Density:** 221 mg/cm<sup>2</sup>

**Water-Equivalent Window Thickness:** 2.2 mm

**Sensitive Volume:** 1 mm<sup>2</sup> circular; 30  $\mu$ m thick

**Outer Dimensions:** 7 mm diameter x 47 mm length

Item	Description
300-681	PTW 60016 - Dosimetry Diode P - Photons

## PTW 60017 DOSIMETRY DIODE E - PHOTON / ELECTRON

Waterproof Silicon Detector for Dosimetry in High-Energy Electron and Photon Beams  
Specifications



- Useful for measurements in all electron fields and for small photon fields
- Excellent spatial resolution
- Minimized energy response
- Thin entrance window for measurements in the vicinity of surfaces and interfaces

The Dosimetry Diode E is ideal for dose measurements in small electron and photon fields as encountered in IORT, IMRT and stereotactic beams. The excellent spatial resolution makes it possible to measure very precisely beam profiles even in the penumbra region of small fields. The superior energy response enables the user to perform accurate percentage depth dose measurements which are field size independent up to field sizes of 40 x 40 cm<sup>2</sup>. The waterproof detector can be used in air, solid state phantoms and in water.

### Useful Ranges

**Radiation Quality:** 6...25 MeV electrons; <sup>60</sup>Co...25 MV photons  
**Field Size:** 1 x 1 cm<sup>2</sup>...40 x 40 cm<sup>2</sup> for electrons;  
 1 x 1 cm<sup>2</sup>...10 x 10 cm<sup>2</sup> for photons  
**Temperature:** 50...104 °F (10...40 °C)  
**Humidity:** 10...80%, max 20 g/m<sup>3</sup>

**Type of Product:** p-type silicon diode  
**Application:** Dosimetry in radiotherapy beams  
**Measuring Quantity:** Absorbed dose to water  
**Reference Radiation Quality:** <sup>60</sup>Co  
**Nominal Sensitive Volume:** 0.03 mm<sup>3</sup>  
**Design:** Waterproof, disk-shaped sensitive volume perpendicular to detector axis  
**Reference Point:** On detector axis, 0.77 mm from detector tip  
**Direction of Incidence:** Axial  
**Nominal Response:** 9 nC/Gy  
**Dose Stability:** <math>\leq 0.5\%/kGy</math> at 6 MV; <math>\leq 1\%/kGy</math> at 15 MV; <math>\leq 0.5\%/kGy</math> at 5 MeV; <math>\leq 4\%/kGy</math> at 21 MeV  
**Temperature Response:** <math>\leq 0.4\%/K</math>  
**Energy Response:** At higher depths than  $d_{max}$ , the percentage depth dose curves match curves measured with ionization chambers within  $\pm 0.5\%$   
**Detector Bias Voltage:** 0 V  
**Signal Polarity:** Negative  
**Directional Response in Water:** <math>\leq \pm 0.5\%</math> for rotation around the chamber axis, <math>\leq \pm 1\%</math> for tilting <math>\leq \pm 20^\circ</math>  
**Leakage Current:** <math>\leq \pm 50\text{ fA}</math>  
**Cable Leakage:** <math>\leq 1\text{ pC}/(\text{Gy}\cdot\text{cm})</math>

### Materials and Measures

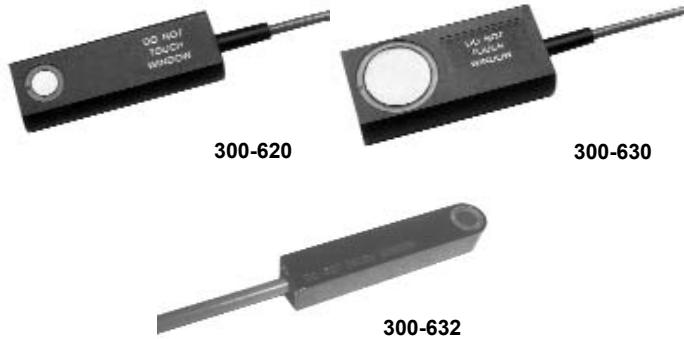
**Entrance Window:** 0.3 mm RW3, 1.045 g/cm<sup>3</sup>, 0.4 mm epoxy  
**Total Window Area Density:** 140 mg/cm<sup>2</sup>  
**Water-Equivalent Window Thickness:** 1.33 mm  
**Sensitive Volume:** 1 mm<sup>2</sup> circular; 30  $\mu\text{m}$  thick  
**Outer Dimensions:** 7 mm diameter x 45.5 mm length

Item	Description
300-682	PTW 60017 - Dosimetry Diode E - Photon/Electron

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## SOFT X-RAY IONIZATION CHAMBERS



### Specifications - Item 300-620 (PTW 23342) - Small 0.02 cm<sup>3</sup> Chamber

**Volume:** 0.02 cm<sup>3</sup>  
**Response:** 3 □ 10<sup>-10</sup> C/Gy  
**Leakage:** ± 1 □ 10<sup>-14</sup> A  
**Polarizing Voltage:** Max 300 V  
**Cable Leakage:** 1 □ 10<sup>-12</sup> C/(Gy □ cm)  
**Wall Material:** PE (CH<sub>2</sub>)<sub>n</sub>  
**Membrane Thickness:** 0.03 mm  
**Area Density:** 2.5 mg/cm<sup>2</sup>  
**Electrode:** Graphite; 3 mm Ø  
**Range of Temperature:** 10° C to 40° C  
**Range of Relative Humidity:** 20% to 75%  
**Ion Collection Time:** 150 V: 0.05 ms; 300 V: 0.03 m

Item #	Description
300-620	Small 0.02 cm <sup>3</sup> Soft X-Ray Chamber - PTW 23342

### Specifications - Item 300-630 (PTW 23344) - Big 0.2 cm<sup>3</sup> Chamber

**Volume:** 0.20 cm<sup>3</sup>  
**Response:** 7 □ 10<sup>-10</sup> C/Gy  
**Leakage:** ± 1 □ 10<sup>-14</sup> A  
**Polarizing Voltage:** Max 500 V  
**Cable Leakage:** 1 □ 10<sup>-12</sup> C/(Gy □ cm)  
**Wall Material:** PE (CH<sub>2</sub>)<sub>n</sub>  
**Membrane Thickness:** 0.03 mm  
**Area Density:** 2.5 mg/cm<sup>2</sup>  
**Electrode:** Graphite with amber, graphite coated; 13 mm Ø  
**Range of Temperature:** 10° C to 40° C  
**Range of Relative Humidity:** 20% to 75%  
**Ion Collection Time:** 300 V: 0.05 ms; 400 V: 0.04 ms; 500 V: 0.03 ms

Item #	Description
300-630	Big 0.2 cm <sup>3</sup> Soft X-Ray Chamber - PTW 23344

### Specifications - Item 300-632 (PTW 34013) - Soft X-Ray Chamber 0.0053 cm<sup>3</sup>

**Volume:** 0.0053 cm<sup>3</sup>  
**Response:** 2 □ 10<sup>-10</sup> C/Gy  
**Leakage:** ± 1 □ 10<sup>-14</sup> A  
**Polarizing Voltage:** Max 400 V  
**Cable Leakage:** 1 □ 10<sup>-12</sup> C/(Gy □ cm)  
**Wall Material:** PE (CH<sub>2</sub>)<sub>n</sub>  
**Membrane Thickness:** 0.025 mm  
**Area Density:** 2.3 mg/cm<sup>2</sup>  
**Electrode:** Graphite; 1.7 mm Ø  
**Range of Temperature:** 10° C to 40° C  
**Range of Relative Humidity:** 10% to 80% (max. 20g /m<sup>3</sup>)  
**Ion Collection Time:** 400 V: 0,009 ms  
**Directional Dependence:** £ ± 5% at £ ± 10°

Item #	Description
300-632	0.0053 cm <sup>3</sup> Soft X-Ray Chamber - PTW 34013

Plane-parallel chambers with thin membranes for measuring therapeutic x-rays in air and solid state phantoms.

#### Features

- Guard ring up to measuring volume
- Suitable for use in solid state phantoms and in air
- Guard ring at the potential of the inner electrode. All touchable parts free of high voltage
- Open measuring volume, without check device air density correction is necessary
- Very thin flat entrance windows for dose measurements of low energy x-ray beams
- High voltage to be connected only with active current-limiting device ( $I_{max} < 0.5$  mA)

**Item 300-620** the Small 0.02 cm<sup>3</sup> soft X-ray chamber is the standard chamber for dose measurements in superficial radiation therapy.

**Item 300-630** the Big 0.20 cm<sup>3</sup> soft X-ray chamber is an alternative chamber for dose measurements in superficial radiation therapy or mammography, where a higher response is necessary.

The usual calibration of both chambers is done at 15 kV to 70 kV. The chambers have a very flat energy response in the range from 10 kV to 100 kV

**Item 300-632** the 0.0053 cm<sup>3</sup> soft X-ray chamber has an extremely small design that allows measurements in very small fields or with steep dose gradients. The typical calibration is at 15 to 50 KV, and the energy response within this range is ±2%.

All chambers include a calibration certificate. Air density correction is required for each measurement.

**Cable Length:** 0.7 m

**Standard Connection:** BNC-M Triax

If non standard connection is needed - specify connection.

