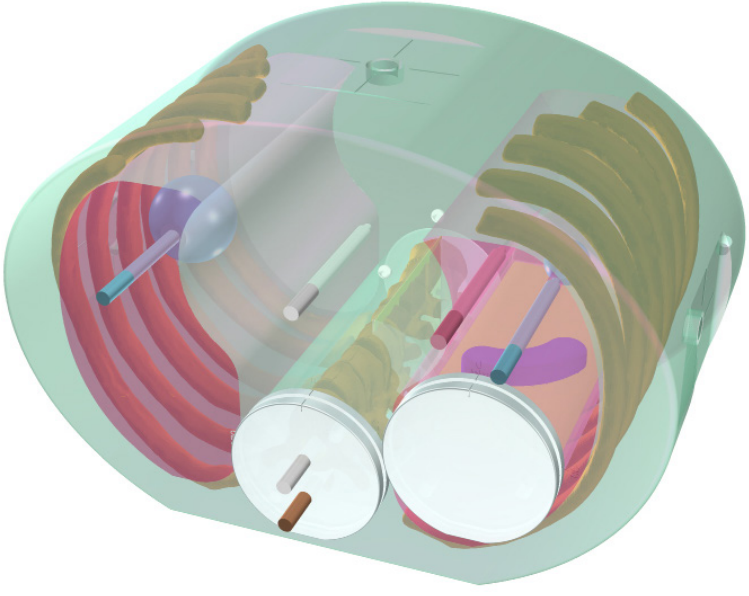
E2E® SBRT Phantom with Removable Spine

Model 036S-CVXX-xx



SBRT e2e SCAN PLAN LOCALIZE TREAT

USER GUIDE

CIRS
900 Asbury Ave • Norfolk, Virginia 23513 • USA • Tel: 757-855-2765 • WWW.CIRSINC.COM

CONTENTS

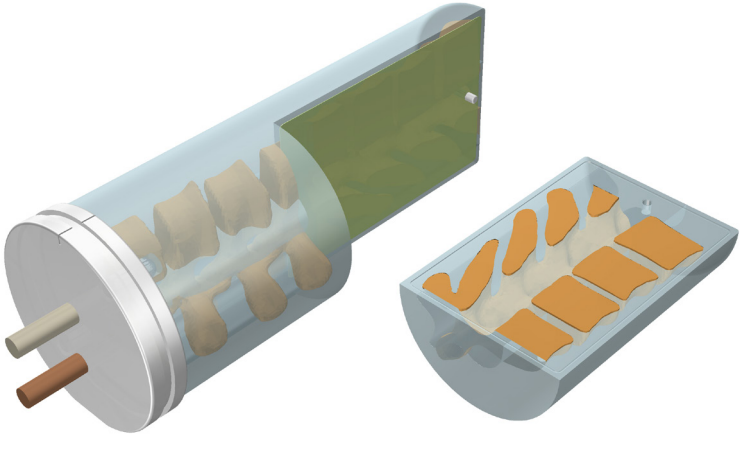
OVERVIEW

The high dose per fraction associated with SBRT necessitates a high degree of accuracy in target localization and dose delivery. Small errors can result in significant under treatment of portions of the tumor volume and over dosage of nearby normal tissues.

The E2E® SBRT Phantom with Removable Spine is a single tool for end-to-end commissioning and routine QA. The anthropomorphic, tissue-equivalent thorax phantom contains articulated spine, ribs, and lungs. All materials are suitable for use in kV and MV energies.

Model 036S enables dose measurements to critical structures and high dose-gradient areas using small volume ion chambers, and radiochromic film. Concentric circle targets, point targets and alignment marks make isocenter coincidence checks possible.

The optional SBRT Abdominal Phantom provides 3D spine anatomy for film and nanoDot™ OSL dosimetry. The additional bolus material allows dose distribution assessments within the abdomen due to non-coplanar beams.



