ATOM® Phantom Family

Models 701 -706

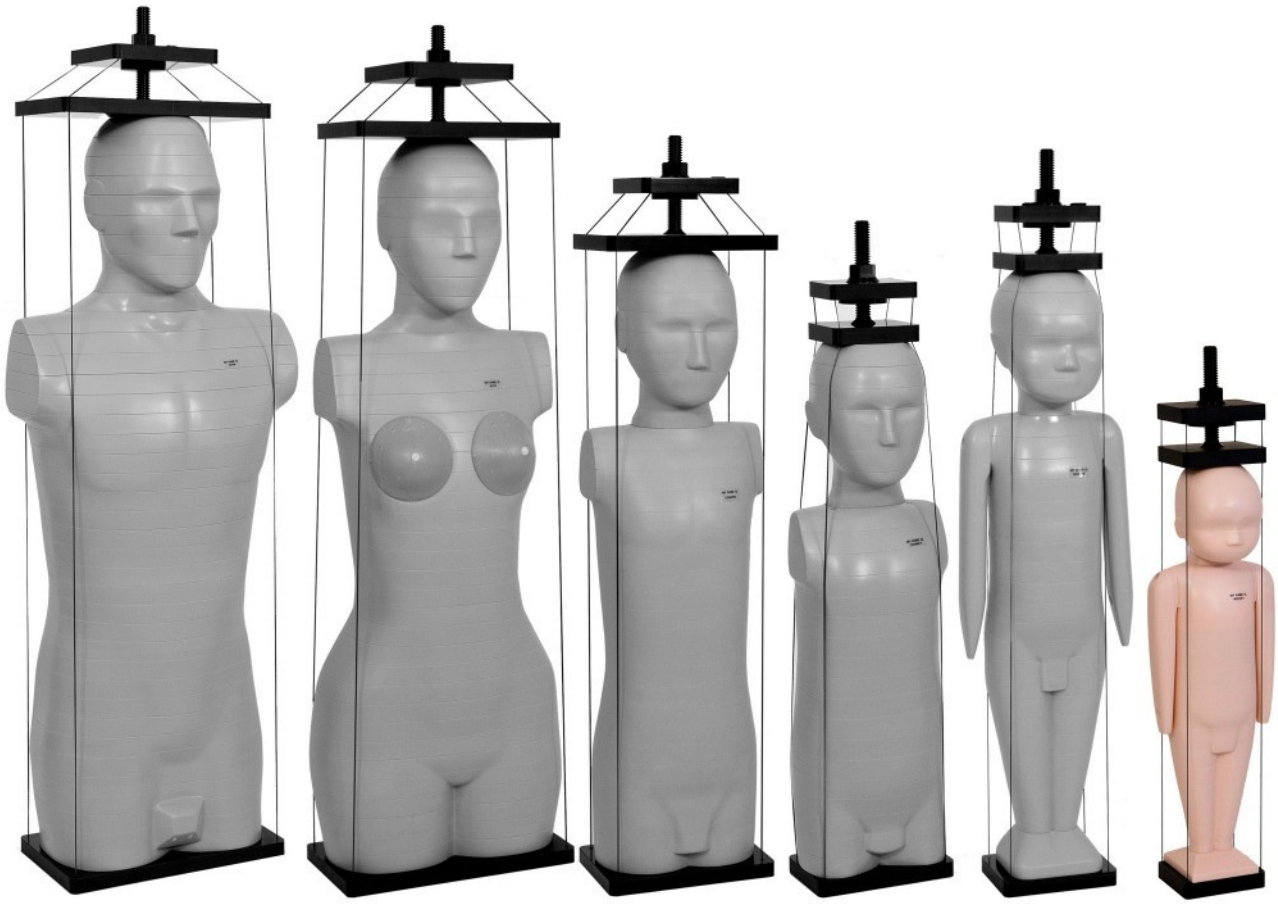
CIRS

Part of SUN NUCLEAR

ATOM® Phantom Family User Guide

Computerized Imaging Reference Systems, Inc. has been certified by UL DQS Inc. to **(ISO) 13485:2016**. Certificate Registration No.10000905-MP2016.

