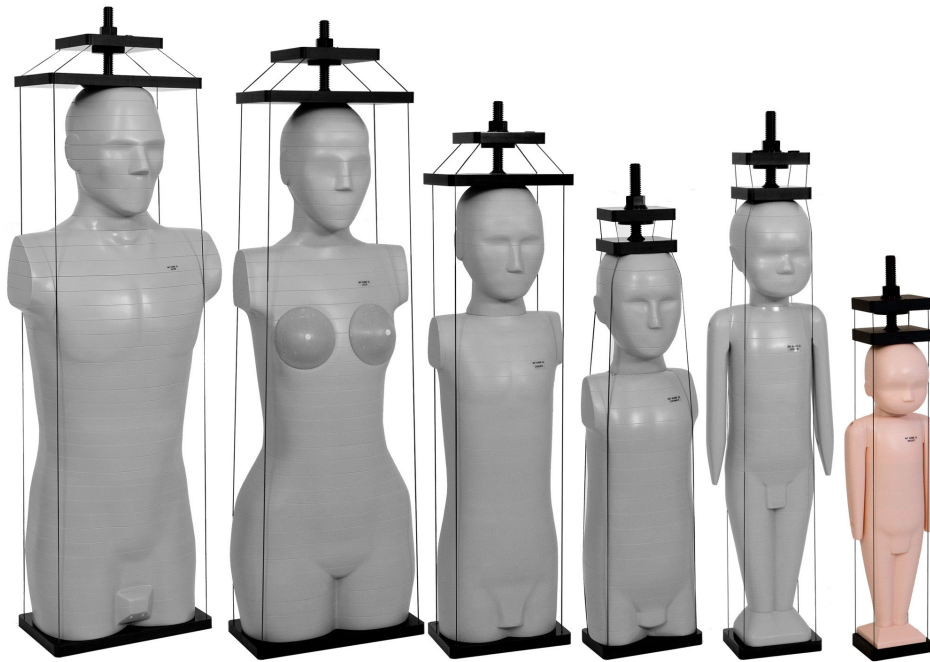


# ATOM<sup>®</sup> Dosimetry Phantoms

Models 701 - 706



*WHOLE BODY DOSE • ORGAN DOSE • THERAPEUTIC RADIATION*

**CIRS**

900 Asbury Ave • Norfolk, Virginia 23513 • USA • Tel: 757-855-2765 • [WWW.CIRSINC.COM](http://WWW.CIRSINC.COM)





D O S I M E T R Y P H A N T O M S

## FEATURES

- Phantom models cover a wide range of patient ages
- Organ specific dosimetry with minimal detectors
- Superior tissue simulation and lifelike imaging properties
- Homogeneous bone
- Accommodates wide variety of detectors
- Age appropriate references

CIRS ATOM® phantoms are a full line of anthropomorphic, cross sectional dosimetry phantoms designed to investigate organ dose, whole body effective dose as well as verification of delivery of therapeutic radiation doses.

ATOM is the only line of dosimetry phantoms to range in sizes from newborn to adult. Six models are available: newborn, 1-year, 5-year and 10-year old pediatric phantoms as well as adult male and female phantoms.

Each phantom is sectional in design with traditional 25 mm thick sections. The sectional surfaces are extremely flat and smooth and do not require any special coatings or treatment. This results in minimal interfaces between the slabs when viewed in a scout or projection X-ray. The ATOM line also differs from other dosimetry phantoms by providing optimized TLD locations specific to 21 inner organs.

Tissue-equivalent epoxy resins are used in all aspects of the phantom. CIRS technology offers superior tissue simulation Dosimetry Verification Phantoms by covering a wider range of energy levels from diagnostic to therapeutic. In addition, all bones are homogeneous and are formulated to represent age appropriate, average bone composition. CIRS bone formulations offer distinct advantages over natural skeletons and other types of simulated bone.

**CIRS**

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*Computerized Imaging Reference Systems, Inc is recognized world wide for tissue simulation technology and is the leader in the manufacture of phantoms and simulators for medical imaging and radiotherapy.*

[www.cirsinc.com](http://www.cirsinc.com)

# The Choice for Quality Assurance, Clinical and Research Applications

ATOM phantoms provide our best tissue simulation and the widest variety of options available on whole body cross sectional dosimetry phantoms. Additionally they are designed to accommodate a wide variety of detectors in a variety of configurations offering dose measurements in precise body locations.

This publication introduces the main concepts for ATOM Phantoms; however, when ordering you should contact your CIRS representative or CIRS Technical support to design the best dosimetry phantom for your needs.

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# Anthropomorphic Phantoms From Adults to Infants

## DOSE CALCULATIONS RELATED TO SIZE

The size of each model is based on ICRP 23, ICRU 48 and available anatomical references (See Table 1). Only CIRS ATOM phantoms represent both pediatric and adult patient groups.

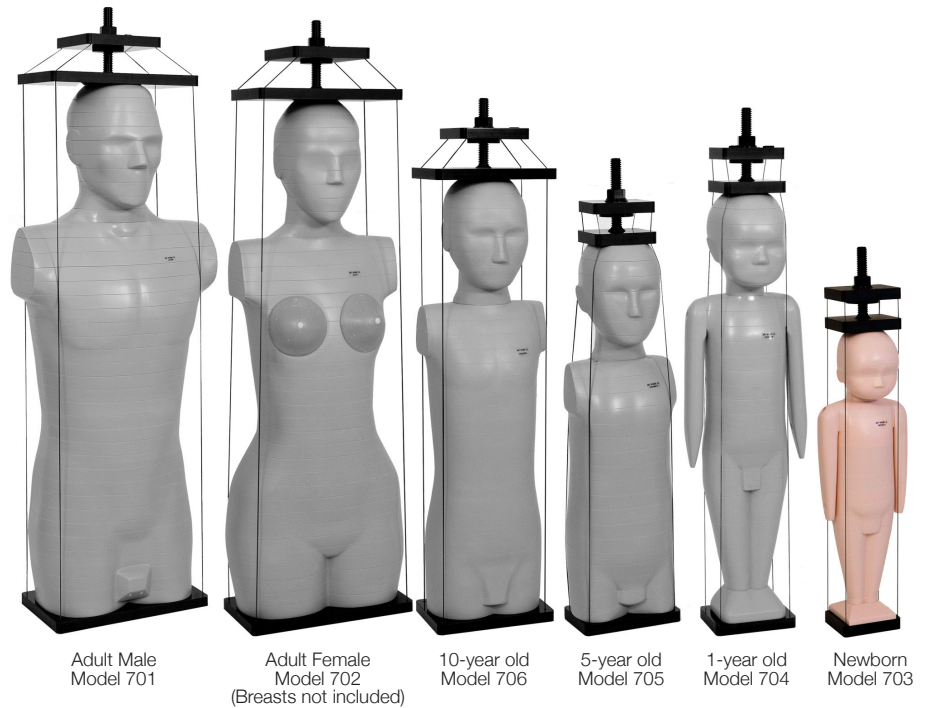
- Newborn
- 10-year old
- 1-year old
- Adult Male
- 5-year old
- Adult Female

This age range allows more accurate calculations of dose. The pediatric products support practitioners efforts to “child size” diagnostic scanning protocols in CT and more precisely determine effective doses in diagnostic radiology. Because scattering radiation can give a significant dose contribution to the surrounding tissue, the ATOM newborn and 1-year old are provided with arms and legs as a standard configuration. Arms and legs for most ATOM models can be ordered separately (see page 10).

**Note:** ATOM Fat Layers, Model 701-12, can be used with Adult Male ATOM Phantoms to represent bariatric or pregnant patients. See page 11.