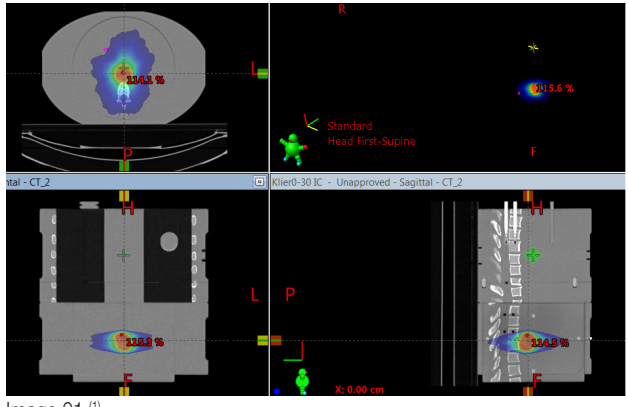


Image 01 (1)

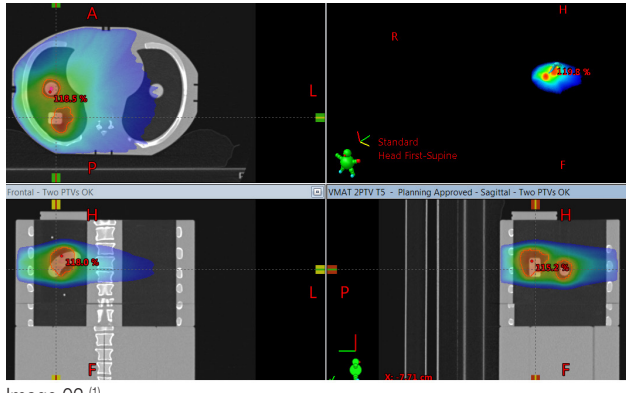


Image 02 (1)

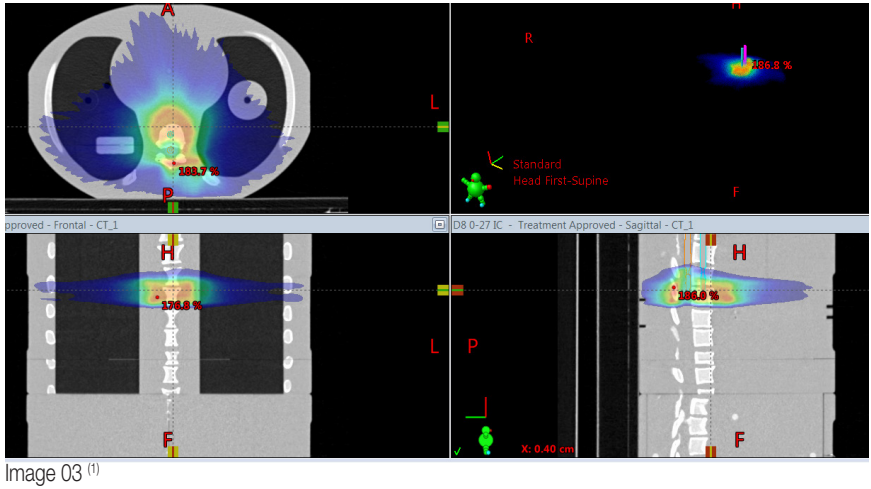


Image 03 (1)

(1) Images provided by UZ Leuven, “Evaluating a versatile new-generation anthropomorphic phantom for Stereotactic Body Radiation Therapy”, E35-2122

SPECIFICATIONS

E2E® SBRT PHANTOM WITH REMOVABLE SPINE (036S-CVXX-xx)

DIMENSIONS:	16.5 cm x 30 cm x 20 cm 6.5" x 11.8" x 7.9"
PHANTOM WEIGHT:	~7 kg (15 lb)
MATERIALS:	Proprietary Epoxy Resins