1 Introduction



Adult Male | Adult Female (Breasts not included) | 10-year old | 5-year old | 1-year old | Newborn

General Care and Handling

Consult instructions for use. This equipment must be used in accordance with the instructions in this manual. Read all instructions and safety labels before use.

Upon initial receipt of the phantom and before removing the phantom, perform a parts inventory to ensure that all required components have been received before attempting to assemble the unit.

After completing an inventory, begin removing the phantom for assembly. Inspect each component upon removal of the phantom from the case. If there is a discrepancy with the inventory or you observe damage, this must be reported with 30 days of receipt to ensure your warranty is intact. Some transport carriers require transit damage notification within 15 days. If there are any signs of damage, please keep all packaging and notify CIRS immediately.

Slight color variations may be visible in the phantom body. This is a normal manufacturing deviation and natural aging characteristic and will not affect the tissue mimicking or imaging properties of the phantom in any way.

ATOM phantoms are manufactured from epoxy-based tissue substitutes. They are durable but can still be damaged if mis- handled. Take special care not to scratch the surfaces of each section by keeping them clean of dirt and debris, especially prior to assembly and compression of the sections. Do not use solvents or abrasive cleaners on any part of the phantom. If the phantom must be cleaned, use mild soapy water and dry with a soft towel.

2 Setup

Sequence of Assembly

1. ATOM sectional phantoms are sequentially numbered starting at the top of the head. Once all desired detectors have been placed in each section, start by placing the bottom most section on the base plate of the reinforcement device. Alignment pins will ensure proper location.
2. Assemble the pelvis, torso and head separately on a flat, even surface. Compile the entire phantom in the same order and place the top plate of the reinforcement device on the top section.
3. Turning the top nut counterclockwise will apply tension to the four strings and a downward pressure on the phantom. Optimal tension is reached when the strings give off a high-pitched tone when plucked with a finger.

- Note: Should the threaded string break during phantom assembly, use the extra string provided and follow restringing instructions.

Breasts and Extremities

Once the body is assembled the breasts, or upper and lower extremities can be attached using the screws provided.

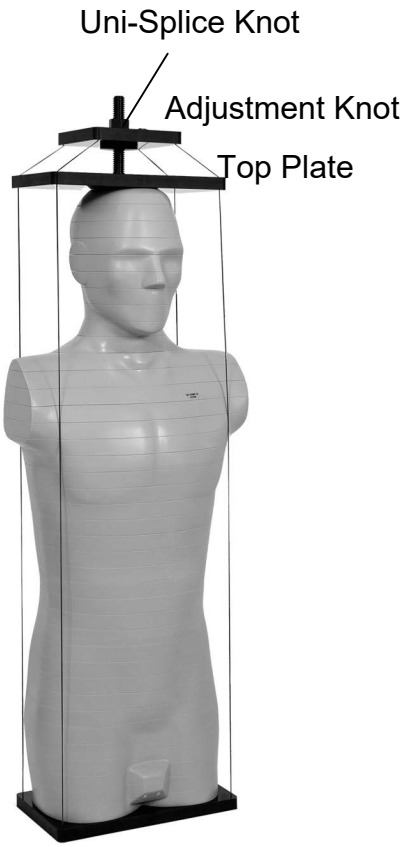
Arrows on the breasts or attachments should be directed upward. The left and right are marked “L” and “R”. Do not over tighten the screws and take care not to cross thread the screws when assembling.

Dismantling

To dismantle the phantom simply work backwards in the same manner used to assemble the unit. If the phantom is stored assembled for extended periods, it may be necessary to re-tension the strings or strap periodically.