## BONE SIMULATION APPROPRIATE TO AGE

Bone density varies significantly with age. This is especially significant in the pediatric models because the red bone marrow is distributed throughout the skeletal systems compared with adults. Proper bone simulation is also important for a pediatric patient because they have a higher sensitivity to the effects of radiation. Therefore, for more precise dosimetry measurements, ATOM phantoms are formulated with bone equivalent materials based on the appropriate bone composition typical of each age.



## ATOM ANATOMICAL REFERENCES

(Based on ICRP 23, ICRU 48 and available anatomical reference data)

DESCRIPTION	HEIGHT, CM	WEIGHT, KG	THORAX DIMENSIONS, CM
ADULT MALE	173	73	23 cm x 32
ADULT FEMALE	160	55	20 x 25*
PEDIATRIC NEWBORN	51	3.5	9 x 10.5
PEDIATRIC 1 YEAR	75	10	12 x 14
PEDIATRIC 5 YEARS	110	19	14 x 17
PEDIATRIC 10 YEARS	140	32	17 x 20

\*Measurement does not include breasts

Table 1

## PHANTOM BONE MATERIAL SPECIFICATIONS

DESCRIPTION	PHYSICAL DENSITY, G/CC	ELECTRON DENSITY, 1/CC
ADULT MALE	1.60	$5.030 \cdot 10^{23}$
ADULT FEMALE	1.60	$5.030 \cdot 10^{23}$
PEDIATRIC NEWBORN	1.41	$4.498 \cdot 10^{23}$
PEDIATRIC 1 YEAR	1.45	$4.606 \cdot 10^{23}$
PEDIATRIC 5 YEARS	1.52	$4.801 \cdot 10^{23}$
PEDIATRIC 10 YEARS	1.56	$4.878 \cdot 10^{23}$

Table 2

# Proven Tissue Equivalent Technology

CIRS tissue simulation technology has been validated through specific testing, continuous monitoring of manufacturing applications, worldwide use and acceptance of products for over 25 years.

CIRS formulates Tissue Equivalent (TE) materials for quantitative measurement, training, image quality control and dose calibration. Resins and polymers are available to simulate any tissue in the human body. CIRS computer models

consider tissue to be mimicked, modality/energy level and raw materials to be used.

ATOM phantoms are constructed of CIRS proprietary tissue equivalent materials. Linear attenuations of the simulated tissues are within 1% of actual attenuation for soft tissue and bone and within 3% for lung from 50 keV to 15 MeV. Lung tissue in each phantom is made standard with a low density inhale

formulation equivalent to 0.2 g/cc. Other densities are available by special order.

The tissues simulated in ATOM phantoms are average soft tissue, average bone tissue, cartilage, spinal cord, spinal disks, lung, brain and sinus. Simulated bone tissue for pediatric models matches age related density (Reference Table 2).

## PHYSICAL AND ELECTRON DENSITY OF TISSUE EQUIVALENT MATERIALS

ATOM Dosimetry Phantoms (adult) - Recalculated linear attenuation coefficients (cm<sup>-1</sup>)

EN, MEV	AVERAGE SOFT TISSUE		AVERAGE BONE TISSUE		AVERAGE LUNG TISSUE (INHALE)*		AVERAGE BRAIN TISSUE		BREAST TISSUE 50/50	
	REFERENCE <sup>1</sup>	ATOM	REFERENCE <sup>1</sup>	ATOM	REFERENCE <sup>2</sup>	ATOM	REFERENCE <sup>2</sup>	ATOM	REFERENCE <sup>3</sup>	ATOM
0.04	0.2679	0.2678	0.7884	0.7887	0.0537	0.0531	0.2791	0.2791	0.2428	0.2436
0.06	0.2087	0.2091	0.4244	0.4242	0.0410	0.0414	0.2135	0.2138	0.1954	0.1954
0.08	0.1871	0.1876	0.3251	0.3248	0.0365	0.0372	0.1902	0.1907	0.1770	0.1767
0.10	0.1742	0.1748	0.2822	0.2819	0.0339	0.0346	0.1767	0.1772	0.1655	0.1652
0.15	0.1538	0.1544	0.2344	0.2341	0.0299	0.0306	0.1557	0.1562	0.1466	0.1463
0.20	0.1401	0.1406	0.2098	0.2095	0.0272	0.0279	0.1418	0.1422	0.1337	0.1334
0.40	0.1086	0.1090	0.1605	0.1602	0.0211	0.0216	0.1098	0.1102	0.1037	0.1035
0.60	0.0917	0.0920	0.1351	0.1349	0.0178	0.0182	0.0927	0.0930	0.0875	0.0874
0.80	0.0805	0.0808	0.1186	0.1184	0.0156	0.0160	0.0814	0.0817	0.0769	0.0767
1.00	0.0724	0.0726	0.1066	0.1064	0.0140	0.0144	0.0731	0.0734	0.0691	0.0690
1.50	0.0589	0.0591	0.0868	0.0866	0.0114	0.0117	0.0595	0.0597	0.0562	0.0561
2.00	0.0505	0.0507	0.0746	0.0745	0.0098	0.0101	0.0511	0.0513	0.0482	0.0481
4.00	0.0347	0.0348	0.0521	0.0520	0.0068	0.0069	0.0352	0.0352	0.0331	0.0329
6.00	0.0282	0.0282	0.0431	0.0430	0.0055	0.0056	0.0286	0.0286	0.0268	0.0266
8.00	0.0247	0.0247	0.0383	0.0383	0.0048	0.0049	0.0251	0.0250	0.0234	0.0231
10.0	0.0225	0.0225	0.0355	0.0355	0.0044	0.0044	0.0229	0.0228	0.0212	0.0210
15.0	0.0196	0.0195	0.0319	0.0320	0.0038	0.0038	0.0200	0.0199	0.0184	0.0180
20.0	0.0182	0.0181	0.0305	0.0305	0.0036	0.0036	0.0186	0.0185	0.0170	0.0166
30.0	0.0171	0.0170	0.0296	0.0296	0.0034	0.0033	0.0176	0.0174	0.0159	0.0154
Density, gcm <sup>-3</sup>	1.03	1.055	1.577	1.60	0.20	0.21	1.04	1.069	0.982	0.991
El. density, *10 <sup>23</sup> , cm <sup>-3</sup>	3.421	3.434	5.035	5.028	0.663	0.681	3.458	3.470	3.267	3.261

\* Exhale lung tissue (d=0.5) or average (d=0.26-0.30) also available.

Table 3

1. ICRP 23, Report of the Task Group on Reference Man (1975).
2. Woodard, H.Q., White, D.R., The Composition of Body Tissues, The British Journal of Radiology (1986) 59: 1209-1219.
3. G. Richard Hammerstein, et al, "Absorbed Radiation Dos in Mammography", RADIOLOGY, 130:485-491, February 1979

