CTP698 and CCT162 Lung Phantom II Manual

WARRANTY
THE PHANTOM LABORATORY INCORPORATED ("Seller") warrants that this product shall remain in good working order and free of all material defects for a period of one (1) year following the date of purchase. If, prior to the expiration of the one (1) year warranty period, the product becomes defective, Buyer shall return the product to the Seller at:

By Truck	By Mail
The Phantom Laboratory, Incorporated	The Phantom Laboratory, Incorporated
2727 State Route 29	PO Box 511
Greenwich, NY 12834	Salem, NY 12865-0511

Seller shall, at Seller's sole option, repair or replace the defective product. The Warranty does not cover damage to the product resulting from accident or misuse.

IF THE PRODUCT IS NOT IN GOOD WORKING ORDER AS WARRANTED, THE SOLE AND EXCLUSIVE REMEDY SHALL BE REPAIR OR REPLACEMENT, AT SELLER'S OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT. THIS LIMITATION APPLIES TO DAMAGES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, DIRECT OR INDIRECT DAMAGES, LOST PROFITS, OR OTHER SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER FOR BREACH OF CONTRACT, TORT OR OTHERWISE, OR WHETHER ARISING OUT OF THE USE OF OR INABILITY TO USE THE PRODUCT. ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANT ABILITY AND FITNESS FOR PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED.

WARNING
This product has an FH3-4 mm/min flame rating and is considered to be flammable. It is advised not to expose this product to open flame or high temperature (over 125° Celsius or 250° Fahrenheit) heating elements.

CTP698 and CCT162 Lung Phantom II manual

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Indications for Use

The CTP698 and CCT162 Lung Phantoms are designed for performing comparative measurements between CT scanners. These phantoms are not intended to replace comprehensive quality assurance testing programs. Instead, they are intended to offer additional information for use in monitoring CT scanners used in clinical studies.

Image of CTP698

Introduction

The Phantom Laboratory, Incorporated developed the CTP698 and CCT162 Lung Phantoms to provide test objects intended for use in the comparison of CT scanners.

The phantom contains a number of test objects that are described in this manual. To address the specific needs of the sites or scientific studies, physicists, radiologists, and other imaging professionals should develop procedures for the use of this phantom.

If you have questions about the CTP698 or CCT162 Lung Phantoms please contact The Phantom Laboratory at the following address:

info@phantomlab.com

phantomlab.com

The Phantom Laboratory, Incorporated
PO Box 511, Salem NY 12865 USA
Phone: 800-525-1190 or 518-692-1190
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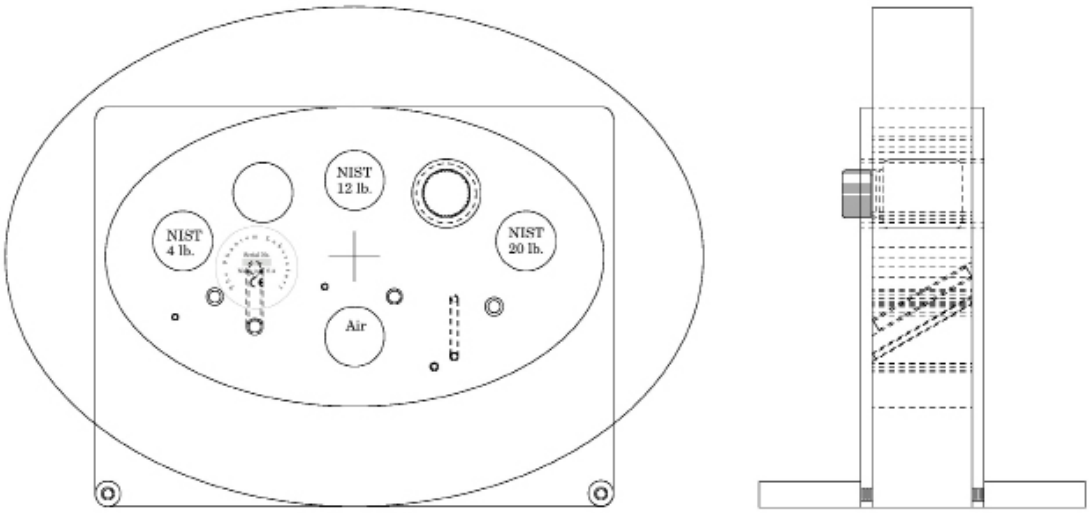
Differences between the CTP698 and CCT162

The CCT162 contains all the components of the CTP698 phantom with the addition of CTP672-1 end plates and CTP672-2 stabilizer legs. The CTP698 phantom can be used with different size optional annuli. The end plates and stabilizer legs on the CCT162 provide greater stability when scanning and the plates help protect the lung foam material from damage.