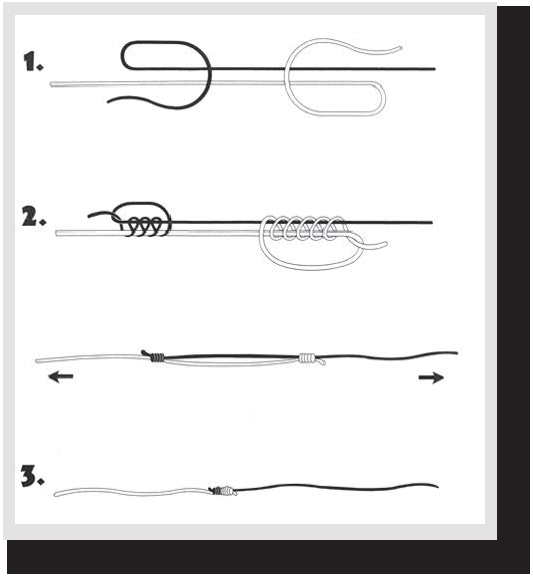
Restringing the ATOM Phantom Holder

1. Remove string from packaging and straighten.
2. Assemble the phantom on the bottom plate, then place top plate on head and slide adjusting plate over screw and down onto flange on nut.
3. Start stringing phantom by pushing string through hole 1 from top. Continue through holes 2,3,4, and so on, until you reach hole 12. Be sure to pull all excess string through as you go, leaving a minimum of 12” sticking out of hole 1 (see illustration). If you are stringing phantom Model 703, 704, 705 or 706 continue to Step 5.
4. If you are stringing phantom Model 701or 702, start at Hole 1 and repeat Step 3.
5. Lower the adjuster plate to its lowest position and remove all slack from string, pulling excess out from Holes 1 and 12.
6. Tie uni-splice knot in string between hole 1 and 12 as close to the plate as possible (Refer to the next section: *Tying a Uni-Splice Knot*). Trim off excess string with razor blade or nail clipper.
7. Raise adjustment plate and add tension to string by turning the top bolt counter- clockwise using included open-end wrench. Optimal tension is reached when the strings give off a high-pitched tone when plucked with a finger. Check strings for equal tension.



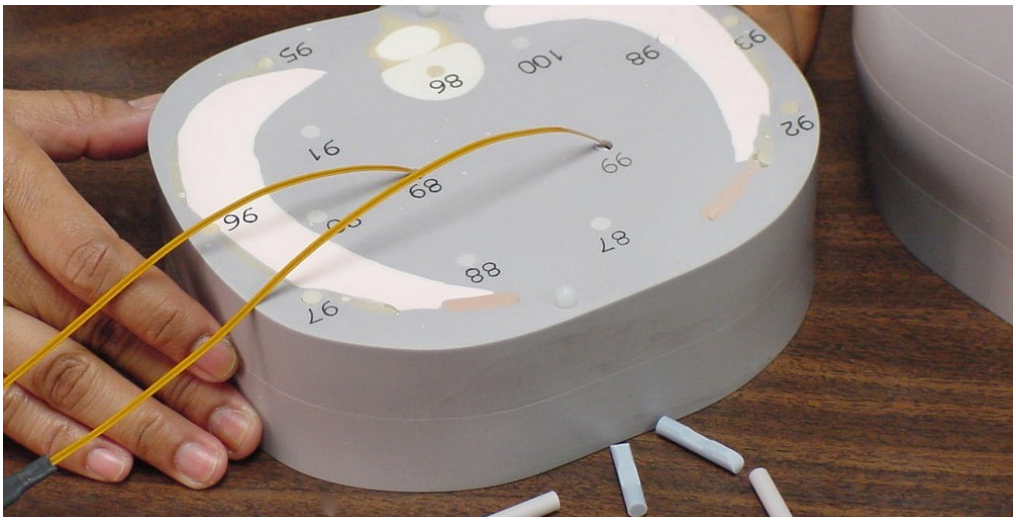
Tying a Uni-Splice Knot

1. Position the ends of the strings so that they run parallel with each other for 12” to 18”.
2. Make a loop with the string and pass the tag end through the loop and around both lines 5 or 6 times.
3. Pull the tag end and secure the knot making sure that the loops snug down in an orderly fashion. Repeat with the other end of the line, except with 8 to 10 wraps through the loop.
4. Pull on the standing lines, and you will see the two knots jam, forming the connection.
5. Trim the line about 1/8” past the knot.