# Homogeneous Bone

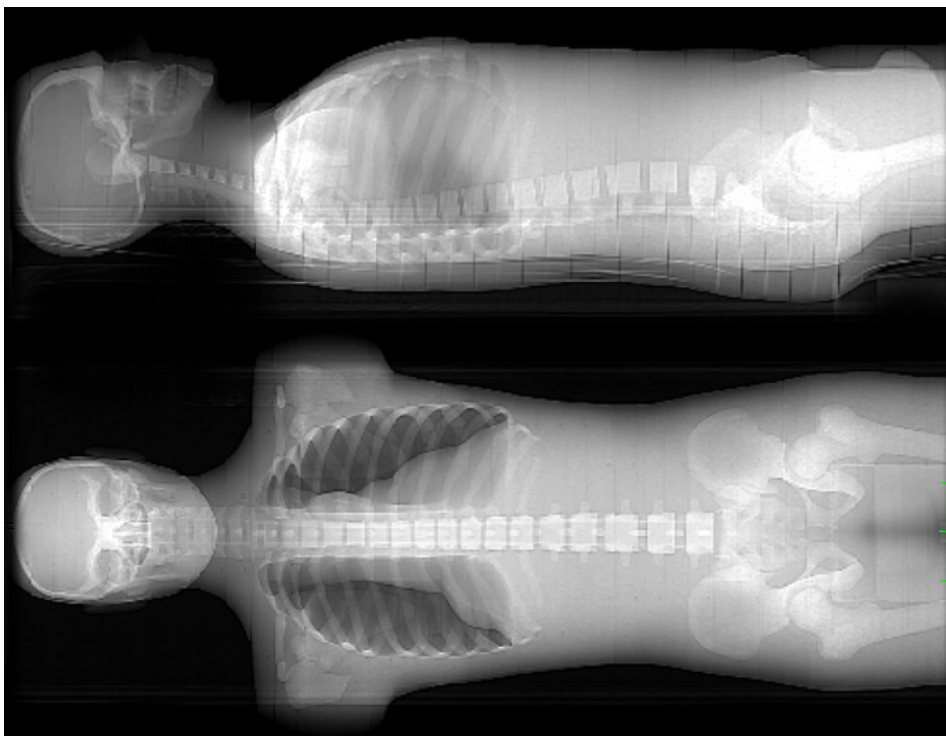
The skeletal anatomy of ATOM phantoms includes a homogeneous bone tissue composition that averages known cortical to trabecular ratios and age based mineral densities. Bone tissue compositions for the adult and pediatric phantoms were designed based on the most reliable data available. There are many advantages to using average bone rather than natural skeletons or simulated skeletons that include separate trabecular and cortical densities. \*This design feature provides for dose verification in different applications, especially when comparative Monte-Carlo calculations are necessary.

For inner organ dosimetry the bones usually play a shielding role and can be simulated using an average bone because their inner structure is not critical. For the purpose of red marrow dosimetry, it is important to make measurements in electron equilibrium, which is easier to obtain in a homogeneous average bone of known density than in an unknown ratio of cortical to trabecular bone material. Further, the size of actual dosimeters is typically larger than the trabecular structure leading to imprecise measured trabecular dose. As a result an average bone substitute is often preferred for simulation except in very unique cases and for reasons of image aesthetics.

## **LIFE-LIKE IMAGING CHARACTERISTICS**

Because CIRS materials are epoxy based they can be machined to achieve optimal flatness. They also do not require surface treatment or coating thus the air interface between sections is minimized.

Even the phantom holder has been designed to optimize ATOM imaging characteristics. Each phantom comes standard with a unique holding apparatus that consists of a top and bottom compression plate that is adjusted with the included wrench. The plates are joined with four thin Teflon wires that are radiographically opaque. There are no solid rods running through the phantom body to interfere with the imaging characteristics. Instead, the top of each section has a small tab which fits into the corresponding indentation on the underside of the preceding section.



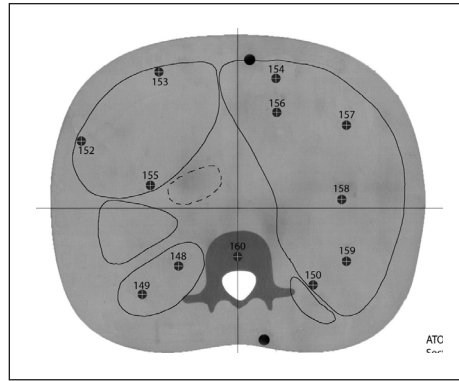
## **Benefits of Homogeneous Bone**

- Consistent size and density
- Eliminates problem of air voids found in trabecular regions of natural bone
- Simplifies dose calculations by eliminating need to know densities and ratios of cortical and trabecular components
- No regulatory concerns associated with use of human remains

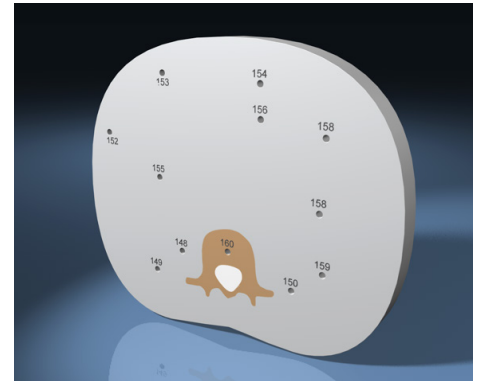
# Optimized Organ Dosimetry

CT and Cone Beam CT dosimetry can require organ dosimetry and whole body dosimetry. CIRS is the only manufacturer that offers organ hole locations specific to 22 radiosensitive internal organs, optimized for precise calculations using the minimum number of detectors necessary. The selection of hole positions is supported by detailed anatomical information about the average position of these 22 radiosensitive internal organs. A set of maps outlining the most frequently observed organ locations and also the optimized detector hole distribution within each organ accompanies each phantom with “-D” configuration. This map book shows the hypothetical outline of the internal organs appropriate for each section.

The holes that are drilled into each section are also shown on the map along with the corresponding unique hole ID



Model 702-D Section 23 Organ Map Showing Theoretical Organ Outlines



Model 702-D Section 23 Organ Dosimetry Option

number. The map is used in conjunction with a lookup table that indicates, for each organ, the number of detectors to insert, the hole number for each inserted detector and the corresponding detector depth for each hole. This assists the dosimetrist in minimizing the quantity of detectors utilized. In

this regard it is important to note that the precision of an average organ dose calculation is dependent upon the precision of the detector method. The “organ placement” feature eliminates estimating detector placement and is supported by extensive anatomical and dosimetric research.

## ATOM PHANTOM INTERNAL ORGANS

		NUMBER OF DETECTOR HOLES IN EACH ORGAN*					
		701-D/G	702-D/G	703-D	704-D	705-D/G	706-D/G
1.	EYES	2	2	2	2	2	2
2.	BRAIN	11	11	7	9	10	13
3.	THYROID	6	4	2	2	4	4
4.	HEART	2	2	1	2	2	2
5.	THYMUS	4	4	3	2	3	3
6.	LUNGS	36	36	15	25	28	24
7.	LIVER	29	28	13	8	18	22
8.	GALL BLADDER	5	3	1	2	2	3
9.	SPLEEN	12	6	2	4	4	6
10.	ESOPHAGUS	3	3	2	3	3	5
11.	STOMACH	14	18	6	6	10	10
12.	PANCREAS	5	4	2	3	3	3
13.	KIDNEYS	16	12	4	8	8	8
14.	ADRENALS	2	2	2	2	2	2
15.	INTESTINE	16	16	8	12	10	11
16.	OVARIES	-	2	2	2	2	2
17.	UTERUS	-	3	2	1	2	2
18.	URINARY BLADDER	13	13	6	6	6	6
19.	TESTES	2	-	2	2	2	2
20.	PROSTATE	3	-	-	1	1	1
21.	BREASTS	2	grid	2	2	2	2
22.	ACTIVE BONE MARROW**	85	85	58	64	56	65
	<b>TOTAL</b>	268	254	142	168	180	198

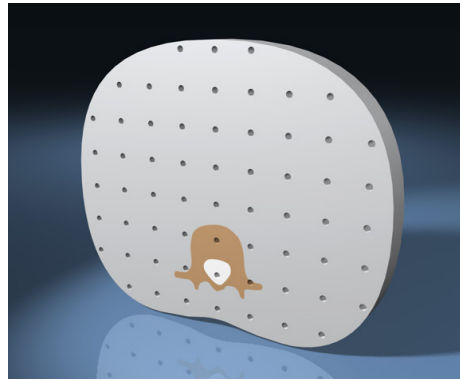
\*The number of G-holes may vary due to hole size.