**Specs. - Info. - MSDS:** Visit [www.rpdinc.com](http://www.rpdinc.com) or call.

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# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## 3.2 cc CT ION CHAMBER



### Specifications

**Detector Type:** Vented air ion chamber  
**Volume:** 3.2 cc  
**Sensitive Length:** 10.0 cm  
**Chamber Material:** Polystyrene  
**Chamber Inside Diameter:** 6.4 mm  
**Chamber Wall Thickness:** 54 mg/cm<sup>2</sup>  
**Electrode Material:** Aluminum  
**Sensitivity:** 10 R•cm/nC (nominal)  
**Standard Calibration:** 100 kVCP, 5.5 mm Al HVL (NIST Tech. M100)

**Response Uniformity Along Axis:** ± 3% over central 90% of active length  
**Beam Orientation:** Normal to chamber axis  
**Phantom Adapter OD:** 1.27 ± 0.04 cm (0.50 ± 0.015 in)  
**Leakage Current (300 V collection potential):** Less than 1013 A at 10 min polarization time, less than 1014 A at 2 hr polarization time  
**Intensity Limits:** Continuous beam: 4.86 kR/min (1% recombination loss)  
**Pulsed Beam:** 51.5 mR/pulse (1% recombination loss)  
**Maximum Pulse Repetition Rate:** 3.3 kHz  
**Cable Length:** 3' (0.9 m)  
**Operating Voltage:** -300V

Item #	Description
300-505	CT Ion Chamber, 3.2 cc, with triax BNC: used with the 35040 (ATD), TRIAD™ and TRIAD™ TnT
300-515	CT Ion Chamber, 3.2 cc, with coax BNC for signal and banana plug for bias: used with the 4000, 8000 and RAD-CHECK® PLUS Dosimeter

## 10 cc CT ION CHAMBER



### Specifications

**Detector Type:** Vented air ion chamber  
**Volume:** 10.1 cc  
**Sensitive Length:** 10.0 cm  
**Chamber Material:** Acrylic (PMMA)  
**Chamber Outside Diameter:** 0.5 in ± 0.015 in (12.7 mm ± 0.4 mm)  
**Chamber Inside Diameter:** 0.45 in (11.4 mm)  
**Chamber Wall Thickness:** 77 mg/cm<sup>2</sup>

**Electrode Material:** Aluminum, 1100  
**Sensitivity:** 3.2 R•cm/nC (nominal) or 0.3/n  
**Standard Calibration:** 100 kVCP, 5.5 mm Al HVL (NIST Tech. M100)  
**Response Uniformity Along Axis:** ± 3% over central 90% of active length  
**Beam Orientation:** Normal to chamber axis  
**Leakage Current:** (300 V collection potential) Less than 10<sup>-14</sup>A at 10 min polarization time  
**Intensity Limits:** Continuous beam: 31.6 R/Sec, (1% recombination loss)  
**Pulsed Beam:** 15.8 mR/pulse (1% recombination loss)  
**Collection Time:** 0.478 mSec  
**Cable Length:** 3' (0.9 m)  
**Operating Voltage:** -300 V

Item #	Description
300-510	CT Ion Chamber High Sensitivity, 10 cc for multislice CT, with triax BNC: used with the 35040 ATD and other electrometer/dosimeters, including TRIAD™ and TRIAD™ TnT

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## EXRADIN FARMER-TYPE CHAMBERS

Model A12, A12S, and A19

For absolute dosimetry calibrations in water, air or other phantom material



Model A12



Model A12S



Model A19

### Features

- Proven guard design yields stable, precise measurements and minimizes settling time by creating uniform field lines
- Shell, collector, and guard are made of durable, long lasting Shonka conductive plastic
- Use of homogeneous material throughout the chamber minimizes perturbation of the beam due to the presence of the chamber and optimizes measurements
- Axially symmetric design of the chamber provides an uniform, isotropic response
- Inherent waterproof construction eliminates need for additional protective coverings
- A matching 2.8 mm thick 60Co build-up cap of C552 Shonka air-equivalent plastic is provided for air calibrations and measurements
- Additional build-up caps of Delrin and brass are available
- Ionization collection efficiency is 99.9% or better

Waterproof construction and two piece removable stem makes it ideal for use in water phantoms. The chamber vents through a flexible tube that surrounds the triaxial cable, ensuring the collecting volume is in pressure equilibrium with the surroundings. The design assures there are no stem or voltage soakage effects, providing precise and reliable measurements.

Farmer-type Chambers are constructed of rugged C552 Shonka air-equivalent plastic, providing excellent conductivity and years of reliable use. Rigorous one meter drop test proves ruggedness and reliability.

### Model A12

For absolute dosimetry calibrations in water, air, or other phantom material. The Model A12 is completely characterized in TG 51 and TRS 398. Two separate stem pieces of 5.1 cm and 12.7 cm can be coupled together for ease of use. Collecting volume is 0.65 cc.

### Model A12S

The Model A12S thimble chamber is a modified Farmer-Type Chamber Model A12. The collector length of the Model A12S is approximately one-third the size of the Model A12, which confines its collecting volume to more of the tip of the chamber. Collecting volume is 0.25 cc.

### Model A19

The Classic Farmer-type Chamber is fully guarded in the Exradin tradition of quality design to eliminate perturbation and minimize settling times and provides precise absolute dosimetry calibrations in water, air, or other phantom material. The Classic Farmer-type Chamber fits existing plastic phantom cavities and build-up caps. Collection volume is 0.63 cc.



CE0413, Designed to meet IEC 60601-1, IEC 60731

Item #	Description
300-240-A12	Exradin A12 Farmer Type Chamber, 0.65 cc
300-240-A12S	Exradin A12S Farmer Type Chamber, 0.25 cc
300-240-A19	Exradin A19 Farmer Type Chamber, 0.63 cc

### EXRADIN IONIZATION CHAMBERS MATERIAL CODES:

**A** = C552 Shonka Air Equivalent Plastic  
**P** = D400 Polystyrene Equivalent Plastic

**T** = A150 Shonka Tissue Equivalent Plastic  
**M** = Magnesium

Specifications	Item 300-240-A12	Item 300-240-A12S	Item 300-240-A19
<b>Exradin</b>	Model 12	Model 12S	Model 19
<b>Collecting Volume:</b>	0.65 cm <sup>3</sup>	0.25 cm <sup>3</sup>	0.63 cm <sup>3</sup>
<b>Nominal Calibration Factor:</b>	5 R/nC	14 R/nC	5 R/nC
<b>Centroid of Collecting Volume:</b>	12.9 mm from chamber tip	5.8 mm from chamber tip	12.8 mm from chamber tip
<b>Collector Diameter:</b>	1.0 mm	1.0 mm	1.0 mm
<b>Outside Diameter Sensitive Region:</b>	7.1 mm	7.1 mm	7.0 mm
<b>Wall Thickness:</b>	0.5 mm	0.5 mm	0.5 mm
<b>Stem:</b>	1.3 cm OD black phenolic, two piece w/ 5.1 & 12.7 cm segments	1.3 cm OD black phenolic, two piece w/ 5.1 & 12.7 cm segments	Non-removable 1.3 cm OD x 4.6 cm long black anodized aluminum
<b>Wall, Collector and Guard Material:</b>	A	A	A
<b>Maximum Polarizing Potential:</b>	1000 V		
<b>Inherent Leakage Currents:</b>	10 <sup>-15</sup> A		
<b>Cable:</b>	50 Ohms, 29 pF/ft, 1.5 m long		
<b>Signal Connector:</b>	Triax BNC-M		
<b>High Voltage Connector:</b>	Integral with triaxial connector		
<b>Venting:</b>	Vented to the Ambient via the flexible vent tube surrounding the triaxial cable		
<b>Included 60CO Build-up Cap:</b>	Wall thickness of 2.8 mm; constructed of C552		
<b>Nominal Collection Efficiency:</b>	1.000		
<b>Waterproof:</b>	Yes		

## IBA DOSIMETRY DIODE DETECTORS



322-610

322-605

322-600

322-615

### Applications

The IBA Dosimetry Diode Detectors are designed for depth dose and profile measurements in water and in air and for output factor measurements in small photon beams.

The IBA Dosimetry Diode Detectors are an excellent choice in relative field analysis as well as output factor measurements. They are based on the 3rd generation of pSi semiconductors. The high doped p-type silicon detector chips, specifically designed for radiation therapy applications, have since their introduction in 1992 been the natural choice for measurements where high spatial resolution is required. The accuracy and lifetime of the diode detectors is unsurpassed in the field of radiation therapy today.

Item 300-605 EFD<sup>3G</sup> Electron Diode and Item 300-615 SFD Stereotactic Diode provides direct electron depth dose, no need for ionization to dose conversion.

- **Waterproof**
- **Have a proven dose rate and energy independence**
- **Have a high uniform spatial resolution in the beam plane and precise definition of the measurement depth (accurately shaped penumbras in the whole beam plane using the same detector orientation)**
- **Independent of bias, pressure and moisture, very robust, always reliable, no "warm-up" time**
- **High durability: 3 year warranty - low lifetime costs**

Diode	Item 322-600	Item 322-605	Item 322-610	Item 322-615
Effective Measurement Point	< 0.9 mm	< 0.9 mm	NA	< 0.9 mm
Chip Size (Side / Thickness)	2.5 / 0.5 mm	2.5 / 0.5 mm	2.5 / 0.5 mm	0.95 / 0.5 mm
Geometric Form of Active Area	Circled	Circled	Circled	Circled
Diameter of Active Area	2 mm	2 mm	2 mm	0.6 mm
Thickness of Active Volume	0.06 mm	0.06 mm	0.06 mm	0.06 mm

Item #	Description
322-600	PFD <sup>3G</sup> Photon Diode Detector
322-605	EFD <sup>3G</sup> Electron Diode Detector
322-610	RFD <sup>3G</sup> Reference Diode Detector
322-615	SFD Stereotactic Diode Detector





# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## EXRADIN PARALLEL PLATE CHAMBERS

Model A10, Model 11 and Model 11TW

For use in routine electron beam measurements and for depth-dose studies in electron, photon, proton, and neutron beams.