MODEL 036S-CVXX-xx INCLUDES

QTY	COMPONENT DESCRIPTION
1	E2E® SBRT Thorax Phantom with Removable Spine drilled for customer-specified ion chamber*
1	Sample Precision Cut EBT3 Film Kit for Model 036S
1	User Guide
1	Foam-Lined Carry Case
-	60-Month Warranty

** Customer must specify ion chamber at time of purchase. Refer to CIRS cavity codes at www.cirsinc.com/support for corresponding CV number.*

OPTIONAL ACCESSORIES

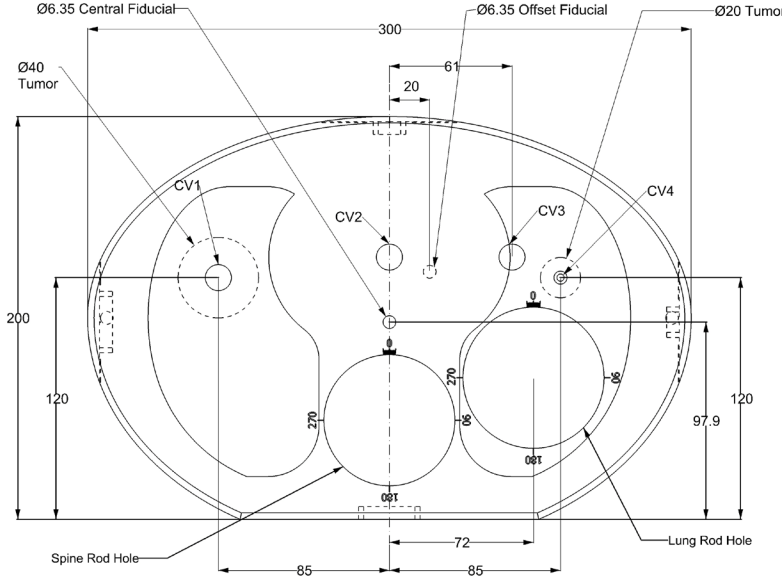
PART NO.	COMPONENT DESCRIPTION
036-01	SBRT Abdomen Phantom with 3D spine for film and nanoDot™ Dosimetry with Foam-Lined Carry Case
062QA-35	CBCT Image Quality Phantom

PRECISION CUT FILM

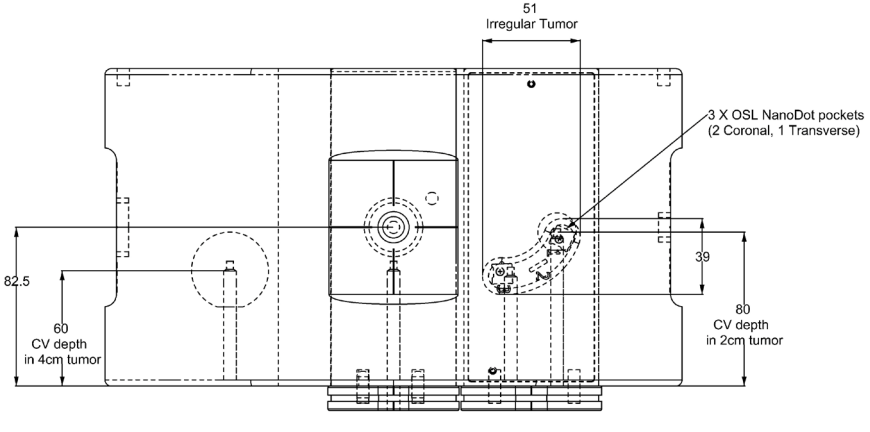
Precision-cut films with integral registration holes are available for both lung and spine inserts. To order film, please contact CIRS Customer Service directly at admin@cirsinc.com and reference part numbers below. All precut films are provided with a set of 6 calibration strips with matching LOT number.