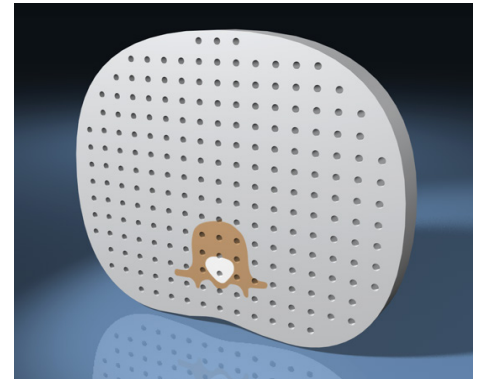
# Dosimetry Holes in Standard Grid Patterns

Dose verification in Radiation Therapy can require standard 3cm X 3cm (option “-B”) or 1.5cm X 1.5cm (option “-C”) hole grids. These are available in lieu of the organ placement feature.

For all hole options, the thru holes are typically 5 mm diameter. Thru drilled holes of 3mm, 7mm, 10mm and 14mm diameters are available via custom request.



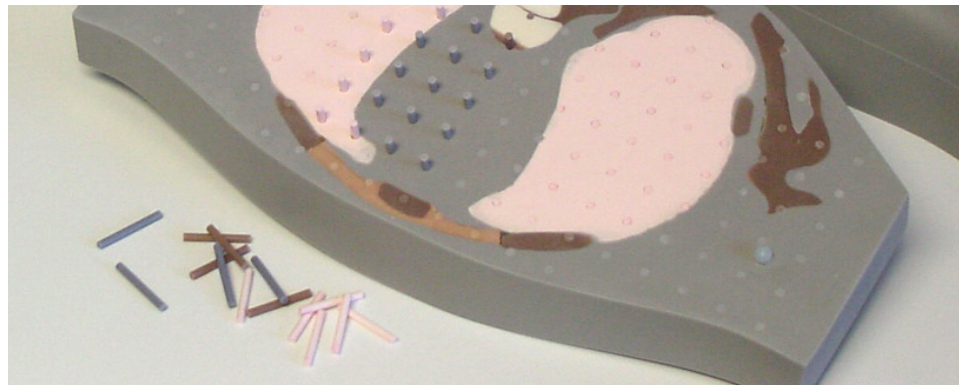
Model 702-B section 23  
3 cm x 3 cm grid option



Model 702-C section 23  
1.5 cm x 1.5 cm grid option

## Detector Options

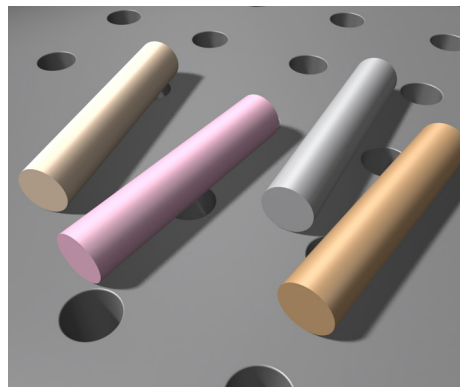
For all grid options, holes are filled with 5mm diameter X 25 mm long, solid plugs of corresponding tissue (soft tissue, bone, lung and brain). Extra plugs of each tissue are also provided with every unit. Plugs specifically machined for TLD chips, TLD rods, TLD bars, TLD cubes, MOSFET detectors, and Landauer OSL Micro Dot and nanoDot holders are also available as optional accessories.



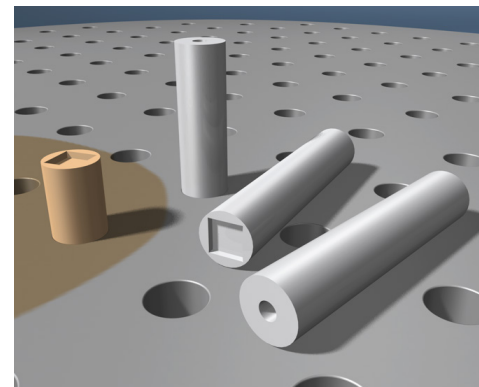
### THERMOLUMINESCENCE DOSIMETRY (TLD)

Sectioned and drilled phantoms readily accept TLDs. The end user can cut the tissue equivalent solid plugs so the TLD can be sandwiched between the cut plug and positioned at the appropriate depth within each section. This is especially critical in organ dosimetry and is supported with a table indicating at what depth to place each detector within the sections corresponding to the organ of interest.

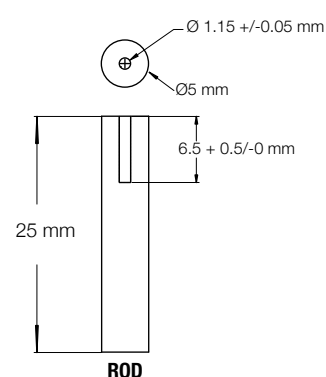
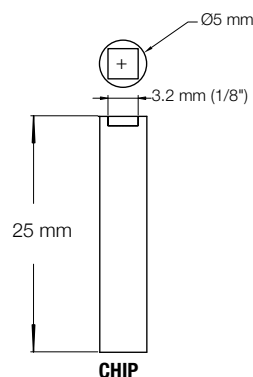
Tissue equivalent plugs cast to precisely receive TLD chips, rods, bars and cubes are an available accessory. These rods are available in brain, bone, lung and soft tissue formulations and can be cut to length by the end-user in order to position the TLD at the appropriate depth within the section. TLD disks use the standard TE plug provided with the phantom.



Standard Solid TE Plugs



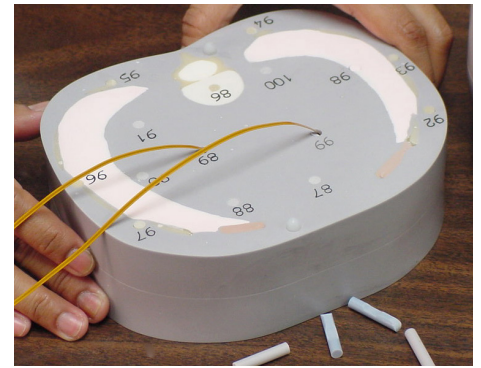
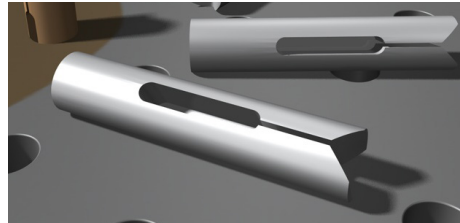
TLD and Chip Rod Holders



## MOSFET DOSIMETRY

MOSFETs are accommodated by ordering the ATOM MOSFET Cartridge as an accessory. This specially machined plug is available in soft tissue and bone formulations. The plug has a recessed area that fits the MOSFET detector along the side of the plug while still allowing the plug to fit into the 5 mm diameter hole within the section. A radius on the end of the cartridge allows a 90 degree bend in the cable. Black

tape (included) can be placed on either side of the cable on the slab to prevent damage to the cable when the phantom is assembled.



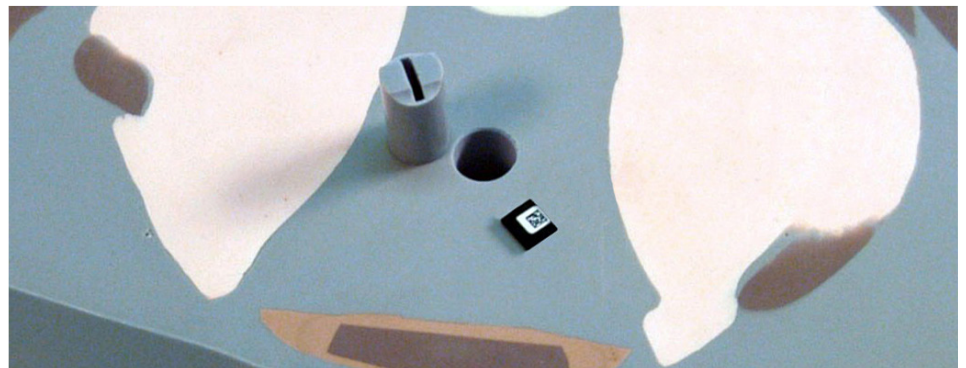
## FILM

Film dosimetry is supported by ATOM dosimetry phantoms. Both radiographic and radiochromic film may be placed between any two contiguous sections. The sections are then sealed with the black tape provided to prevent any exposure of the film to light.