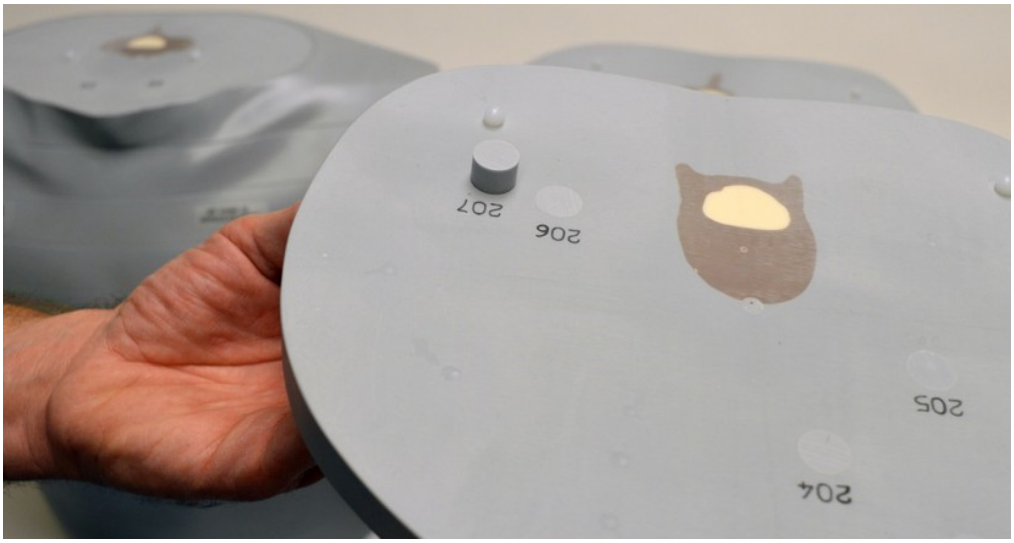


Placement and Remove of TLD & MOSFET Detectors

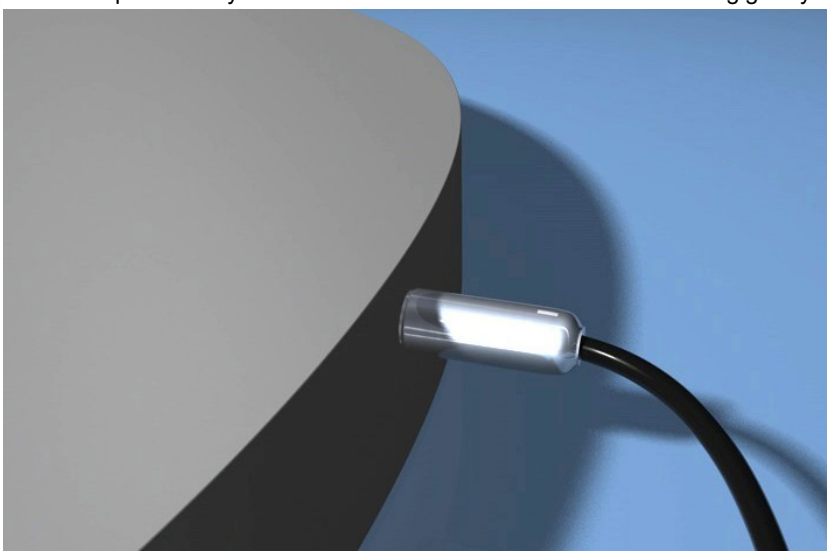
It is recommended that detectors be placed and removed in sequence according to their numeric order. Each through hole comes with a tissue equivalent plug which is inserted at the factory. These plugs can be removed using the plastic push rod provided. (Push through from down side of slab). Through hole plugs can be cut to length to achieve appropriate depth to detector placement within each section. Plugs are not cut in advance to enable the user to account for the variance in thickness of different detectors on the market. Additional and replacement plug kits are available for sale.



When loading detectors in through holes place the bottom half of the plugs into their appropriate positions first. Pushing from top side of slab, check to make sure that all the plugs are flush to the bottom surface. Gently place each detector in its appropriate hole. Check to make sure each detector is positioned correctly within the hole before inserting the top-covering plug. Be sure the length of the top plug takes into account the thickness of the detector before pushing the plug flush to the top surface. Failure to do so may result in damage to the detector.