CCT162 Assembly

The CCT162 is shipped with the four CTP672-2 stabilizer legs removed. These legs can be threaded into the holes in the bottom corners of the end plates.



CCT162 Lung Phantom Sketch

Schematic Drawing

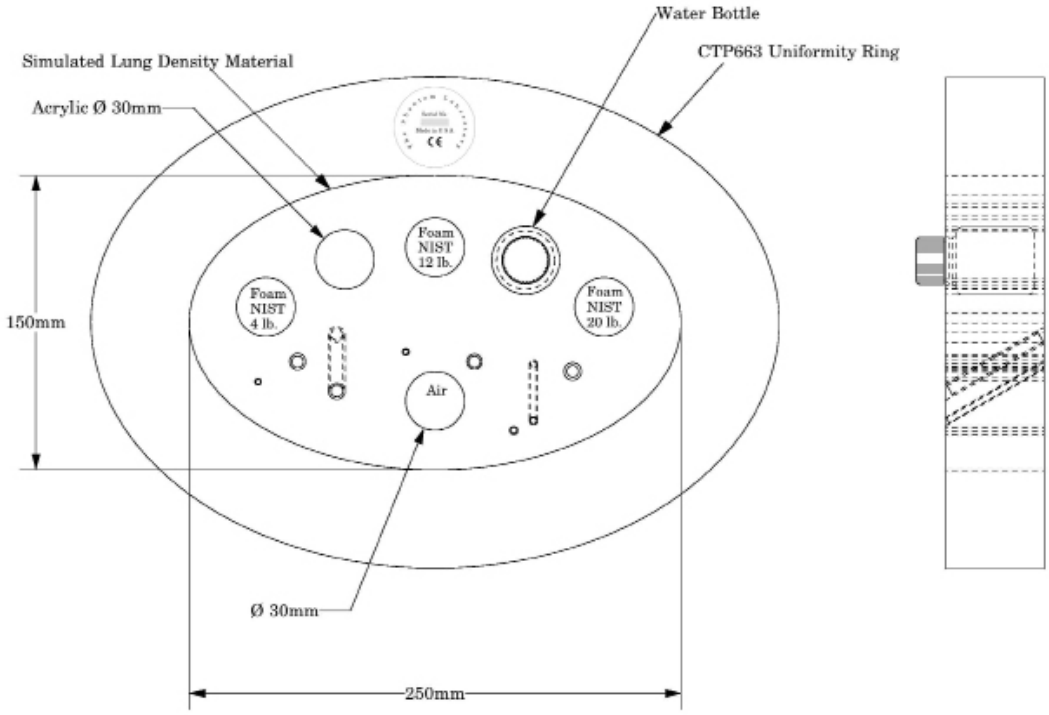


Figure 1.

The CCT162 Lung Phantom consists of an outer ring (Catphan® Uniformity Material Ring), which simulates tissue attenuation, and a central oval insert, which simulates lung attenuation.

Drawings on the following pages provide details on components and their respective locations included in this phantom.