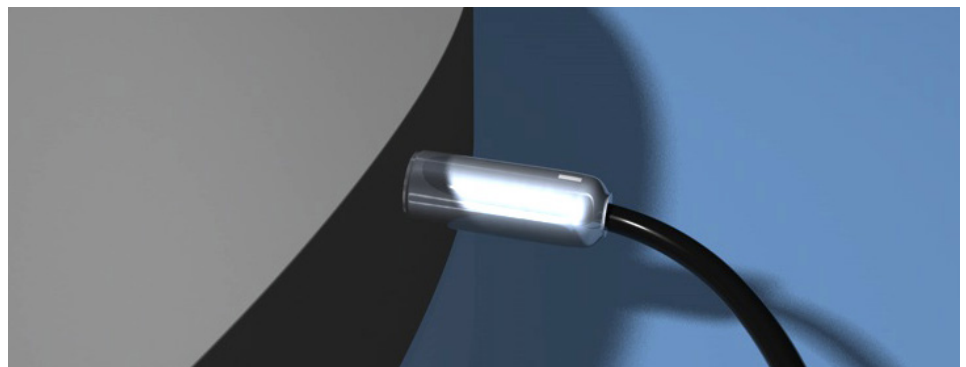
## NANODOT DOSIMETRY

Landauer OSL nanoDot holders can be utilized with the ATOM phantoms. These dosimeters require 14mm diameter drilled thru holes and plugs configured to receive the holder. **This option is only available with the organ dosimetry option and is not available with all models.**



## ION CHAMBERS AND DIODES

ATOM phantoms can be drilled to accommodate various ion chambers and diodes. The Chamber cavity is drilled in the lateral direction along the mid-plane of the section. Customers should specify the desired anatomical location of the ion chamber. Each chamber cavity is supplied with a soft tissue-equivalent plug.

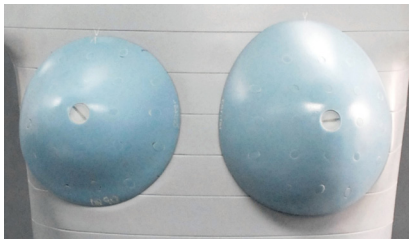


# Breast Attachments

Breast Attachments are an optional accessory for the Adult ATOM male and female phantoms only. ATOM phantoms do not come configured with breast attachments. All breast attachments are manufactured from 50% glandular/50% adipose equivalent material (BR50/50). They are available in two shapes: standard shape (representative of a patient in the upright position) or with supine shape. Each shape may have a range of available sizes. Customer must indicate if right or left side attachment is desired.

## FEMALE BREAST ATTACHMENTS

The Model 702 Adult ATOM Female does not include breast attachments. 190 cc and 350 cc standard shaped breast attachments are available as an optional accessory. These attachments will be provided drilled with 5mm diameter thru holes in a 2cm X 2cm grid pattern.



Female Single Breast Attachments (190cc & 350cc)  
702-BR-190 & -350

## MALE BREAST ATTACHMENTS

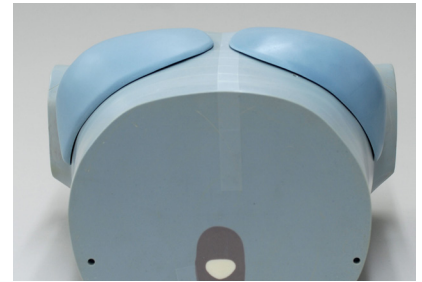
The Model 701 Adult ATOM Male can also represent a larger female patient than the Model 702. For this reason, breast attachments are available for use with the Model 701.

One standard shaped size, 350cc, is available and is provided drilled with 5mm diameter thru holes in a 2cm X 2cm grid pattern.

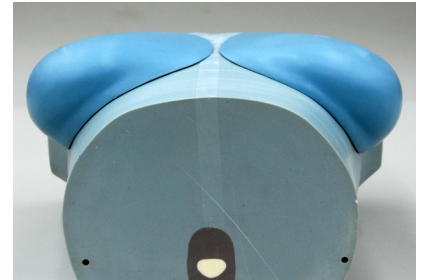
Supine breasts are available in three sizes: small (400cc B-C cup), medium (800cc D cup) and large (1200cc DD cup). They represent the clinically relevant geometry of a patient laying on her back. Supine breasts are typically used for compensation and are not drilled with any hole pattern.



Male Single Breast Attachment (350cc)  
701-BR-350



Male Small Single Supine Breast Attachment (400cc)  
701-BR-01



Male Medium Single Supine Breast Attachment (800cc)  
701-BR-02



Male Large Single Supine Breast Attachment (1200cc)  
701-BR-03

# Arm & Leg Attachments

Certain studies may require the use of arm and leg attachments. This may be of particular importance during environmental studies and in the analysis of radiation protection in an industrial setting.

Because scattering radiation can give a significant dose contribution to the surrounding tissue, the ATOM newborn and 1-year old are provided with arms and legs as a standard configuration. For all other models, arm and leg attachments are available as an optional accessory. This option includes both right and left arms and legs. Limited dosimetry configurations are available and presented on page 13.

In case of A, B, D and G configurations, arms are provided with a single sagittal slice along the mid-line and attach to the shoulders with a nylon screw. This allows for rotational movement. However, legs are sliced axially in 25 mm thick contiguous sections. The legs for models 701, 702, 705 & 706 are assembled using an assembly fixture as shown in the image on the right.



# CT Imaging QA Kit

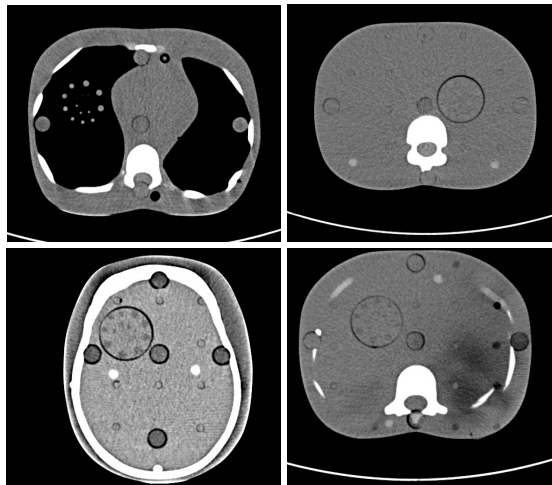
## EVALUATE CT PERFORMANCE IN ANTHROPOMORPHIC PHANTOMS

The CIRS CT Imaging QA Kit is designed for use in ATOM Dosimetry phantoms. The inserts contained in the kit investigate correlation between the image quality and CT doses. The kit provides various targets for evaluation of two important CT performance parameters: low contrast detectability and spatial resolution in soft tissues and lung regions.

The Model 700-QA includes four target inserts: (1) lung and (3) soft tissue - cylindrical, spherical and true 3D line pair targets. The diameter of the spheres and cylinders provide a 2:1 volume and cross-sectional area ratios respectively for each adjacent pair of spheres and cylinders. The ATOM phantom is machined and receives the inserts in three standard locations: head, liver and lung.

The Model 700-QA is not available for ATOM Model 703. Also, when combined with configuration "D", some organ dosimetry and/or grid locations will be replaced by inserts.

For alternate insert locations, send requests to [engineering@cirsinc.com](mailto:engineering@cirsinc.com).



Images from CIRS Model 705 (5-year old) by Xyauwei (Winnie) Zhu, MSc - The Children's Hospital of Philadelphia.