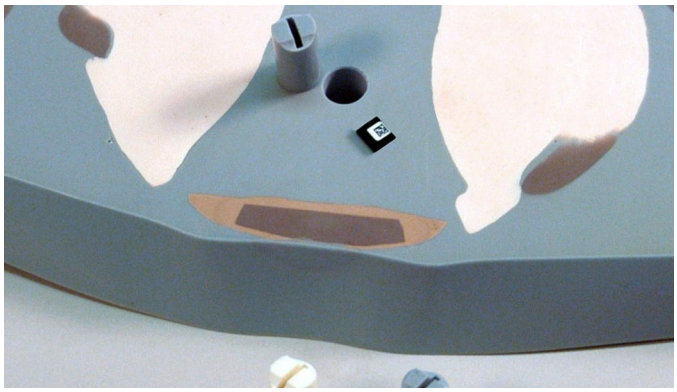


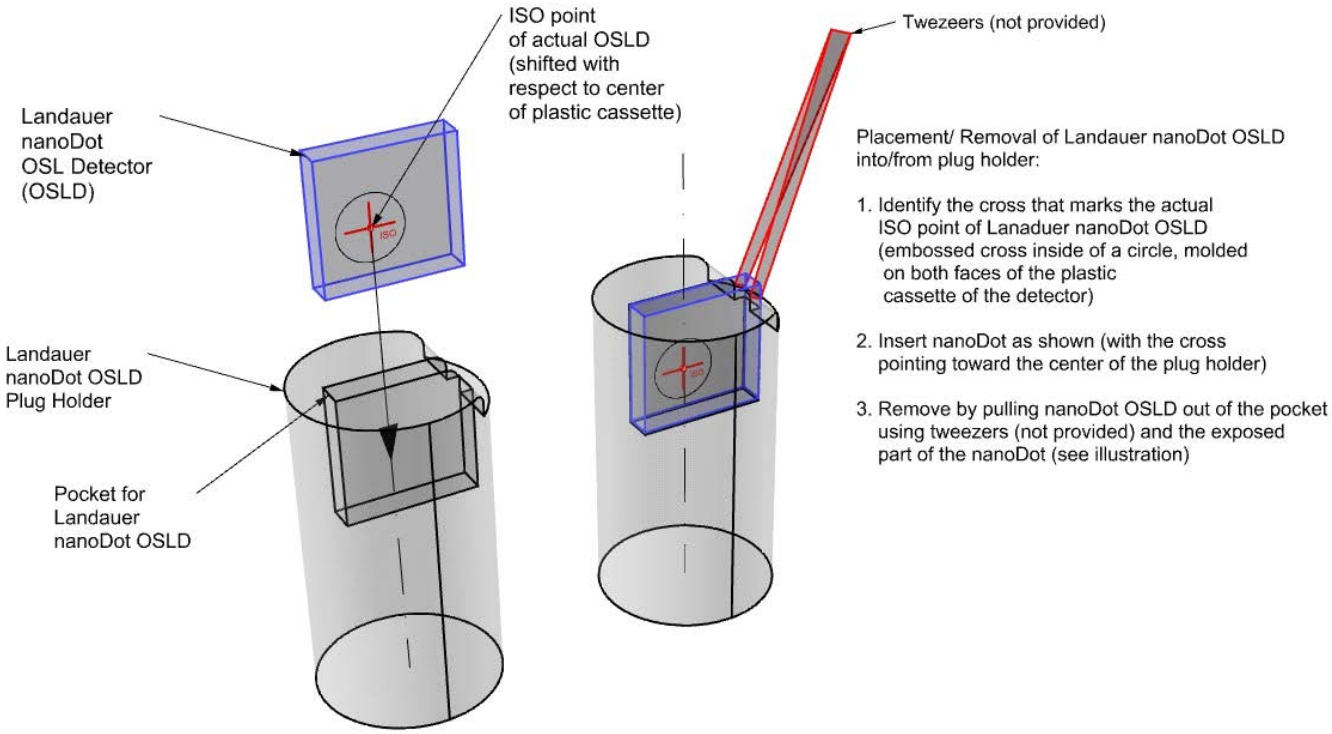
After placing the phantom body on the CT/ LINAC couch, insert the ion chamber in the matching drill cavity. Position the ion chamber as desired and fix the ion chambers' cable in place with electrical tape or equivalent to prevent any undesired movement of the ion chamber during gantry movement.



Placement and Removal of Landauer OSL NanoDot Detectors

It is recommended that detectors be placed and removed in sequence according to their numeric order.