- The TG-51 Protocol requires a parallel plate chamber for electron energies  $\leq 6$  MeV.
- The **Model 11** is **inherently waterproof** without any additional cap or covering. The **11TW** and the **A10** **require waterproof caps** due to their Kapton film windows. Both chambers include a water proofing cover for TG-51.
- Fully guarded for extremely uniform field lines and negligible variation of polarizing potential, thus polarity corrections are not needed.
- Exceptionally wide 4.14 mm guard rings exceed the benefits described in TG-39 for 3 mm rings. This allows for no perturbation in field line, even at low electron energies, ensuring precision in depth-dose measurements.
- Strong, reliable construction with homogenous conductive plastic construction allows for little to no scatter when compared to other similar type chambers.
- Long rigid stem allows accurate positioning of the chamber. No stem effects are present.
- Energy dependence is only influenced by the stopping power correction, a type dependent correcting is not necessary.
- The chamber vents through a flexible tube that surrounds the triaxial cable. This vent tube is sealed to the chamber body and open near the connector.
- The **Model 11's** larger volume is ideally suited for routine electron field measurements in a water phantom. A Cobalt-60 buildup cap is available.
- **Model A10's** small measuring volume allows for excellent spatial resolution. It is ideally suited for smaller electron field measurements in a water phantom for absolute electron dosimetry calibration.
- **Model A10** is capable of measuring in zero depth in the buildup region of an electron field.



Item #	Description
300-225-A10	Exradin A10 Planar Electron, Markus Type, 0.05 cc
300-230-A11	Exradin A11 Spokas, Parallel Plate Chamber, 0.62 cc
300-230-P11	Exradin P11 Spokas, Parallel Plate Chamber, 0.62 cc
300-230-T11	Exradin T11 Spokas, Parallel Plate Chamber, 0.62 cc
300-232-A11TW	Exradin A11TW Thin Window Parallel Plate, 0.94 cc
300-232-P11TW	Exradin P11TW Thin Window Parallel Plate, 0.94 cc
300-232-T11TW	Exradin T11TW Thin Window Parallel Plate, 0.94 cc

### EXRADIN IONIZATION CHAMBERS MATERIAL CODES:

**A = C552 Shonka Air Equivalent Plastic**  
**IP = D400 Polystyrene Equivalent Plastic**

**T = A150 Shonka Tissue Equivalent Plastic**  
**M = Magnesium**

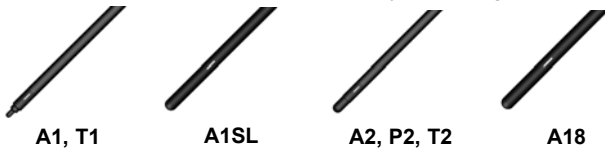
Specifications	Item 300-225-A10	Item 300-230-A11, P11, T11	Item 300-232-A11TW, P11TW, T11TW
<b>Exradin</b>	Model 10	Model 11	Model 11TW
<b>Collecting Volume:</b>	0.05 cm <sup>3</sup>	0.6 cm <sup>3</sup>	0.94 cm <sup>3</sup>
<b>Nominal Calibration Factor:</b>	60 R/nC (TG-21) 527.4 Gy/ $\mu$ C (Air Kerma)	5.5 R/nC (TG-21) 48.3 Gy/ $\mu$ C (Air Kerma)	3.4 R/nC (TG-21) 29.9 Gy/ $\mu$ C (Air Kerma)
<b>Centroid of Collecting Volume:</b>	1.0 mm from window surface	2.0 mm from window surface	1.5 mm from window surface
<b>Collector Diameter:</b>	5.4 mm	20.0 mm	20.0 mm
<b>Window-Collector Gap:</b>	2.0 mm	2.0 mm	3.0 mm
<b>Window:</b>	Conductive Kapton Film, 3.86 mg/cm <sup>2</sup>	1.0 mm thick	Conductive Kapton Film, 3.86 mg/cm <sup>2</sup>
<b>Body, Collector and Guard Material:</b>	A	A, P or T	A, P or T
<b>Maximum Polarizing Potential:</b>	< 1000 volts	< 1000 volts	< 1000 volts
<b>Inherent Leakage Currents:</b>	<10 <sup>-15</sup> amps	<10 <sup>-15</sup> amps	<10 <sup>-15</sup> amps
<b>Cable:</b>	50 Ohms, 29 pF/F, 1.5 m Long	50 Ohms, 29 pF/F, 1.5 m Long	50 Ohms, 29 pF/F, 1.5 m Long
<b>Stem:</b>	8.9 mm O.D. Black Delrin 1 piece 7.6 cm L; not removable	11.1mm OD Black Phenolic, 2 piece 10.0 + 12.7 cm L.; removable	11.1mm OD Black Phenolic 2 piece(10.0 + 12.7 cm L. ; removable
<b>Signal Connector:</b>	Triaxial BNC-M		
<b>High Voltage Connector:</b>	Integral with Triaxial Connectors		
<b>Venting:</b>	Vented to the ambient via the flexible vent tube surrounding the triaxial cable		

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## EXRADIN THIMBLE CHAMBERS

Model 1, Model A1S, Model 2, and Model A18

For relative dosimetry scanning and measuring points in water, air or other phantom material.



### Exradin Thimble Chambers

- Proven guard design yields stable, precise measurements and minimizes settling time by creating uniform field lines
- Shell, collector, and guard are all made of durable, long lasting Shonka conductive plastic
- Use of homogeneous material throughout the chamber minimizes perturbation of the beam due to the presence of the chamber and optimizes measurements
- Axially symmetric design of the chamber provides a uniform, isotropic response
- Inherent waterproof construction eliminates need for additional protective coverings
- Ionization collection efficiency is always 99.9% or better

The chambers vent through a flexible tube that surrounds the triaxial cable, ensuring the collecting volume is in pressure equilibrium with the surroundings. The designs assure there are no stem or voltage soakage effects, providing precise and reliable measurements.

### Model 1

The Exradin Miniature Shonka Thimble Chamber provides a perfect balance between fast scanning and point dose measurements within 1 cm in water, air, or other phantom material. Model A1 is completely characterized in TG 51 and TRS 398. The chamber features exceptional spatial resolution for relative dosimetry scanning and is capable of measuring small field sizes of 6 mm by 8 mm for accurate point dose measurements. Its waterproof construction and two piece removable stem makes it ideal for use in water phantoms. Two separate stem pieces of 5.1 cm and 12.7 cm can be coupled together for ease of use.

#### EXRADIN CHAMBER MATERIAL CODES:

A = C552 Shonka Air Equivalent Plastic  
 T = A150 Shonka Tissue Equivalent Plastic  
 P = D400 Polystyrene Equivalent Plastic

### Model A1SL

The Model A1SL Thimble Chamber is the Slim-Line version of Model A1. It has the exact same internal dimensions and collecting volume as the Model A1, yet the entire chamber has the uniform diameter of 6.4 mm (0.250"), ideal when using a small phantom. Non-removable one piece stem for easy, precise positioning. Small collection volume allows for optimal spatial resolution and exact characterization of a small area of the beam in depth-dose measurements.

### Model A2

The Spokas Thimble Chamber permits the precise measurement of exposure and air kerma in photon beams and of absorbed dose in photon, electron, proton, neutron, and mixed photon-neutron beams. Waterproof construction and two piece removable stem makes it ideal for use in water phantoms. Two separate stem pieces of 5.1 cm and 12.7 cm can be coupled together for ease of use.

### Model A18

Features exceptional spatial resolution for relative dosimetry scanning and is capable of measuring small field sizes of 6.9 mm by 8.3 mm for accurate point dose measurements. Waterproof construction. Non-removable one piece stem for easy, precise positioning. A matching 2.0 mm thick Cobalt-60 build-up cap of C552 Shonka air-equivalent plastic is provided for air calibrations and measurements. <sup>60</sup>Co Build-up cap is included with wall thickness of 2.0 mm, constructed of C552 Shonka air equivalent plastic.

CE CE0413, Designed to meet IEC 60601-1, IEC 60731

Item #	Description
300-205-A1	Exradin A1 Miniature Shonka, 0.056 cc
300-205-T1	Exradin T1 Miniature Shonka, 0.056 cc
300-205-A1SL	Exradin A1SL Slim-Line Miniature Shonka, 0.056 cc
300-210-A2	Exradin A2 Spokas Thimble Chamber, 0.5 cc
300-210-P2	Exradin P2 Spokas Thimble Chamber, 0.5 cc
300-210-T2	Exradin T2 Spokas Thimble Chamber, 0.5 cc
300-205-A18	Exradin A18 Shonka Thimble Chamber, 0.125 cc

Specifications	Item 300-205-A1, and T1	Item 300-205-A1SL	Item 300-210-A2, P2 and T2	Item 300-205-A18
<b>Exradin</b>	Model 1	Model A1SL	Model 2	Model A18
<b>Collecting Volume:</b>	0.057 cm <sup>3</sup>	0.057 cm <sup>3</sup>	0.54 cm <sup>3</sup>	0.125 cm <sup>3</sup>
<b>Nominal Calibration Factor:</b>	60 R/nC	60 R/nC	6 R/nC	25 R/nC
<b>Centroid of Collecting Volume:</b>	4.0 mm from tip of chamber	4.1 mm from tip of the chamber	7.0 mm from tip of chamber	4.9 mm from tip of chamber
<b>Collector Diameter:</b>	1.0 mm	1.0 mm	4.6 mm	1.0 mm
<b>Outside Diameter Sensitive Region:</b>	6.0 mm	6.35 mm	11.4 mm	6.9 mm
<b>Wall Thickness:</b>	1.0 mm	1.1 mm	1.0 mm	1.0 mm
<b>Wall, Collector and Guard Material:</b>	A or T	A	A, P or T	A
<b>Maximum Polarizing Potential:</b>	1000 volts	1000 volts	1000 volts	1000 volts
<b>Inherent Leakage Currents:</b>	10 <sup>-15</sup> Amps	10 <sup>-15</sup> Amps	10 <sup>-15</sup> Amps	10 <sup>-15</sup> Amps
<b>Cable:</b>	50 Ohms, 29 pF/f, 1.5 m long	50 Ohms, 29 pF/f, 1.5 m long	50 Ohms, 29 pF/f, 1.5 m long	50 Ohms, 29 pF/f, 1.5 m long
<b>Signal Connector:</b>	Triaxial BNC-M	Triaxial BNC-M	Triaxial BNC-M	Triaxial BNC-M
<b>High Voltage Connector:</b>	Integral w/triaxial connectors	Integral w/triaxial connectors	Integral w/triaxial connectors	Integral w/triaxial connectors
<b>Stem:</b>	1.3 cm OD Black phenolic two piece with 5.1 & 12.7 cm segments	Non-removable 0.64 cm OD x 5.6 cm L, black anodized aluminum	1.3 cm OD Black phenolic two piece with 5.1 & 12.7 cm segments	Non-removable 0.69 cm OD x 5.5 cm L, black anodized aluminum
<b>Waterproof:</b>	Yes	Yes	Yes	Yes