QTY	COMPONENT DESCRIPTION
1	Lung Insert - Spherical & Cylindrical Targets
1	Soft Tissue Insert - Cylindrical Targets
1	Soft Tissue Insert - Spherical Targets
1	Soft Tissue Insert - True 3D Line Pair Targets

QTY	COMPONENT DESCRIPTION
2	Soft Tissue Solid Inserts
2	Brain Equivalent Solid Inserts
2	Lung Exhale Solid Inserts

### LUNG INSERT- SPHERICAL & CYLINDRICAL TARGETS

<b>OVERALL DIMENSIONS:</b>	Ø 1.5" X 2"
<b>BACKGROUND:</b>	Lung Exhale Tissue-Equivalent Epoxy
<b>CYLINDRICAL TARGETS</b>	
<b>PROPERTIES:</b>	+10 HU; (+1% linear attenuation)
<b>DIMENSIONS:</b>	Ø 7, 5, 3.5, 2.5, 1.8 & 1.2 mm
<b>QUANTITY:</b>	18 - three (3) of each diameter
<b>SPHERICAL TARGETS</b>	
<b>PROPERTIES:</b>	+20 HU; (+2% linear attenuation)
<b>DIMENSIONS:</b>	Ø 10, 8, 6.5, 5, 4, 3.2, 2.5 & 2 mm
<b>QUANTITY:</b>	8 - one (1) of each diameter

### SOFTTISSUE INSERT - TRUE 3D LINE PAIR TARGETS

<b>BACKGROUND:</b>	Soft Tissue-Equivalent Epoxy
<b>PROPERTIES:</b>	350 HU above soft tissue 300 HU above line pair pattern background (low contrast)
<b>DIMENSIONS:</b>	5 line pairs: 5 mm wide x 12 mm deep
<b>LP/CM</b>	6, 8, 10, 11 & 12

### SOFT TISSUE INSERT - CYLINDRICAL TARGETS

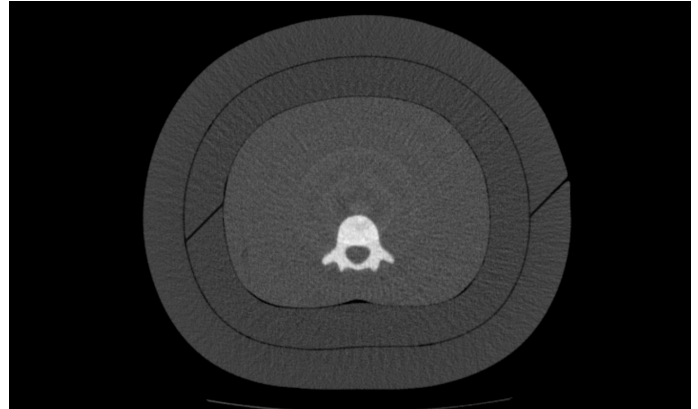
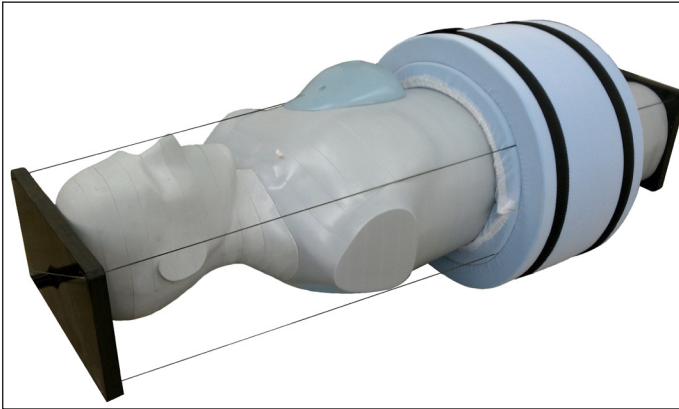
<b>OVERALL DIMENSIONS:</b>	Ø 1.5" X 2"
<b>BACKGROUND:</b>	Soft Tissue-Equivalent Epoxy
<b>PROPERTIES:</b>	Group 1: +10 HU contrast above background (+1% linear attenuation) Group 2: +20 HU contrast above background (+2% linear attenuation)
<b>DIMENSIONS:</b>	Ø 7, 5, 3.5, 2.5, 1.8 & 1.2 mm
<b>QUANTITY:</b>	18 per target group 1 & 2; Three (3) of each diameter

### SOFT TISSUE INSERT - SPHERICAL TARGETS

<b>OVERALL DIMENSIONS:</b>	Ø 1.5" X 2"
<b>BACKGROUND:</b>	Soft Tissue-Equivalent Epoxy
<b>PROPERTIES:</b>	Group 1: +10 HU contrast above background (+1% linear attenuation) Group 2: +20 HU contrast above background (+2% linear attenuation)
<b>DIMENSIONS:</b>	Ø 10, 8, 6.5, 5, 4, 3.2, 2.5 & 2 mm
<b>QUANTITY:</b>	8 per target group 1 & 2; One (1) of each diameter

# ATOM Fat Layers

Imaging and diagnosis of bariatric patients presents unique challenges. Improper scanning parameters can result in missed diagnosis, equipment failure, or increased radiation dose to patients and staff. To more appropriately assess image quality and dosimetric values for these patients, optional ATOM Fat Layers can be applied to Adult Male ATOM phantoms. Fat layers mimic human tissue within 2% by linear attenuation for MV and KV energies and are suitable for CT imaging with Wide Bore and Cone Beam CT scanners. Model 701-12 includes a set of two 4 cm thick layers, which may be used together or separately.



## ATOM Ordering Information

Most ATOM Phantoms include the top of the head through the mid-thigh. Adult ATOM male and female phantoms (Model 701 and 702) are made in three parts: head with c-spine, thorax and pelvis. Therefore, these two models are available as complete or partial phantoms.

Standard configurations include solid non-sectioned parts without dosimetry holes or axially sliced, 25mm thick, contiguous sections. Sectional phantoms are available without dosimetry holes or thru drilled with 5mm diameter holes. For drilled sectional phantoms, there is a choice of three different hole grid patterns 3cm X 3cm grid spacing, 1.5cm X 1.5cm grid spacing or Organ Dosimetry spacing.

The Newborn and one-year old (Model 703 and 704) are only available in 25 mm sections and include both arms and legs. An optional set of arm and leg attachments is available for all other models (see Optional Accessories table on page 13 for part number).

### **SPECIAL REQUESTS**

Although most dosimeters can utilize the 5mm diameter thru holes, there are those detectors that cannot. CIRS offers thru drilled holes of 3mm, 7mm, 10mm and 14mm diameters via custom request. Contact customer service for availability. Additional diameters may be available via custom order.

ATOM phantoms are available with a wide variety of standard grid patterns,

hole sizes and additional accessories. As each ATOM is made to order, phantom configuration must be indicated at the time of order (see configuration table on page 13). Not all configurations and options are available with every model. Please contact CIRS or your distributor for configuration and ordering assistance.



## CONFIGURATION TABLE

When ordering indicate the model number and the configuration option from the table below. Only one configuration option can be selected for each model. Additional accessories can be added. (See pages 13 and 14 for part numbers.)