PART NO.	COMPONENT DESCRIPTION
158200-02	Precision Cut EBT3 Film Kit for Model 036-01 (Set of 4 inserts plus 6 calibration strips)
158200-25	Precision Cut EBT3 Film Kit for Model 036S (Set of 18 spine inserts and 12 lung inserts plus 6 calibration strips)

TECHNICAL DRAWINGS

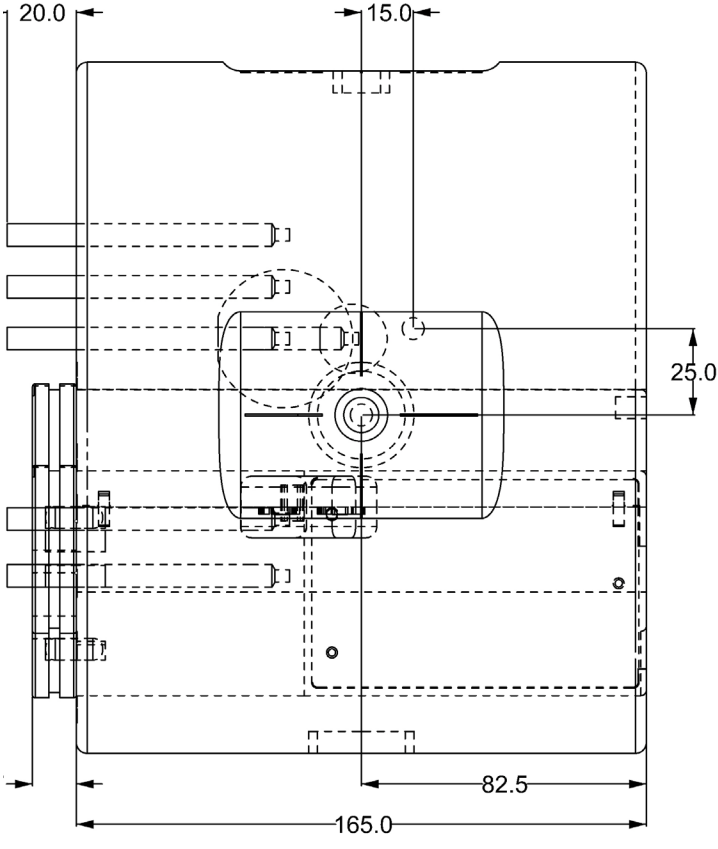


Front View



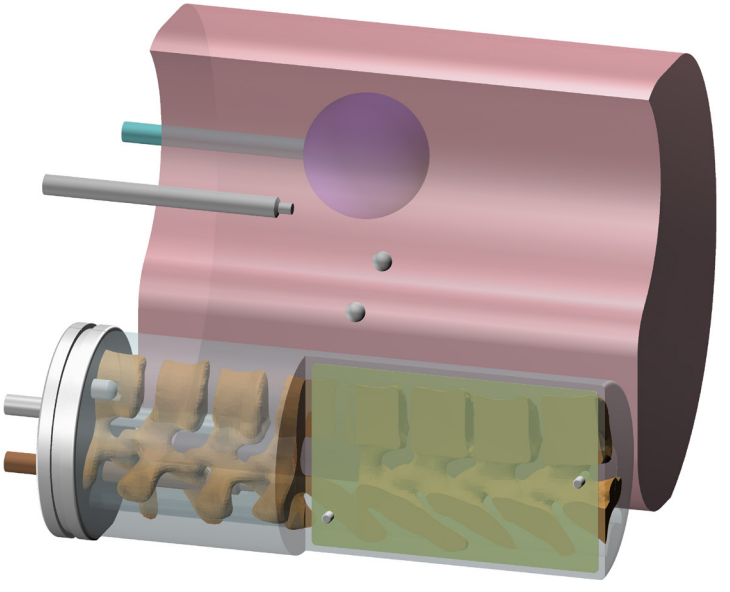
Top View

TECHNICAL DRAWINGS (CONT.)