Vented to the ambient via the flexible vent tube surrounding the triaxial cable

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

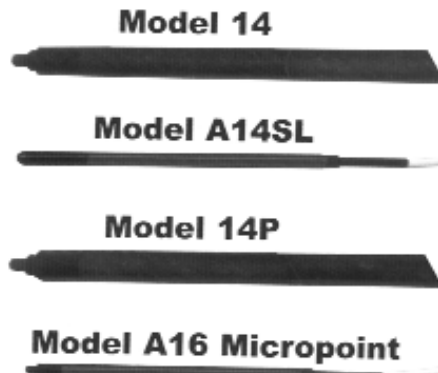
## EXRADIN MICROCHAMBERS

Model 14, Model 14P, Model A14SL and Model A16

For assessing pinpoint radiation fields for orthovoltage, x-rays and stereotactic, and superficial skin therapy.

- Axially symmetric design, homogenous construction, and complete guarding for uniform field lines.
- Extremely small volumes allow for exceptional spatial resolution and exact pinpoint characterization of a small area of the beam and beam profile measurements in a water phantom or water equivalent material.
- **Inherently waterproof** construction.
- Uniform isotropic response on cylindrical axis measuring volume.
- Two separate stem pieces of 10.1 cm and 12.7 cm can be coupled together for easy mounting.
- The **Model A14SL** stem keeps the entire chamber with stem only 0.64 cm in diameter.
- The chamber vents through a flexible tube that surrounds the triaxial cable. This vent tube is sealed to the chamber body and open near the connector.
- Extremely small field sizes of 4 x 6 mm for **Model 14** and **A14SL** and 4 x 4 mm for **Model A16** allow for accurate measurements without partial volume effects.

**A16 Micropoint** chamber is designed primarily for applications like IMRT and stereotactic surgery, which use Cobalt and higher energy beams. A typical calibration factor for air kerma in a cobalt beam is  $3.5 \times 10^9$  Gy/C.



CE

Item #	Description
300-250-A14	Exradin A14 Microchamber, 0.009 cc
300-250-T14	Exradin T14 Microchamber, 0.009 cc
300-250-A14SL	Exradin A14ASL Microchamber, 0.009 cc
300-252-A14P	Exradin A14P Planar Microchamber, 0.002 cc
300-252-T14P	Exradin T14P Planar Microchamber, 0.002 cc
300-253-A16	Exradin A16 Micropoint, 0.007 cc

### EXRADIN IONIZATION CHAMBERS MATERIAL CODES:

A = C552 Shonka Air Equivalent Plastic  
IP = D400 Polystyrene Equivalent Plastic

T = A150 Shonka Tissue Equivalent Plastic  
M = Magnesium

Specifications	Item 300-250-A14, T14	Item 300-250-A14SL	Item 300-252-A14P, T14P	Item 300-253-A16
<b>Exradin</b>	Model 14	Model 14SL	Model 14P	Model 16
<b>Collecting Volume:</b>	0.009 cm <sup>3</sup>	0.009 cm <sup>3</sup>	0.002 cm <sup>3</sup>	0.007 cm <sup>3</sup>
<b>Nominal Calibration Factor:</b>	365 R/nC (TG-21) 3.2 Gy/nc (Air Kerma)	365 R/nC(TG-21) 3.2 Gy/nc (Air Kerma)	1430 R/nC(TG-21) 12.6 Gy/nc (Air Kerma)	400 R/nC (TG-21), 3.5 Gy/nc (Air Kerma)
<b>Centroid of Collecting Volume:</b>	2.0 mm from tip of shell	2 mm from tip of shell	1.5 mm from tip of shell	1.7 mm from tip of Shell
<b>Collector Diameter / Length:</b>	1.5 mm x 0 Length	1.5 mm x 0 Length	1.5 mm x 0 Length	0.3 mm x 1.3 mm Long
<b>Outside Diameter Sensitive Region:</b>	6.0 mm	6.25 mm	6.0 mm	3.4 mm
<b>Wall Thickness:</b>	1.0 mm	1.1 mm	1.0 mm	0.5 mm
<b>Wall, Collector and Guard Material:</b>	A or T	A	A or T	A
<b>Maximum Polarizing Potential:</b>	< 1000 volts			
<b>Inherent Leakage Currents:</b>	-10 <sup>-15</sup> Amps			
<b>Cable:</b>	50 Ohms, 29 pF/f, 1.5 m			
<b>Signal Connector:</b>	Triaxial BNC-M			
<b>High Voltage Connector:</b>	Integral with Triaxial Connectors			
<b>Venting:</b>	Vented to ambient via the flexible vent tube surrounding the triaxial cable			
<b>Stem:</b>	12.7 mm OD Black Phenolic, two piece 10.1 and 12.7 cm L. ; removable.			6.4 O.D. aluminum, one piece 10.1 cm L, not removable

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## SCANDATRONIX / WELLHOFFER FARMER TYPE CHAMBERS



- Waterproof
- Air ionization chamber
- Vented through waterproof sleeve
- Fully guarded
- Includes Build-up Cap, with individual factory calibration certificate and user's guide

Item #	Description
300-720	Farmer Type Chamber FC65-P



- Waterproof
- Air ionization chamber
- Vented through waterproof sleeve
- Fully guarded
- Includes Build-up Cap, with individual factory calibration certificate and user's guide

Item #	Description
300-722	Farmer Type Chamber FC65-G



- Waterproof
- Air ionization chamber
- Vented through waterproof sleeve
- Fully guarded
- Includes Build-up Cap, with individual factory calibration certificate and user's guide

Item #	Description
300-725	Farmer Type Chamber FC23-C

Specifications	Item 300-720	Item 300-722	Item 300-725
Scanditronix / Wellhofer	FC65-P	FC65-G	FC23-C
Volume (Nominal)	0.65 cm <sup>3</sup>	0.65 cm <sup>3</sup>	0.23 cm <sup>3</sup>
Total Active Length	23.1 mm	23.1 mm	8.8 mm
Wall Thickness	0.4 mm	0.4 mm	0.4 mm
Central Electrode Material	Aluminum	Aluminum	C552
Diameter of Inner Electrode	1.0 mm	1.0 mm	1.0 mm
Wall Thickness of Build-Up Cap for <sup>60</sup> Co	3.9 mm	3.9 mm	3.9 mm
Connector	BNC-M	BNC-M	BNC-M
Cable	1.4 m	1.4 m	1.4 m

C

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## SCANDATRONIX / WELLHOFER PARALLEL PLATE CHAMBERS



- Waterproof
- Air ionization chamber
- High spatial resolution
- Fully guarded
- Vented through waterproof sleeve
- Suitable for phantoms and holders designed for Markus chamber
- Supplied with individual factory calibration certificate and user's guide



- Waterproof
- Air ionization chamber
- Vented through waterproof sleeve
- Fully guarded
- Superior physics characteristics:
  - stabilization time after polarity change approx. 30 s
  - polarity effect < 1% for all usable energies, field sizes and depths at linear accelerators
- Supplied with individual factory calibration certificate and user's guide

Item #	Description
300-735	Parallel Plate Chamber PPC05

Item #	Description
300-740	Parallel Plate Chamber PPC40



- Waterproof
- Air-vented
- Fully guarded
- Low polarity effect
- Thin front wall minimizes contamination of the beam and allows measurements at shallow depth
- High accuracy even at low electron energies (perturbation factor very close to unity due to large guard ring)
- Supplied with an individual factory calibration certificate and scientific papers
- Specify BNC or TNC connector

Item #	Description
300-745	Parallel Plate Chamber NACP

Specifications	Item 300-735	Item 300-740	Item 300-745
Scanditronix / Wellhofer	PPC05	PPC40	NACP
Volume (Nominal)	0.05 cm <sup>3</sup>	0.4 cm <sup>3</sup>	0.16 cm <sup>3</sup>
Cylinder Height	0.6 mm	2.0 mm	2.0 mm
Front Window Thickness	1.0 mm	1.0 mm	-
Graphite	-	-	0.5 mm
Mylar Foil	-	-	0.1 mm
Diameter of Inner Electrode	9.9 mm	16.0 mm	10.0 mm
Guard Ring Width	3.5 mm	4.0 mm	3.0 mm
Polarity Effect	-	-	0.5%
Connector	BNC-M	BNC-M	BNC-M
Cable	1.4 m	1.4 m	2.0 m

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## SCANDATRONIX / WELLHOFER COMPACT CHAMBERS



- Waterproof
- Air ionization chamber
- High uniform spatial resolution
- Vented through waterproof sleeve
- Fully guarded
- Supplied with individual factory calibration certificate and user's guide