Each through hole comes with a tissue equivalent plug which is inserted at the factory. The plugs can be easily removed by pushing then up from the bottom side of the slab with the

push rod provided. The sensitive part of the nanoDot is encapsulated, so as it's ISO point is shifted with respect to the center of the plastic cassette. Therefore, in order to perform measurements that are not affected by this shift, CIRS recommends that the nanoDot be inserted so as the ISO point matches the central axis of the nanoDot plug holder (see illustration).

3 Support and Maintenance

Hardware Maintenance

Inspection

Periodically inspect the ATOM Phantom Family and accessories for damage. If damage is visible, if any mechanical or electrical degradation is suspected, or if errors are suspected, discontinue use and contact Sun Nuclear Support. See *Contacting Technical Support* on page 8.

Repair

The ATOM Phantom Family and the parts provided with the ATOM Phantoms cannot be repaired by the user. If there are problems with any of the devices, contact Sun Nuclear Support.

Cleaning

ATOM Phantom Family can be cleaned by wiping with a dry cloth. If necessary, external surfaces can be cleaned with a damp cloth, moistened with water and mild cleaning solution. Do not use any solvents or abrasive cleaners.

Do not immerse ATOM Phantom Family in any liquid. Do not allow any liquid to flow onto the surface of the instrument or any associated parts or accessories, or into any cavity.

Disposal and Recycling

Do not discard unit as waste. Recycle the components in accordance with local regulations

Contacting Technical Support

You may request support in two ways:

Contact the Sun Nuclear Support team by telephone

- U.S.A.: +1 321-259-6862
- Netherlands: +31 20 399 90 41
- Germany: +49 61 02 50 49 500

Support Website

1. Open an internet browser and navigate to www.sunnuclear.com/support.
2. Enter your email address and password and then click Login.
   - To download product information, click Products and Devices, select the product, and then select the download type.
   - To open a Support request, click Open New Case, complete the form, and then click Create Case.

4 Specifications

Phantom Material Specifications

	C	O	H	N	Ca	Mg	Cl	Physical Density g/cc	Electron Density g/cc
Adult Bone	0.3705	0.3567	0.0483	0.0097	0.1524	0.0619	0.0005	1.597	$5.030 \cdot 10^{23}$
Pediatric Newborn Bone	0.4563	0.3065	0.0647	0.0111	0.0909	0.0695	0.0005	1.407	$4.498 \cdot 10^{23}$
Pediatric 1 Yr Bone	0.4505	0.3160	0.0577	0.0123	0.1286	0.0340	0.0006	1.450	$4.606 \cdot 10^{23}$
Pediatric 5 Yr Bone	0.4163	0.3331	0.0523	0.0111	0.1509	0.0354	0.0005	1.518	$4.801 \cdot 10^{23}$
Pediatric 10 Yr Bone	0.4015	0.3406	0.0507	0.0106	0.1545	0.0413	0.0005	1.545	$4.878 \cdot 10^{23}$
Soft Tissue	0.5747	0.2460	0.0847	0.0165	0.0000	0.0762	0.0019	1.055	$3.434 \cdot 10^{23}$
Newborn Soft Tissue	0.5880	0.2286	0.0833	0.0184	0.0000	0.0800	0.0015	1.055	$3.433 \cdot 10^{23}$
Spinal Cord	0.5429	0.2659	0.0736	0.0217	0.0000	0.0937	0.0022	1.070	$3.448 \cdot 10^{23}$
Spinal Discs	0.4577	0.3107	0.0671	0.0188	0.0000	0.1436	0.0021	1.131	$3.624 \cdot 10^{23}$
Cartilage	0.4576	0.3106	0.0671	0.0188	0.0000	0.1436	0.0021	1.131	$3.624 \cdot 10^{23}$
Lung, inhale	0.6590	0.1929	0.0859	0.0352	0.0101	0.0000	0.0169	0.205	$0.668 \cdot 10^{23}$
Brain	0.5363	0.2651	0.0816	0.0153	0.0000	0.0998	0.0019	1.069	$3.470 \cdot 10^{23}$
Breast 50/50 (Gland/ Adipose)	0.7026	0.1700	0.0960	0.0193	0.0940	0.0000	0.0020	0.991	$3.262 \cdot 10^{23}$

Linear Attenuation Coefficients, Physical and Electron Densities of ATOM Materials