Side View

DOSIMETER LOCATIONS



In addition to ion chamber locations in left and right lung targets, spinal cord, veterbal body, center mediastinum, and mediastinum/ lung interface, the Model 036S accommodates radiochromic film and OSL nanoDot dosimeters.

The Model 036S receives radiochromic film through a sagittal slice in the spine rod and in the removable lung insert in the right lung. The sagittal slice enables high-resolution dose distribution measurements to the vertebral body and spinal cord. The phantom is loaded with a set of plastic sheets to be used for imaging and planning in place of radiochromic film to avoid air gap. One set of precision cut GafChromic film is provided in the sample kit for testing. Additional film is available for purchase from CIRS. Please refer to Page 6 for additional information.

The lung insert contains an irregular tumor volume with three nanoDot pockets to allow localized dosimetry measurements. The proximity of the lung target to the vertebral body allows clinicians to measure high-resolution dose distribution to the target and dose to the spinal cord in a single delivery.

The removable spine rod is split to facilitate the use of radiochromic film in the sagittal orientation in the inferior half of the spine. Ion chambers cavities are located in the spinal cord and the vertebrae in the superior half of the removable spine rod. Alignment marks at 0, 90, 180 & 270 degrees allow for consistent re-positioning.

Additional nanoDot measurement locations are available in the optional SBRT Abdominal Phantom (Model 036-01). Phantoms are shipped with nanoDot-shaped plugs for when nanoDot dosimeters are not in use.

MATERIAL SPECIFICATIONS

The phantom body approximates the average human thorax in both size and structure using simplified geometries. It is constructed of proprietary tissue equivalent epoxy materials. Linear attenuations of the simulated tissues are within 1% of actual attenuation for water and bone, and within 3% for lung from 50 keV to 15 MeV.

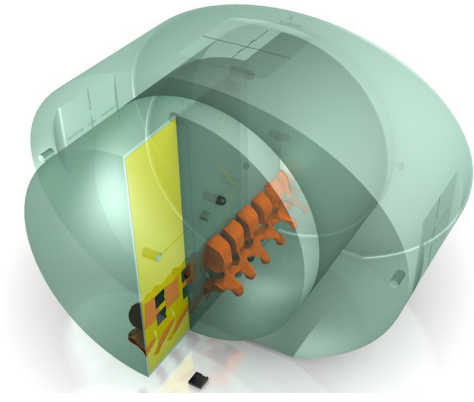
The phantom contains a 3D anthropomorphic spine with cortical and trabecular bone as internal landmarks. External alignment marks facilitate rapid orientation with positioning lasers and phantom image registration.

Material	Density, g/cc	Electron Density x 10^23, per cc	Ratio to H_2O
Plastic Water® DT	1.04	3.35	1.003
Lung	0.21	0.67	0.201
Cortical Bone	1.91	5.95	1.782
Trabecular Bone	1.20	3.86	1.156
Soft tissue target	1.06	3.43	1.028

Linear Attenuation Coefficients To Reference Tissues [1] [2]				
	Plastic Water® DT	Trabecular Bone	Cortical Bone	Lung (Inhale)
En, MeV	Ratio, %	Ratio, %	Ratio, %	Ratio, %
0.05	100.8	100.0	100.00	100.3
0.06	100.5	100.1	100.00	101.1
0.08	100.3	100.3	99.99	101.9
0.10	100.2	100.3	99.99	102.2
0.15	100.0	100.4	100.0	102.5
0.20	100.1	100.5	99.99	102.5
0.40	100.1	100.5	100.0	102.7
0.60	100.1	100.5	100.0	102.6
0.80	100.1	100.4	100.0	102.7
1.00	100.1	100.5	100.0	102.7
1.50	100.1	100.5	100.0	102.7
2.00	100.1	100.5	99.99	102.6
4.00	100.0	100.5	99.92	102.1
6.00	99.8	100.3	99.85	101.6
8.00	99.7	100.0	99.79	101.2
10.0	99.6	100.0	99.73	100.7
15.0	99.2	99.78	99.61	100.0
20.0	99.1	99.58	99.55	102.7