Item #	Description
300-750	Compact Chamber CC01



- Waterproof
- Air ionization chamber
- High uniform spatial resolution
- Vented through waterproof sleeve
- Fully guarded
- Supplied with individual factory calibration certificate and user's guide

Item #	Description
300-755	Compact Chamber CC04



- Waterproof
- Air ionization chamber
- Vented through waterproof sleeve
- Fully guarded
- Supplied with individual factory calibration certificate and user's guide
- Designed for axial beam entrance
- Sphere-symmetrically designed to obtain resolution for all beam directions. (axial and radial, according to ICRU)

Item #	Description
300-760	Compact Chamber CC08



- Waterproof
- Air ionization chamber
- Vented through waterproof sleeve
- Fully guarded
- Used for radial and axial beam incidence

Item #	Description
300-767	Compact Chamber CC13-S
300-768	CC13-S Holder for RFA Phantoms



- Waterproof
- Air ionization chamber
- Vented through waterproof sleeve
- Fully guarded
- PTB approved [15.101 / 97.01]
- Used for radial and axial beam incidence
- Supplied with individual factory calibration certificate and user's guide

Item #	Description
300-765	Compact Chamber CC13



- Waterproof
- Air ionization chamber
- Vented through waterproof sleeve
- Fully guarded
- PTB approved [15.101 / 98.01]
- Supplied with individual factory calibration certificate and user's guide

Item #	Description
300-770	Compact Chamber CC25

Specifications	Item 300-750	Item 300-755	Item 300-760	Item 300-767	Item 300-765	Item 300-770
Scanditronix / Wellhofer	CC01	CC004	CC08	CC13-S	CC13	CC25
Volume (Nominal)	0.01 cm <sup>3</sup>	0.04 cm <sup>3</sup>	0.08 cm <sup>3</sup>	0.13 cm <sup>3</sup>	0.13 cm <sup>3</sup>	0.25 cm <sup>3</sup>
Total Active Length	3.6 mm	3.6 mm	4.0 mm	5.8 mm	5.8 mm	10.0 mm
Wall Thickness	0.5 mm	0.4 mm	0.4 mm	0.88mm	0.4 mm	0.4 mm
Diameter of Inner Electrode	0.35 mm	1.0 mm	1.0 mm	1 mm	1.0 mm	1.0 mm
Connector	BNC-M	BNC-M	BNC-M	BNC-Banana Plug	BNC-M	BNC-M
Cable	1.4 m	1.4 m	1.4 m	1.4 m	1.4 m	1.4 m

C

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

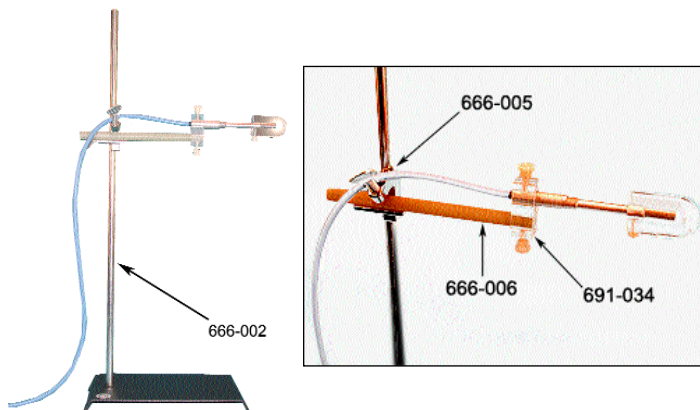
## CHAMBER SUPPORT STAND

The steel chamber support stand will hold an ion chamber for "in air" measurements. The base of the stand is 6" x 9" (15.24 x 22.86 cm) and the vertical post is 24" (61 cm). The support stand includes a 90° clamp which holds a 15 cm rod. A farmer style chamber holder is also included and attaches to the 15 cm fiberglass rod.

### Item 666-000 Chamber Support Stand Includes

- Item 666-002 Support Base and Post
- Item 666-005 90° Clamp
- Item 666-006 Rod for Chamber Support
- Item 691-034 Farmer Style Chamber Holder

Item	Description
666-000	Chamber Support Stand



## CYLINDRICAL SCATTER PHANTOMS AND STAND

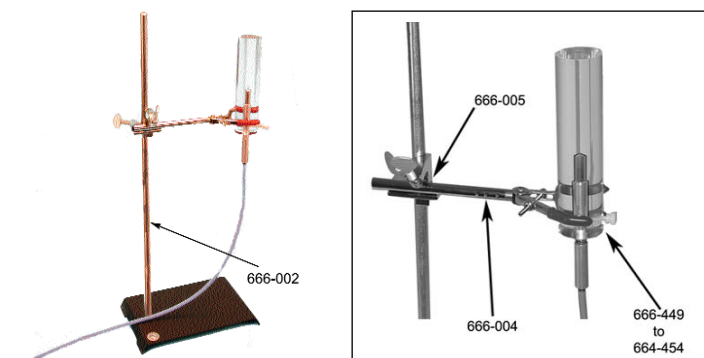
### Item 664-448 Cylindrical Scatter Phantom Support Stand Includes

- Item 666-002 Support Base and Post
- Item 666-005 90° Clamp
- Item 666-004 Three Prong Adjustable Clamp

Item	Description
664-448	Cylindrical Scatter Phantom Support Stand

Item	Cylindrical Scatter Phantom	Material
664-449	for PTW 31002 / 31010	Acrylic
664-450	for PTW Farmer Chamber	Acrylic
664-451	for Exradin A-12 Chamber	Polystyrene
664-452	for Exradin A-2 Chamber	Acrylic
664-454	for Exradin A-14 Chamber	Acrylic

Items are Custom Made and Nonreturnable



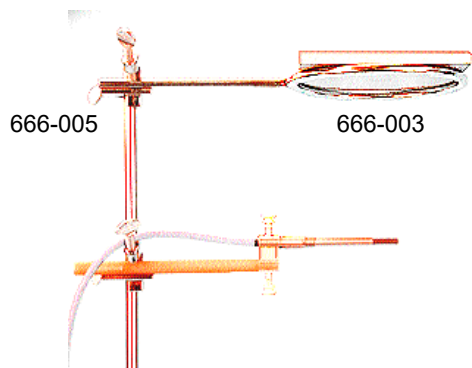
The Cylindrical Scatter Phantom is used vertically to check the collimator scatter.

The steel Cylindrical Scatter Phantom Support Stand will hold a Cylindrical Scatter Phantom vertically. The base of the stand is 6" x 9" (15.24 x 22.86 cm) and the vertical post is 24" (61 cm). The support stand includes a three prong adjustable clamp that attaches to the vertical post using a 90° clamp.

## EXTENSION RING

The steel extension ring has a 6" (15.24 cm) inside diameter and an overall length of 13.75" (35 cm). It attaches to the support stand using a 90° clamp.

Item	Description
666-003	Extension Ring, 6" (15.24 cm) ID
666-0034	Extension Ring, 4" (10.16 cm) ID
666-005	90° Clamp, Three-Prong Adjustable





## PROBE HOLDER



NASA Space Shuttle engineering assures smooth and effortless operation. Performs like a robot arm in zero gravity. Fingertip control raises, lowers, and pivots (360°) the perfectly balanced holder wherever desired. Moves in all directions and the arm articulates at three points. Weighted die-cast metal base and spring counterbalance permit fluid movement with superior stability.

### Item 666-010 Probe Holder Includes

- 21" (53.34 cm) Metal Arm
- 8" (20.32 cm) Diameter Metal Base
- Probe Holder

### Specifications

**Metal Arm:** 21" (53.34 cm)

**Metal Base:** 8" (20.32 cm) Diameter

**Diameter:** 10 mm and 14 mm

**Weight:** 6 lb (2.8 kg)

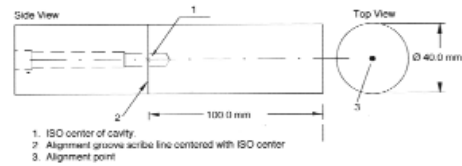
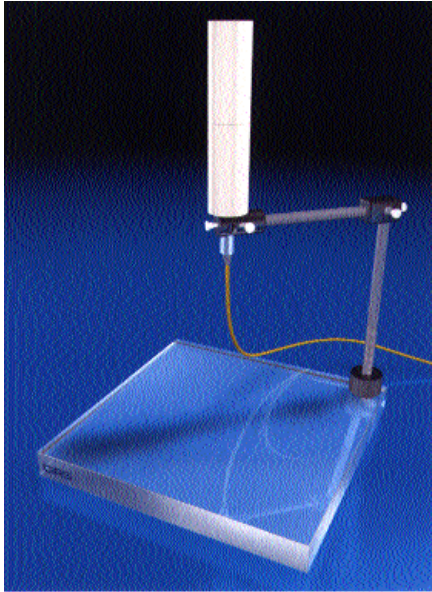
Item	Description
666-010	Probe Holder

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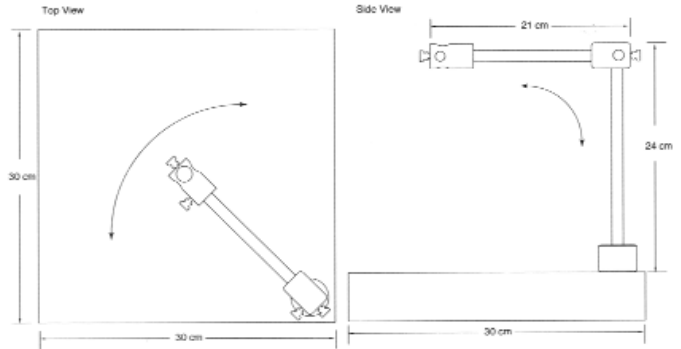
# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## WATER EQUIVALENT MINI PHANTOM

Permits Precise Evaluation of Scatter



Stand: Acrylic base with adjustable holder and carbon rods



The Water Equivalent Mini Phantom for Radiotherapy eliminates scatter radiation and X-Ray beam electron contamination during the ion chamber measurements at a reference depth of 10 cm. Phantom material is Plastic Water® and precise machining improves the dosimetric accuracy and reliability of LINAC beam MU calibrations.