COMPLETE PHANTOMS		-A	-B	-C	-D	-F	-G
MODEL NUMBER	DESCRIPTION	Without holes	Ø 5 mm holes in a 3 x 3 cm grid spacing	Ø 5 mm holes in a 1.5 x 1.5 cm grid spacing	Ø 5 mm Hole placement for Organ Dosimetry	Non-sectioned without holes	Ø 14mm Hole placement for Organ Dosimetry (nanoDot)
701	Adult Male Phantom (Sections 1-39)	Available	Available	Available	Available	Available	Available
702*	Adult Female Phantom (Sections 1-38)	Available	Available	Available	Available	Available	Available
703	Newborn Phantom (Sections 1-20)	Available	Available	Not Available	Available	Not Available	Not Available
704	1 Year Old Phantom (Sections 1-28)	Available	Available	Available	Available	Available	Available
705	5 Year Old Phantom (Sections 1-26)	Available	Available	Available	Available	Available	Available
706	10 Year Old Phantom (Sections 1-32)	Available	Available	Available	Available	Available	Available
<b>PARTIAL PHANTOMS</b>							
701-HN	Adult Male Head & Neck Phantom (Sections 1-10)	Available	Available	Available	Available	Available	Available
701-T	Adult Male Thorax Phantom (Sections 11-25)	Available	Available	Available	Available	Available	Available
701-P	Adult Male Pelvis Phantom (Sections 26-39)	Available	Available	Available	Available	Available	Available
702-HN	Adult Female Head & Neck Phantom (Sections 1-10)	Available	Available	Available	Available	Available	Available
702-T*	Adult Female Thorax Phantom (Sections 11-23)	Available	Available	Available	Available	Available	Available
702-P	Adult Female Pelvis Phantom (Sections 24-38)	Available	Available	Available	Available	Available	Available
705-HN	5 Year Old Head & Neck Phantom (Sections 1-8)	Available	Available	Available	Available	Available	Available
705-TR	5 Year Old Trunk Phantom (Sections 9-26)	Available	Available	Available	Available	Available	Available
706-HN	10 Year Old Head & Neck Phantom (Sections 1-9)	Available	Available	Available	Available	Available	Available
706-TR	10 Year Old Trunk Phantom (Sections 10-32)	Available	Available	Available	Available	Available	Available

Table 5

## ITEMS INCLUDED WITH EACH PHANTOM

QUANTITY	DESCRIPTION
Model Specific	Numbered Sectional Slabs (refer to table 3)
1	User Guide
1	Organ Dosimetry Map (D and G Configurations only)**
<b>WHOLE PHANTOMS</b>	
1	Custom fitted Storm® Transport/Storage case (703, 704 & 705)
2	Custom fitted Storm® Transport/Storage cases (701 & 702)
1	Reinforcement base
1	Reinforcement top with threaded assembly
1	Open end wrench
1 Bag	Reinforcement assembly cord
<b>PARTIAL PHANTOMS</b>	
QUANTITY	DESCRIPTION
1	Nylon strap with buckle

\*Adult female does not include breast attachments.

PHANTOMS WITH HOLES	
2	Push rod for plugs
1 Bag	Extra soft tissue equivalent solid hole plugs (700-09-S / 703-09-S)
1 Bag	Extra lung equivalent solid hole plugs (700-09-L)
1 Bag	Extra bone equivalent solid hole plugs (70X-09-BN)
1 Bag	Extra brain equivalent solid hole plugs (700-09-BT)
1 Bag	Extra spinal cord equivalent solid hole plugs (700-09-SC)
1 Roll	Black (light proof) electrical tape

Table 6

QUANTITY	DESCRIPTION
<b>G PHANTOMS WITH Ø 14 mm HOLES</b>	
1 Bag	Soft tissue equivalent solid plugs
1 Bag	Lung equivalent solid plugs
1 Bag	Brain equivalent solid plugs
1 Bag	Bone equivalent solid plugs
1 Roll	Black (light proof) electrical tape

Table 7

## OPTIONAL ACCESSORIES

OPTIONAL ARM AND LEG ATTACHMENTS*		-A	-B	-C	-D	-F	-G
MODEL NUMBER	DESCRIPTION	Without holes	Ø 5 mm holes in a 3 x 3 cm grid spacing	Ø 5 mm holes in a 1.5 x 1.5 cm grid spacing	Ø 5 mm Hole placement for Organ Dosimetry	Non-sectioned without holes	Ø 14mm Hole placement for Organ Dosimetry (nanoDot)
701-10-R	Right Arm Attachment for Adult Male Phantom	Available	Not Available	Not Available	Available	Available	Available
701-10-L	Left Arm Attachment for Adult Male Phantom	Available	Not Available	Not Available	Available	Available	Available
701-11-R	Right Leg Attachment for Adult Male Phantom	Available	Available	Not Available	Available	Available	Available
701-11-L	Left Leg Attachment for Adult Male Phantom	Available	Available	Not Available	Available	Available	Available
702-10-R	Right Arm Attachment for Adult Female Phantom	Available	Not Available	Not Available	Available	Available	Available
702-10-L	Left Arm Attachment for Adult Female Phantom	Available	Not Available	Not Available	Available	Available	Available
702-11-R	Right Leg Attachment for Adult Female Phantom	Available	Available	Not Available	Available	Available	Available
702-11-L	Left Leg Attachment for Adult Female Phantom	Available	Available	Not Available	Available	Available	Available
705-10-R	Right Arm Attachment for 5 Year Old Phantom	Available	Not Available	Not Available	Available	Available	Available
705-10-L	Left Arm Attachment for 5 Year Old Phantom	Available	Not Available	Not Available	Available	Available	Available
705-11-R	Right Leg Attachment for 5 Year Old Phantom	Available	Not Available	Not Available	Available	Available	Available
705-11-L	Left Leg Attachment for 5 Year Old Phantom	Available	Not Available	Not Available	Available	Available	Available

Table 8

\*Optional arms, legs, breasts and CT Imaging QA Kit should be ordered at the time of initial phantom purchase. If these accessories are ordered after the phantom, the customer must return the affected portions of the phantom for retrofitting or drilling to accommodate accessories.

OPTIONAL BREAST ATTACHMENTS*						
MODEL NUMBER	DESCRIPTION	COMPATIBLE WITH	SIZE	SIDE	-D	-G
701-BR-01R	Single Supine Breast Attachment	Adult Male Phantom	400cc	Right	Available	Available
701-BR-01L	Single Supine Breast Attachment	Adult Male Phantom	400cc	Left	Available	Available
701-BR-02R	Single Supine Breast Attachment	Adult Male Phantom	800cc	Right	Available	Available
701-BR-02L	Single Supine Breast Attachment	Adult Male Phantom	800cc	Left	Available	Available
701-BR-03R	Single Supine Breast Attachment	Adult Male Phantom	1200cc	Right	Available	Available
701-BR-03L	Single Supine Breast Attachment	Adult Male Phantom	1200cc	Left	Available	Available
701-BR-350R	Single Breast Attachment	Adult Male Phantom	350cc	Right	Available	Available
701-BR-350L	Single Breast Attachment	Adult Male Phantom	350cc	Left	Available	Available
702-BR-01R	Single Supine Breast Attachment	Adult Female Phantom	400cc	Right	Available	Available
702-BR-01L	Single Supine Breast Attachment	Adult Female Phantom	400cc	Left	Available	Available
702-BR-02R	Single Supine Breast Attachment	Adult Female Phantom	800cc	Right	Available	Available
702-BR-02L	Single Supine Breast Attachment	Adult Female Phantom	800cc	Left	Available	Available
702-BR-190R	Single Breast Attachment	Adult Female Phantom	190cc	Right	Available	Available
702-BR-190L	Single Breast Attachment	Adult Female Phantom	190cc	Left	Available	Available
702-BR-350R	Single Breast Attachment	Adult Female Phantom	350cc	Right	Available	Available
702-BR-350L	Single Breast Attachment	Adult Female Phantom	350cc	Left	Available	Available



Table 9

\*Optional arms, legs, breasts and CT Imaging QA Kit should be ordered at the time of initial phantom purchase. If these accessories are ordered after the phantom, the customer must return the affected portions of the phantom for retrofitting or drilling to accommodate accessories.

ION CHAMBER OPTIONS	
700-08-CV	Positioning Fee To Accommodate Ion Chamber Positioned Midplane In One Sectional Slab Of Atom Phantom (CV=Cirs Cavity Code, Specify Ion Chamber And Isocenter Location) Includes Soft Tissue Plug

Table 10

ADDITIONAL OPTIONS	
701-HN-CS	Case for Adult Head & Neck
701-12	ATOM Fat Layers
700-QA*	CT Imaging QA Kit for ATOM & 007TE Phantoms
038-20	SRS Frame Support Cups, Set of 4 (Compatible with all head neck phantoms)

Table 11

OPTIONAL ACCESSORIES (CONT.)