OPTIONAL CONFIGURATIONS

SBRT ABDOMINAL PHANTOM (036-01)



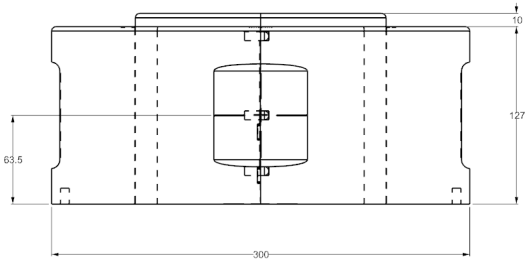
The SBRT Abdominal Phantom (Model 036-01) is an optional accessory of Model 036S which provides additional bolus to evaluate the effects of the non-coplanar beams on critical structures, including the vertebra body and spinal cord.

The abdomen measures 127 mm long and is machined to receive a central insert, which contains the anatomic spine with cortical and trabecular distinction. All materials are tissue equivalent and suitable for use from 50 keV to 15 MeV.

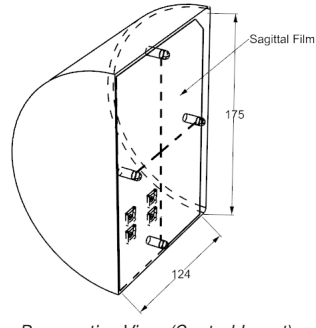
The central insert is cut in the sagittal plane. A film for high resolution dosimetry measurements can be placed between the two halves. The phantom is loaded with a plastic sheet to be used for imaging and planning in place of radiochromic film to avoid air gap. One set of precision cut GafChromic film is provided in the sample kit for testing. Additional film is available for purchase from CIRS. Please refer to Page 6 for additional information.

Four nanoDot pockets permit localized dosimetry measurements within the vertebra body, spinal cord and spinal discs.

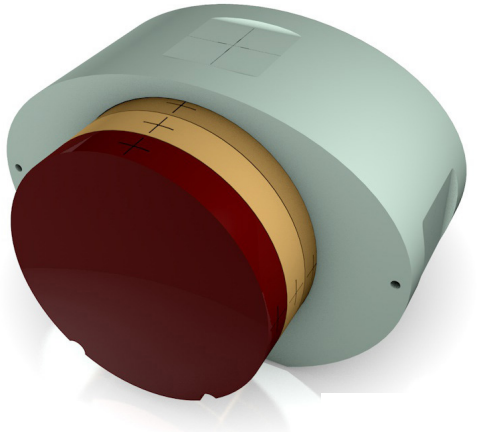
The Model 036S and 036-01 are connected using lateral pins, which allow rotation of the central insert about the Inferior-Superior axis.



Top View



Perspective View (Central Insert)

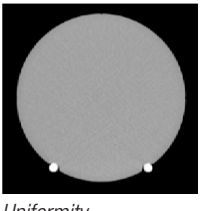


SBRT ABDOMINAL PHANTOM WITH CBCT IMAGE QUALITY PHANTOM (062QA-35)

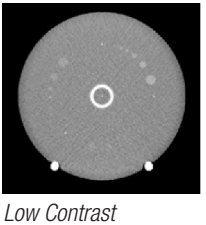
The central insert of the Model 036-01 can also accommodate the CIRS CBCT Image Quality Phantom (Model 062QA-35) to perform image quality assessments of on-board imaging (OBI) systems.

The purpose of image quality measurements is to quantify various image quality indicators for images taken from a selection of image acquisition and reconstruction settings representative of clinical practices. Assessment of the image quality parameters over time can show trends in variation of said parameters helping the user to decide whether or not recalibrations of the imaging system are necessary.