The phantom satisfies the requirements of ESTRO Booklet 3 “Monitor unit calculation for high energy photon beams” for Output, Volume-Scatter and Scatter Primary Ratio measurements.

The Mini Phantom provides an excellent tissue simulation and opportunity of true dose comparison with the 30 x 30 cm Plastic Water® slab phantom. By positioning the ion chamber at a reference depth of 10 cm, the Mini Phantom allows the physicist to isolate and investigate the influence of scatter radiation on a reference dose measured in a slab phantom.

The Mini Phantom stand allows for vertical or horizontal positioning of a 0.6 cc Farmer and smaller diameter chambers. Precise three axis rotation improves measurement accuracy.

### Specifications

**Characteristics:** Water-Equivalent for photon beams 150 keV - 100 MeV

**Composition:** Plastic Water®

**Shape:** Cylindrical

**Dimensions:** As per drawing

**Standard Cavity:** Farmer 0.6 cc Ion Chamber

**Optional Cavities:** By request

Item #	Description
664-500	Water Equivalent Mini Phantom
664-502	Stand for Mini Phantom

## $S_C$ BRASS MINI PHANTOM

$S_C$  for Multivoltage Photon Beams



Item	Description
664-475	Sc Brass Mini Phantom

Specify Chamber and Dimensions

### Task Group 74

In-Air output ratio ( $S_C$ ) is defined as the ratio of primary collision water kerma in free-space,  $K_p$ , per monitor unit between an arbitrary collimator setting and the reference collimator setting at the same location. Mini phantoms with sufficient lateral and longitudinal thickness to eliminate electron contamination and maintain transient electron equilibrium are recommended for the measurement of  $S_C$ . Mini phantoms made of high-Z material are used to measure  $S_C$  for small fields (e.g. IMRT or stereotactic radiosurgery).

Reference: Report of AAPM Therapy Physics Committee Task Group 74: In-air output ratio,  $S_C$ , for megavoltage photon beams - Timothy C Zhu<sup>1)</sup> - University of Pennsylvania, Philadelphia, PA; Andres Ahnesjö - Uppsala University, 751 85 Uppsala, Sweden and Nucletron AB, Box 1704, 751 47 Uppsala, Sweden; Kwok Leung Lam - University Michigan, Ann Arbor, MI 48109; X. Allen Li - Medical College of Wisconsin, Milwaukee, WI 53226; Chang-Ming Charlie Ma - Fox Chase Cancer Center, Philadelphia, PA 19111; Jatinder R. Palta - University of Florida, Gainesville, FL 32610; Michael B. Sharpe - Princess Margret Hospital, Toronto, ON M5G 2M9, Canada; Bruce Thomadsen - University of Wisconsin, Madison, WI 53705; Ramesh C. Tailor - RPD, UT MD Anderson Cancer Center, Houston, TX 77030 - Med. Phys. 36 (11), November 2009.

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## BUILD-UP CAPS FOR 'IN AIR' MEASUREMENTS

Custom Caps Available



Build-up Caps for the **Capintec PR-06C or G, 0.6cm<sup>3</sup> Farmer Style Chamber** with a 0.28 mm wall thickness of air equivalent plastic and a density of 1.785 g/cm<sup>3</sup>.

These build-up caps **fit over the Cobalt 60 polystyrene** (density 1.04 g/cm<sup>3</sup>) build-up cap that has a wall thickness of 5.2 mm and a **17.5 mm outside diameter**.

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Polystyrene Density 1.05 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	660-104	4.30 mm	660-404	1.87 mm	660-604	4.85 mm	660-704	0.60 mm
15 mm	6MV	660-106	7.7 mm	660-406	3.40 mm	660-606	8.74 mm	660-706	1.07 mm
24 mm	10MV	660-110	15.3 mm	660-410	6.70 mm	660-610	17.4 mm	660-710	2.12 mm
27 mm	15MV	660-115	17.8 mm	660-415	7.80 mm	660-615	20.28 mm	660-715	2.48 mm
30 mm	18MV	660-118	20.3 mm	660-418	8.90 mm	660-618	23.17 mm	660-718	2.83 mm
35 mm	20MV	660-120	24.6 mm	660-420	10.70 mm	660-620	27.97 mm	660-720	3.42 mm

D-Max In Water	Nominal Energy	Lead Density 11.35 g/cm <sup>3</sup>		Copper Density 8.90 g/cm <sup>3</sup>		Plastic Water Density 1.02 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	660-1404	0.45 mm	660-1504	0.57 mm	660-1704	4.99 mm
15 mm	6MV	660-1406	0.80 mm	660-1506	1.02 mm	660-1706	8.91 mm
24 mm	10MV	660-1410	1.59 mm	660-1510	2.03 mm	660-1710	17.74 mm
27 mm	15MV	660-1415	1.86 mm	660-1515	2.37 mm	660-1715	20.68 mm
30 mm	18MV	660-1418	2.12 mm	660-1518	2.71 mm	660-1718	23.62 mm
35 mm	20MV	660-1420	2.56 mm	660-1520	3.27 mm	660-1720	28.52 mm

These build-up caps fit over the Cobalt 60 acrylic build-up cap with a 16.4 mm outside diameter.

Build-up caps for the following 0.6 cm<sup>3</sup> Farmer Style Chambers:  
**PTW 23333 / 233633, PTW 30001 / 30010, PTW 30002 / 30011, PTW 30004 / 30012, PTW 30006 / 30013, NEL 2505/3 (A or B), Victoreen 580-006 or Victoreen 0.6 cm<sup>3</sup> Farmer Style Chamber With 0.5 mm Acrylic Wall**

D-Max In Water	Nominal Energy	Acrylic Density 1.85 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>		Polystyrene Density 1.05 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	660-004	4.2 mm	660-304	1.8 mm	660-804	0.6 mm	660-904	4.8 mm
15 mm	6MV	660-006	7.6 mm	660-306	3.3 mm	660-806	1.1 mm	660-906	8.6 mm
20 mm	8MV	660-008	11.8 mm	660-308	5.2 mm	660-808	1.7 mm	660-908	13.4 mm
24 mm	10MV	660-010	15.2 mm	660-310	6.6 mm	660-810	2.1 mm	660-910	17.2 mm
27 mm	15MV	660-015	17.7 mm	660-315	7.7 mm	660-815	2.5 mm	660-915	20.0 mm
30 mm	18MV	660-018	20.3 mm	660-318	8.8 mm	660-818	2.8 mm	660-918	22.9 mm
35 mm	20MV	660-020	24.5 mm	660-320	10.7 mm	660-820	3.4 mm	660-920	27.6 mm
40 mm	24MV	660-024	28.7 mm	660-324	12.5 mm	660-824	4.0 mm	660-924	32.4 mm
50 mm	26MV	660-026	37.1 mm	660-326	16.2 mm	660-826	5.2 mm	660-926	41.9 mm

**Note: At energies above 10 MV metal Build-Up Caps may become slightly activated, please check and take appropriate precautions.**

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## BUILD-UP CAPS FOR 'IN AIR' MEASUREMENTS

The Following Build-Up Caps fit over the 0.6 cm<sup>3</sup> Farmer Style Chambers *Without Build-up Cap*:  
 PTW 23333 / 233633 / 30001 / 30010, PTW 30002 / 30011, PTW 30004 / 30012, PTW 30006 / 30013, NEL 2505/3 (A or B),  
 NE 2571 (A), NE 2581 (A), Exradin A-19, RMI 448, Nuclear Associates 30-351, Capintec PR06-G, Victoreen 580-006  
 There is no compensation for chamber wall thickness.

D-Max In Water	Nominal Energy	Copper Density 8.9 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>		Lead Density 11.35 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	661-004	1.2 mm	661-104	4.0 mm	661-204	1.3 mm	661-304	1.0 mm
15 mm	6MV	661-006	1.7 mm	661-106	5.5 mm	661-206	1.8 mm	661-306	1.3 mm
20 mm	8MV	661-008	2.3 mm	661-108	7.4 mm	661-208	2.3 mm	661-308	1.8 mm
24 mm	10MV	661-010	2.7 mm	661-110	8.8 mm	661-210	2.8 mm	661-310	2.1 mm
27 mm	15MV	661-015	3.0 mm	661-115	9.9 mm	661-215	3.2 mm	661-315	2.4 mm
30 mm	18MV	661-018	3.4 mm	661-118	11.0 mm	661-218	3.5 mm	661-318	2.6 mm
35 mm	20MV	661-020	3.9 mm	661-120	12.9 mm	661-220	4.1 mm	661-320	3.1 mm
40 mm	24MV	661-024	4.5 mm	661-124	14.7 mm	661-224	4.7 mm	661-324	3.5 mm
50 mm	26MV	661-026	5.6 mm	661-126	18.4 mm	661-226	5.9 mm	661-326	4.4 mm