PLUG OPTIONS			
MODEL NUMBER	DESCRIPTION	DIAMETER	MATERIAL
700-01-S	ATOM TLD Chip Holder	Ø 5mm x 25mm L	Soft Tissue Equivalent
700-01-L	ATOM TLD Chip Holder	Ø 5mm x 25mm L	Lung Tissue Equivalent
700-01-BT	ATOM TLD Chip Holder	Ø 5mm x 25mm L	Brain Tissue Equivalent
70X-01-BN	ATOM TLD Chip Holder (X=ATOM Model#)	Ø 5mm x 25mm L	Bone Tissue Equivalent
700-04-S	ATOM MOSFET Cartridge	Ø 5mm x 25mm L	Soft Tissue Equivalent
700-04-L	ATOM MOSFET Cartridge	Ø 5mm x 25mm L	Lung-Tissue Equivalent
700-04-BT	ATOM MOSFET Cartridge	Ø 5mm x 25mm L	Brain Tissue Equivalent
70X-04-BN	ATOM MOSFET Cartridge (X=ATOM Model#)	Ø 5mm x 25mm L	Bone Tissue Equivalent
700-05-S	ATOM nanoDot Single Dosimeter Holder	Ø 14mm x 25mm L	Soft Tissue-Equivalent
700-05-L	ATOM nanoDot Single Dosimeter Holder	Ø 14mm x 25mm L	Lung Tissue Equivalent
700-05-BT	ATOM nanoDot Single Dosimeter Holder	Ø 14mm x 25mm L	Brain Tissue Equivalent
70X-05-BN	ATOM nanoDot Single Dosimeter Holder, (X=ATOM Model#)	Ø 14mm x 25mm L	Bone Tissue Equivalent
700-09-S	ATOM SOLID TE PLUG	Ø 5mm x 25mm L	Soft Tissue Equivalent
700-09-L	ATOM SOLID TE PLUG	Ø 5mm x 25mm L	Lung Tissue Equivalent
700-09-BT	ATOM SOLID TE PLUG	Ø 5mm x 25mm L	Brain Tissue Equivalent
700-09-SC	ATOM SOLID TE PLUG	Ø 5mm x 25mm L	Spinal Cord Tissue Equivalent
70X-09-BN	ATOM SOLID TE PLUG (X=ATOM Model#)	Ø 5mm x 25mm L	Bone Tissue Equivalent
700-13-S	ATOM SOLID TE PLUG	Ø 5mm x 25mm L	Soft Tissue Equivalent
700-13-L	ATOM SOLID TE PLUG	Ø 5mm x 25mm L	Lung Tissue Equivalent
700-13-BT	ATOM SOLID TE PLUG	Ø 5mm x 25mm L	Brain Tissue Equivalent
70X-13-BN	ATOM SOLID TE PLUG (X=ATOM Model#)	Ø 5mm x 12 mm L	Bone Tissue Equivalent
700-14-S	TLD HOLDER (1mm x8.5mm long)	Ø 5mm x 12 mm L	Soft Tissue Equivalent
700-14-L	TLD HOLDER (1mm x8.5mm long)	Ø 5mm x 12 mm L	Lung Tissue Equivalent
700-14-BT	TLD HOLDER (1mm x8.5mm long)	Ø 5mm x 12 mm L	Brain Tissue Equivalent
70X-14-BN	TLD HOLDER (1mm x8.5mm long)	Ø 5mm x 25mm L	Bone Tissue Equivalent
700-15-S	ATOM GLASS ROD HOLDER (1mm x12mm long)	Ø 5mm x 25mm L	Soft Tissue Equivalent
700-15-L	ATOM GLASS ROD HOLDER (1mm x12mm long)	Ø 5mm x 25mm L	Lung Tissue Equivalent
700-15-BT	ATOM GLASS ROD HOLDER (1mm x12mm long)	Ø 5mm x 25mm L	Brain Tissue Equivalent
70X-15-BN	ATOM GLASS ROD HOLDER (1mm x12mm long) (X=ATOM Model#)	Ø 5mm x 25mm L	Bone Tissue Equivalent
700-16-S	ATOM SOLID TE PLUG	Ø 14mm x 25mm L	Soft Tissue Equivalent
700-16-L	ATOM SOLID TE PLUG	Ø 14mm x 25mm L	Lung Tissue Equivalent
700-16-BT	ATOM SOLID TE PLUG	Ø 14mm x 25mm L	Brain Tissue Equivalent
70X-16-BN	ATOM SOLID TE PLUG (X=ATOM Model#)	Ø 14mm x 25mm L	Bone Tissue Equivalent
700-17-S	ATOM SOLID TE PLUG WITH Ø 5 MM HOLE	Ø 14 mm x 25mm L	Soft Tissue Equivalent
700-17-L	ATOM SOLID TE PLUG WITH Ø 5 MM HOLE	Ø 14 mm x 25mm L	Lung Tissue Equivalent
700-17-BT	ATOM SOLID TE PLUG WITH Ø 5 MM HOLE	Ø 14 mm x 25mm L	Brain Tissue Equivalent
70X-17-BN	ATOM SOLID TE PLUG WITH Ø 5 MM HOLE (	Ø 14 mm x 25mm L	Bone Tissue Equivalent

Table 12



# Warranty

All standard CIRS products and accessories are warranted by CIRS against defects in material and workmanship for a period as specified below. During the warranty period, the manufacturer will repair or, at its option, replace, at no charge, a product containing such defect provided it is returned, transportation prepaid, to the manufacturer. Products repaired in warranty will be returned transportation prepaid.

Product	Warranty Period
Models 701-706 ATOM Dosimetry Phantoms	60 Months

There are no warranties, expressed or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description on the face hereof. This expressed warranty excludes coverage of, and does not provide relief for, incidental or consequential damages of any kind or nature, including but not limited to loss of use, loss of sales or inconvenience. The exclusive remedy of the purchaser is limited to repair, recalibration, or replacement of the product at manufacturer's option.

This warranty does not apply if the product, as determined by the manufacturer, is defective because of normal wear, accident, misuse, or modification.

## **NON-WARRANTY SERVICE**

If repairs or replacement not covered by this warranty are required, a repair estimate will be submitted for approval before proceeding with said repair or replacement.

## **RETURNS**

If you are not satisfied with your purchase for any reason, please contact Customer Service prior to returning the product. Call 800-617-1177, email [rma@circinc.com](mailto:rma@circinc.com), or fax an RMA request form to 757-857-0523. CIRS staff will attempt to remedy the issue via phone or email as soon as possible. If unable to correct the problem, a return material authorization (RMA) number will be issued. Non-standard or "customized" products may not be returned for refund or exchange unless such product is deemed by CIRS not to comply with documented order specifications. You must return the product to CIRS within 30 calendar days of the issuance of the RMA. All returns should

be packed in the original cases and or packaging and must include any accessories, manuals and documentation that shipped with the product. The RMA number must be clearly indicated on the outside of each returned package. CIRS recommends that you use a carrier that offers shipment tracking for all returns and insure the full value of your package so that you are completely protected if the shipment is lost or damaged in transit. If you choose not to use a carrier that offers tracking or insure the product, you will be responsible for any loss or damage to the product during shipping. CIRS will not be responsible for lost or damaged return shipments. Return freight and insurance is to be pre-paid.

## **WITH RMA NUMBER, ITEMS MAY BE RETURNED TO:**

CIRS  
Receiving  
900 Asbury Ave,  
Norfolk, Virginia, 23513 USA

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**Additional references may be available.  
Please visit our website or contact CIRS.**





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### Technical Assistance

1.800.617.1177



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