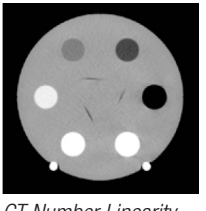
The CBCT Image Quality Phantom is composed of four layers: Uniformity, Low Contrast/Magnification, CT Number Linearity/Slice Thickness, and Spatial resolution. For more information about the Model 062QA-35, please refer to the Model 062MQA Product Brochure.



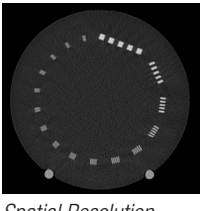
Uniformity



Low Contrast



CT Number Linearity



Spatial Resolution

USE & HANDLING

CIRS does not recommend specific QA protocols, however the phantom is designed to be imaged, planned and irradiated as if it were an actual patient, enabling an End-to-End test of the entire system.

The phantom is manufactured from a highly stable and durable epoxy resin, and has been spray-coated with an acrylic sealer with UV inhibitors to minimize natural discoloration of the materials over time. It is advisable not to clean the phantom surface with solvent based cleaners. Use mild soap and water and dry with a clean towel. Store the phantom in the carry case or on a flat surface when not in use.

INSERTION OF IONCHAMBERS

After placing the phantom body on the CT/ LINAC couch, insert the ion chamber in the matching drill cavity. Use the provided CV plug to fill the ion chamber cavities when they are not used so that the phantom background is reconstituted.

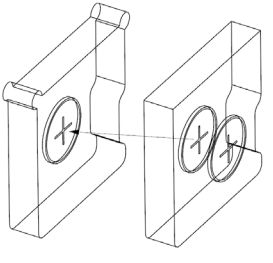
USE OF LASER CUT FILM

Both the E2E SBRT Thorax Phantom and SBRT Abdominal Phantom are shipped with a set of ready-to-use sample films. To order additional laser cut film, please submit the pre-filled order form included with film sample pack to CIRS Customer Service or contact them directly and reference part numbers on page 6. All precut films are provided with a set of 6 calibration strips with matching LOT number.

PLACEMENT OF NANODOTS

For proper insertion of nanoDot OSL Dosimeters within nanoDot pockets, match the cross-mark on the nanoDot with the one engraved in the nanoDot pocket.

When nanoDot dosimeters are not in use, place the provided nanoDot-shaped plugs in the nanoDot pockets.



nanoDot Insertion

DAILY SYSTEMS CHECKS

The Model 036S contains embedded central and off-set fiducials. The offset target is used to ensure the table offset coordinates generated by kV/MV imaging are accurate by locating the target, moving the table the determined amounts and verifying that the offset target has been positioned at the isocenter. The embedded center fiducial and off-set target measure 6.35 mm in diameter and are made of ceramic.

The exterior of the phantom is machined with concentric circle targets and laser cross-marks to allow user to objectively assess all setup errors, including rotations, and to easily align the phantom to the true radiation isocenter. The E2E SBRT Phantom is manufactured on CNC machines with tolerance of ± 0.02 mm. Target positioning accuracy is ± 0.1 mm.

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.

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 your local distributor prior to returning the product. Visit https://www.cirsinc.com/distributors/ to find your local distributor. If you purchased your product direct through CIRS, call Customer Service at 800-617-1177, email rma@cirsinc.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

PRODUCT	WARRANTY PERIOD
Model 036S - E2E® SBRT Phantom with Removable Spine	60 Months

COMPUTERIZED IMAGING REFERENCE SYSTEMS, INC.
900 Asbury Ave
Norfolk, Virginia 23513 USA

Toll Free: 800.617.1177
Tel: 757.855.2765
Fax: 757.857.0523
Email admin@cirsinc.com

www.cirsinc.com

Technical Assistance
1.800.617.1177

Publication: 036 UG 072020

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