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Polystyrene Density 1.05 g/cm <sup>3</sup>		Solid Water Density 1.03 g/cm <sup>3</sup>		Plastic Water Density 1.02 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	661-404	9.3 mm	661-504	10.78 mm	661-604	10.84 mm	661-704	10.8 mm
15 mm	6MV	661-406	12.7 mm	661-506	14.71 mm	661-606	14.78 mm	661-706	14.7 mm
20 mm	8MV	661-408	16.9 mm	661-508	19.61 mm	661-608	19.70 mm	661-708	19.6 mm
24 mm	10MV	661-410	20.3 mm	661-510	23.53 mm	661-610	23.65 mm	661-710	23.5 mm
27 mm	15MV	661-415	22.8 mm	661-515	26.47 mm	661-615	26.60 mm	661-715	26.5 mm
30 mm	18MV	661-418	25.3 mm	661-518	29.41 mm	661-618	29.56 mm	661-718	29.4 mm
35 mm	20MV	661-420	29.5 mm	661-520	34.31 mm	661-620	34.48 mm	661-720	34.3 mm
40 mm	24MV	661-424	33.8 mm	661-524	29.22 mm	661-624	39.41 mm	661-724	39.2 mm
50 mm	26MV	661-426	42.2 mm	661-526	49.02 mm	661-626	49.26 mm	661-726	49.0 mm

The Following Build-Up Caps fit over a 0.015cc Pinpoint Chamber PTW 31006 / 31014

D-Max In Water	Nominal Energy	Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>		Lead Density 11.35 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	662-31006-04-2	3.80 mm	662-31006-04-3	1.21 mm	662-31006-04-4	0.91 mm
15 mm	6MV	662-31006-06-2	5.27 mm	662-31006-06-3	1.68 mm	662-31006-06-4	1.26 mm
24 mm	10MV	662-31006-10-2	8.59 mm	662-31006-10-3	2.74 mm	662-31006-10-4	2.06 mm
27 mm	15MV	662-31006-15-2	9.69 mm	662-31006-15-3	3.09 mm	662-31006-15-4	2.32 mm
30 mm	18MV	662-31006-18-2	10.79 mm	662-31006-18-3	3.45 mm	662-31006-18-4	2.58 mm
35 mm	20MV	662-31006-20-2	12.63 mm	662-31006-20-3	4.03 mm	662-31006-20-4	3.03 mm

The Following Build-Up Caps fit over a 0.016cc Pinpoint Chamber PTW 31016

D-Max In Water	Nominal Energy	Brass Density 8.515 g/cm <sup>3</sup>	
		Item #	Wall Thickness
11 mm	4MV	662-31016-04-3	
15 mm	6MV	662-31016-06-3	1.66 mm
20 mm	8MV	662-31016-08-3	
24 mm	10MV	662-31016-10-3	
27 mm	15MV	662-31016-15-3	
30 mm	18MV	662-31016-18-3	3.42 mm

**Note: At energies above 10 MV metal Build-Up Caps may become slightly activated, please check and take appropriate precautions.**

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## BUILD-UP CAPS FOR 'IN AIR' MEASUREMENTS

The following build-up caps fit over the **0.3 cm<sup>3</sup> semiflex chamber** with an acrylic wall thickness of 0.75 mm.  
Caps fit on the following chambers: **PTW 23332 / 233641 / 31003 / 31013, Nuclear Associates 30-316 and 30-317**

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>		Lead Density 11.35 g/cm <sup>3</sup>		Polystyrene Density 1.05 g/cm <sup>3</sup>		Solid Water Density g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
5.0 mm	1.25MV Co-60	662-001	3.5 mm	662-101		662-201		662-301					
11 mm	4MV	662-004	8.5 mm	662-104	3.72 mm	662-204	1.19 mm	662-304	0.89 mm	662-604	9.63 mm	662-804	
15 mm	6MV	662-006	11.9 mm	662-106	5.19 mm	662-206	1.66 mm	662-306	1.21 mm	662-606	13.44 mm	662-806	
20 mm	8MV	662-008	16.1 mm	662-108	7.03 mm	662-208	2.24 mm	662-308	1.68 mm	662-608	18.20 mm	662-808	
24 mm	10MV	662-010	19.5 mm	662-110	8.50 mm	662-210	2.71 mm	662-310	2.04 mm	662-610	22.01 mm	662-810	
27 mm	15MV	662-015	22.0 mm	662-115	9.61 mm	662-215	3.07 mm	662-315	2.30 mm	662-615	24.87 mm	662-815	
30 mm	18MV	662-018	24.6 mm	662-118	10.71 mm	662-218	3.42 mm	662-318	2.56 mm	662-618	27.72 mm	662-818	
35 mm	20MV	662-020	28.8 mm	662-120	12.55 mm	662-220	4.01 mm	662-320	3.01 mm	662-620	32.49 mm	662-820	
40 mm	24MV	662-024	33.0 mm	662-124	14.39 mm	662-224	4.59 mm	662-324	3.45 mm	662-624	37.25 mm	662-824	

The following build-up caps fit over the **0.125 cm<sup>3</sup> semiflex chamber** with a wall thickness of 0.75 mm and short stem.  
Caps fit on the following chambers: **PTW 233642 / 31002 / 31010, PTW 233643 / 31005 / 31011**

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>		Lead Density 11.35 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	662-2004	8.53 mm	662-2104	3.72 mm	662-2204	1.19 mm	662-2404	0.89 mm
15 mm	6MV	662-2006	11.91 mm	662-2106	5.19 mm	662-2206	1.66 mm	662-2406	1.24 mm
24 mm	10MV	662-2010	19.50 mm	662-2110	8.50 mm	662-2210	2.71 mm	662-2410	2.04 mm
30 mm	18MV	662-2018	24.57 mm	662-2118	10.71 mm	662-2218	3.42 mm	662-2418	2.56 mm
35 mm	20MV	662-2020	28.79 mm	662-2120	12.55 mm	662-2220	4.01 mm	662-2420	3.01 mm
40 mm	24MV	662-2024	33.01 mm	662-2124	14.39 mm	662-2224	4.59 mm	662-2424	3.45 mm

D-Max In Water	Nominal Energy	Copper Density 8.90 g/cm <sup>3</sup>		Polystyrene Density 1.05 g/cm <sup>3</sup>		Plastic Water Density 1.02 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	662-2504	1.14 mm	662-2604	9.63 mm	662-2804	9.91 mm
15 mm	6MV	662-2506	1.59 mm	662-2606	13.44 mm	662-2806	13.83 mm
24 mm	10MV	662-2510	2.60 mm	662-2610	22.01 mm	662-2810	22.66 mm
27 mm	15MV	662-2515	2.93 mm	662-2615	24.87 mm	662-2815	25.60 mm
30 mm	18MV	662-2518	3.27 mm	662-2618	27.72 mm	662-2818	28.54 mm
35 mm	20MV	662-2520	3.83 mm	662-2620	32.49 mm	662-2820	33.44 mm

## MARKUS CHAMBER BUILD-UP DISK

The Markus Chamber (PTW 23343) Build-up Disk is made of acrylic and available in 2 styles.

**Item 664-320** is a Cobalt 60 Disk that is placed over the chamber's acrylic screw on cap. The disk has a 2.99 cm diameter and is 3.2 mm thick.

**Item 664-401** is a Cobalt 60 disk with a shoulder placed over the chamber's mylar window. It has a 3.2 cm diameter and is 4 mm thick.



664-320



664-401

Item #	Description	Thickness
664-320	Cobalt 60 Disk	3.2 mm
664-401	Cobalt 60 w/Shoulder	4.01 mm

**Note: At energies above 10 MV metal Build-Up Caps may become slightly activated, please check and take appropriate precautions.**

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## BUILD-UP CAPS FOR "IN AIR" MEASUREMENTS

The following build-up caps fit on the **Exradin Model A2 0.5cm<sup>3</sup> Spokas Thimble Chamber** with a wall thickness of 1.0 mm.

**Material:** Shonka air equivalent plastic C552. **Density:** 1.76 g/cm<sup>3</sup>

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Polystyrene Density 1.05 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	659-2-04-1	7.80 mm	659-2-04-6	8.80 mm	659-2-04-2	3.40 mm	659-2-04-3	1.09 mm
15 mm	6MV	659-2-06-1	11.17 mm	659-2-06-6	12.61 mm	659-2-06-2	4.87 mm	659-2-06-3	1.55 mm
20 mm	8MV	659-2-08-1	15.39 mm	659-2-08-6	17.37 mm	659-2-08-2	6.71 mm	659-2-08-3	2.14 mm
24 mm	10MV	659-2-10-1	18.77 mm	659-2-10-6	21.18 mm	659-2-10-2	8.18 mm	659-2-10-3	2.61 mm
27 mm	15MV	659-2-15-1	21.30 mm	659-2-15-6	24.04 mm	659-2-15-2	9.29 mm	659-2-15-3	2.96 mm
30 mm	18MV	659-2-18-1	23.83 mm	659-2-18-6	26.90 mm	659-2-18-2	10.39 mm	659-2-18-3	3.32 mm
35 mm	20MV	659-2-20-1	28.05 mm	659-2-20-6	31.66 mm	659-2-20-2	12.23 mm	659-2-20-3	3.90 mm
40 mm	24MV	659-2-24-1	32.27 mm	659-2-24-6	36.42 mm	659-2-24-2	14.07 mm	659-2-24-3	4.49 mm
50 mm	26MV	659-2-26-1	40.71 mm	659-2-26-6	45.94 mm	659-2-26-2	17.75 mm	659-2-26-3	5.67 mm

The following build-up caps fit over the **Exradin Model A12 Farmer type chamber** with a wall thickness of 0.5 mm.