ATOM Phantom Family (Adult) - Recalculated Linear Attenuation Coefficients (CM-1)

	AVERAGE SOFT TISSUE (ADULT)		AVERAGE BONE TISSUE (ADULT)		AVERAGE LUNG TISSUE (INHALE)*		AVERAGE BRAIN TISSUE		BREAST TISSUE 50/50	
EN, MEV	Reference[1]	ATOM	Reference[1]	ATOM	Reference[2]	ATOM	Reference[2]	ATOM	Reference[3]	ATOM
0.04	0.2679	0.2678	0.7884	0.7887	0.0537	0.0534	0.2791	0.2791	0.2428	0.2436
0.06	0.2087	0.2091	0.4244	0.4242	0.0410	0.0411	0.2135	0.2138	0.1954	0.1954
0.08	0.1871	0.1876	0.3251	0.3248	0.0365	0.0367	0.1902	0.1907	0.1770	0.1767
0.10	0.1742	0.1748	0.2822	0.2819	0.0339	0.0341	0.1767	0.1772	0.1655	0.1652
0.15	0.1538	0.1544	0.2344	0.2341	0.0299	0.0301	0.1557	0.1562	0.1466	0.1463
0.20	0.1401	0.1406	0.2098	0.2095	0.0272	0.0274	0.1418	0.1422	0.1337	0.1334
0.40	0.1086	0.1090	0.1605	0.1602	0.0211	0.0212	0.1098	0.1102	0.1037	0.1035
0.60	0.0917	0.0920	0.1351	0.1349	0.0178	0.0179	0.0927	0.0930	0.0875	0.0874
0.80	0.0805	0.0808	0.1186	0.1184	0.0156	0.0157	0.0814	0.0817	0.0769	0.0767
1.00	0.0724	0.0726	0.1066	0.1064	0.0140	0.0141	0.0731	0.0734	0.0691	0.0690
1.50	0.0589	0.0591	0.0868	0.0866	0.0114	0.0115	0.0595	0.0597	0.0562	0.0561
2.00	0.0505	0.0507	0.0746	0.0745	0.0098	0.0099	0.0511	0.0513	0.0482	0.0481
4.00	0.0347	0.0348	0.0521	0.0520	0.0068	0.0068	0.0352	0.0352	0.0331	0.0329
6.00	0.0282	0.0282	0.0431	0.0430	0.0055	0.0055	0.0286	0.0286	0.0268	0.0266
8.00	0.0247	0.0247	0.0383	0.0383	0.0048	0.0048	0.0251	0.0250	0.0234	0.0231

10.0	0.0225	0.0225	0.0355	0.0355	0.0044	0.0043	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	0.0035	0.0186	0.0185	0.0170	0.0166
30.0	0.0171	0.0170	0.0296	0.0296	0.0034	0.0032	0.0176	0.0174	0.0159	0.0154
Density, gcm^3	1.03	1.055	1.577	1.597	0.20	0.205	1.04	1.069	0.982	0.991
El. density, $*10^{23}$, cm^3	3.421	3.434	5.035	5.030	0.663	0.668	3.458	3.470	3.267	3.262

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

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.

Appendix A: Regulatory Supplement

Symbols

The following symbols are used in this guide and on our product labels.

Consult instructions for use. This equipment must be used in accordance with the instructions in this manual. Read all instructions and safety labels before use. (EN ISO 15223-1, 5.4.3)

Do not throw in trash; dispose of in an environmentally friendly way. (EN 50419)

Operator Responsibility

The instructions in this manual are intended for trained clinical personnel. The operator is solely responsible for the accurate setup and use of the phantom.

Reporting Health or Safety Related Issues or Concerns

Should the need arise to report any safety or health related issues or concerns regarding the use of products, contact CIRS, part of Sun Nuclear directly.

CIRS
900 Asbury Ave
Norfolk, VA 23513
Phone +(757) 855-2765

Modifications to Equipment

Any changes or modifications to the device that are not expressly approved by Sun Nuclear Corporation could void your warranty.

CIRS

Part of SUN NUCLEAR

+1 757 855 2765 // CIRSINC.com
CIRS Inc, 900 Asbury Ave, Norfolk, Virginia 23513 USA