**Material:** Shonka Air-Equivalent Plastic C552 **Density:** 1.76 g/cm<sup>3</sup>

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Polystyrene Density 1.05 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	659-12-04-1	8.54 mm	659-12-04-6	9.64 mm	659-12-04-2	3.72 mm
15 mm	6MV	659-12-06-1	11.92 mm	659-12-06-6	13.45 mm	659-12-06-2	5.19 mm
20 mm	8MV	659-12-08-1	16.14 mm	659-12-08-6	18.21 mm	659-12-08-2	7.03 mm
24 mm	10MV	659-12-10-1	19.51 mm	659-12-10-6	22.02 mm	659-12-10-2	8.51 mm
27 mm	15MV	659-12-15-1	22.04 mm	659-12-15-6	24.88 mm	659-12-15-2	9.61 mm
30 mm	18MV	659-12-18-1	24.57 mm	659-12-18-6	27.73 mm	659-12-18-2	10.71 mm
35 mm	20MV	659-12-20-1	28.79 mm	659-12-20-6	32.50 mm	659-12-20-2	12.55 mm
40 mm	24MV	659-12-24-1	33.01 mm	659-12-24-6	37.26 mm	659-12-24-2	14.39 mm
50 mm	26MV	659-12-26-1	41.45 mm	659-12-26-6	46.78 mm	659-12-26-2	18.07 mm

D-Max In Water	Nominal Energy	Brass Density 8.515 g/cm <sup>3</sup>		Lead Density 11.35 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	659-12-04-3	1.19 mm	659-12-04-4	1.14 mm
15 mm	6MV	659-12-06-3	1.66 mm	659-12-06-4	1.59 mm
20 mm	8MV	659-12-08-3	2.25 mm	659-12-08-4	2.15 mm
24 mm	10MV	659-12-10-3	2.72 mm	659-12-10-4	2.60 mm
27 mm	15MV	659-12-15-3	3.07 mm	659-12-15-4	2.93 mm
30 mm	18MV	659-12-18-3	3.42 mm	659-12-18-4	3.27 mm
35 mm	20MV	659-12-20-3	4.01 mm	659-12-20-4	3.83 mm
40 mm	24MV	659-12-24-3	4.59 mm	659-12-24-4	4.40 mm
50 mm	26MV	659-12-26-3	5.77 mm	659-12-26-4	5.52 mm

**We Manufacture Build-Up Caps for All Ionization Chambers - Please Call for More Information**

**Note: At energies above 10 MV metal Build-Up Caps may become slightly activated, please check and take appropriate precautions.**

# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## BUILD-UP CAPS FOR "IN AIR" MEASUREMENTS

Build-up caps for the NE 2571, 0.6cm<sup>3</sup> Farmer Style Chamber with a 0.36 mm graphite (density 1.857 g/cm<sup>3</sup>) wall thickness.

These build-up caps fit over the Cobalt 60 delrin (density 1.415 g/cm<sup>3</sup>) build-up cap that has a wall thickness of 4.13 mm and an outside diameter of 15.14 mm.

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>		Lead Density 11.35 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	660-204	4.08 mm	660-504	1.78 mm	660-5304	0.57 mm	660-5404	0.43 mm
15 mm	6MV	660-206	7.2 mm	660-506	3.1 mm	660-5306	1.04 mm	660-5406	0.78 mm
24 mm	10MV	660-210	14.8 mm	660-510	6.4 mm	660-5310	2.09 mm	660-5410	1.57 mm
27 mm	15MV	660-215	17.3 mm	660-515	7.5 mm	660-5315	2.45 mm	660-5415	1.84 mm
30 mm	18MV	660-218	19.8 mm	660-518	8.6 mm	660-5318	2.80 mm	660-5418	2.10 mm

D-Max In Water	Nominal Energy	Copper Density 8.90 g/cm <sup>3</sup>		Polystyrene Density 1.05 g/cm <sup>3</sup>		Plastic Water Density 1.02 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	660-5504	0.54 mm	660-5604	4.60 mm	660-5704	4.74 mm
15 mm	6MV	660-5506	0.99 mm	660-5606	8.41 mm	660-5706	8.66 mm
20 mm	8MV	660-5508	1.55 mm	660-5608	13.17 mm	660-5708	13.56 mm
24 mm	10MV	660-5510	2.00 mm	660-5610	16.98 mm	660-5710	17.48 mm
27 mm	15MV	660-5515	2.34 mm	660-5615	19.84 mm	660-5715	20.42 mm
30 mm	18MV	660-5518	2.68 mm	660-5618	22.70 mm	660-5718	23.37 mm
35 mm	20MV	660-5520	3.24 mm	660-5620	27.46 mm	660-5720	28.27 mm
40 mm	24MV	660-5524	3.80 mm	660-5624	32.22 mm	660-5724	33.17 mm

The following build-up caps fit on the IBA (Scanditronix/Wellhofer) CC13, IC-15, and IC-10 Chamber

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	663-901-04	8.69 mm	663-902-04	3.79 mm	663-903-04	1.21 mm
15 mm	6MV	663-901-06	12.07 mm	663-902-06	5.26 mm	663-903-06	1.68 mm
20 mm	8MV	663-901-08	16.29 mm	663-902-08	7.10 mm	663-903-08	2.27 mm
24 mm	10MV	663-901-10	19.66 mm	663-902-10	8.57 mm	663-903-10	2.74 mm
27 mm	15MV	663-901-15	22.19 mm	663-902-15	9.68 mm	663-903-15	3.09 mm
30 mm	18MV	663-901-18	24.73 mm	663-902-18	10.78 mm	663-903-18	3.44 mm
35 mm	20MV	663-901-20	28.95 mm	663-902-20	12.62 mm	663-903-20	4.03 mm
40 mm	24MV	663-901-24	33.16 mm	663-902-24	14.46 mm	663-903-24	4.62 mm
50 mm	26MV	663-901-26	41.60 mm	663-902-26	18.14 mm	663-903-26	5.79 mm

D-Max In Water	Nominal Energy	Polystyrene Density 1.05 g/cm <sup>3</sup>	
		Item #	Wall Thickness
11 mm	4MV	663-906-04	9.81 mm
15 mm	6MV	663-906-06	13.62 mm
20 mm	8MV	663-906-08	18.38 mm
24 mm	10MV	663-906-10	22.19 mm
27 mm	15MV	663-906-15	25.05 mm
30 mm	18MV	663-906-18	27.90 mm
35 mm	20MV	663-906-20	32.67 mm
40 mm	24MV	663-906-24	37.43 mm
50 mm	26MV	663-906-26	46.95 mm

**Note: At energies above 10 MV metal Build-Up Caps may become slightly activated, please check and take appropriate precautions.**



# BUILD-UP CAPS, SCATTER & MINI PHANTOMS

## BUILD-UP CAPS FOR “IN AIR” MEASUREMENTS

The following build-up caps fit on the **Exradin A16**

D-Max In Water	Nominal Energy	Aluminum Density 2.718 g/cm <sup>3</sup>		Lead Density 11.35 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	659-A16-04-2	3.72 mm	659-A16-04-4	0.89 mm
15 mm	6MV	659-A16-06-2	5.19 mm	659-A16-06-4	1.24 mm
20 mm	8MV	659-A16-08-2	7.03 mm	659-A16-08-4	1.68 mm
24 mm	10MV	659-A16-10-2	8.51 mm	659-A16-10-4	2.04 mm
27 mm	15MV	659-A16-15-2	9.61 mm	659-A16-15-4	2.30 mm
30 mm	18MV	659-A16-18-2	10.71 mm	659-A16-18-4	2.57 mm
35 mm	20MV	659-A16-20-2	12.55 mm	659-A16-20-4	3.01 mm
40 mm	24MV	659-A16-24-2	14.39 mm	659-A16-24-4	3.45 mm
50 mm	26MV	659-A16-26-2	18.07 mm	659-A16-26-4	4.33 mm

The following build-up caps fit on the **Exradin A14**

D-Max In Water	Nominal Energy	Acrylic Density 1.185 g/cm <sup>3</sup>		Aluminum Density 2.718 g/cm <sup>3</sup>		Brass Density 8.515 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	659-A14-04-1	7.80 mm	659-A14-04-2	3.40 mm	659-A14-04-3	1.09 mm
15 mm	6MV	659-A14-06-1	11.17 mm	659-A14-06-2	4.87 mm	659-A14-06-3	1.55 mm
20 mm	8MV	659-A14-08-1	15.39 mm	659-A14-08-2	6.71 mm	659-A14-08-3	2.14 mm
24 mm	10MV	659-A14-10-1	18.77 mm	659-A14-10-2	8.18 mm	659-A14-10-3	2.61 mm
27 mm	15MV	659-A14-15-1	21.30 mm	659-A14-15-2	9.29 mm	659-A14-15-3	2.96 mm
30 mm	18MV	659-A14-18-1	23.83 mm	659-A14-18-2	10.39 mm	659-A14-18-3	3.32 mm
35 mm	20MV	659-A14-20-1	28.05 mm	659-A14-20-2	12.23 mm	659-A14-20-3	3.90 mm
40 mm	24MV	659-A14-24-1	32.27 mm	659-A14-24-2	14.07 mm	659-A14-24-3	4.49 mm

The following build-up caps fit on the **Exradin A14SL**

D-Max In Water	Nominal Energy	Brass Density 8.515 g/cm <sup>3</sup>		Lead Density 11.35 g/cm <sup>3</sup>	
		Item #	Wall Thickness	Item #	Wall Thickness
11 mm	4MV	659-A14SL-04-3	1.06 mm	659-A14SL-04-4	0.80 mm
15 mm	6MV	659-A14SL-06-3	1.53 mm	659-A14SL-06-4	1.15 mm
20 mm	8MV	659-A14SL-08-3	2.12 mm	659-A14SL-08-4	1.59 mm
24 mm	10MV	659-A14SL-10-3	2.59 mm	659-A14SL-10-4	1.94 mm
27 mm	15MV	659-A14SL-15-3	2.94 mm	659-A14SL-15-4	2.21 mm
30 mm	18MV	659-A14SL-18-3	3.30 mm	659-A14SL-18-4	2.47 mm
35 mm	20MV	659-A14SL-20-3	3.88 mm	659-A14SL-20-4	2.91 mm
40 mm	24MV	659-A14SL-24-3	4.47 mm	659-A14SL-24-4	3.35 mm

**Note: At energies above 10 MV metal Build-Up Caps may become slightly activated, please check and take appropriate precautions.**