Catphan® Uniformity Material Ring

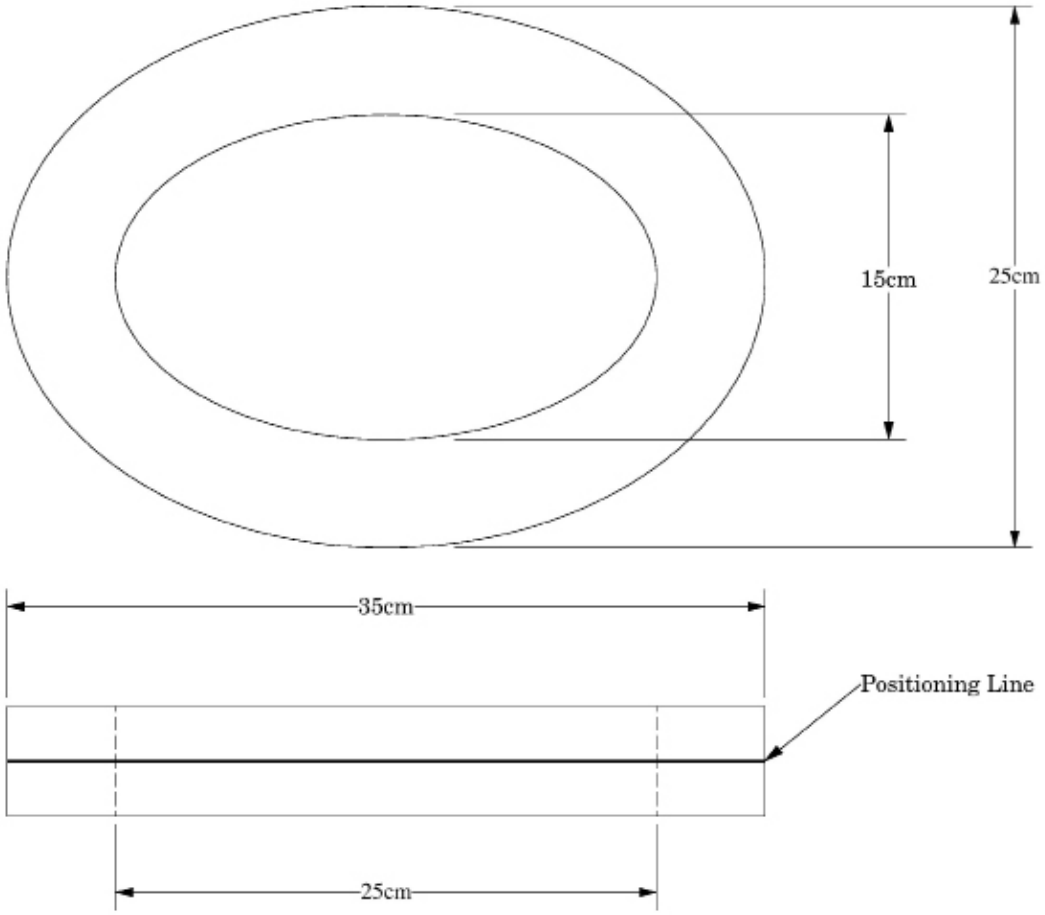


Figure 2

The Catphan® Uniformity Material Ring is cast from a specially formulated urethane with an electron density just above water.

Note:
With the CTP698 The lung insert is pressed into this ring. Because there may be a slight variation between the thickness of the lung insert and the ring, the smooth side of the ring should be flush with the lung material. The positioning line is used to assist alignment of the phantom with the CT scanner's alignment lights.

Simulated Lung Material Insert

The lung insert has a variety of internal holes and structures. On the following pages these items will be described and their locations identified.

Simulated Vessel Tube Locations

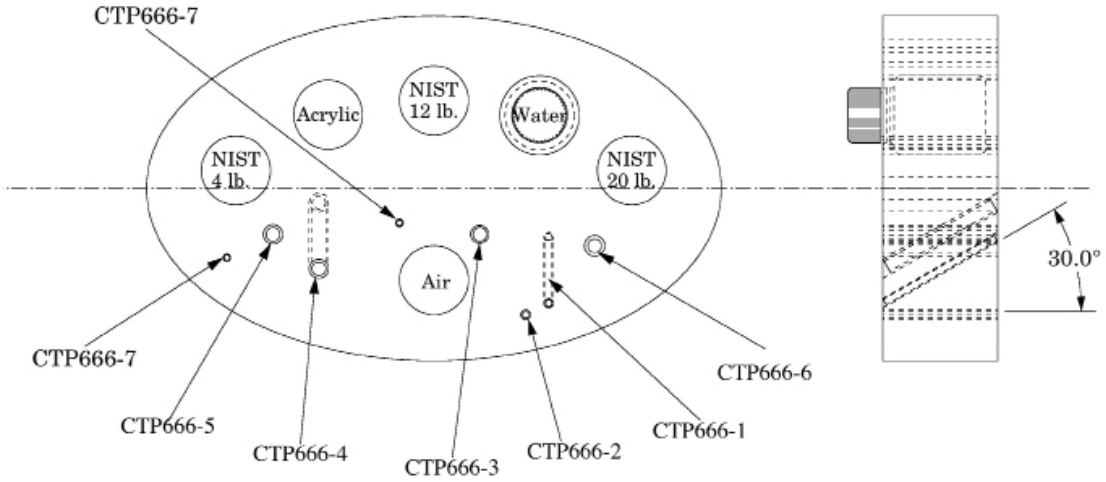


Figure 3.

The sketch above shows the tube inserts. These tubes are machined from polycarbonate plastic. The sketch on the next page shows the specific sizes of the tubes.

Simulated Vessel Tube Dimensions

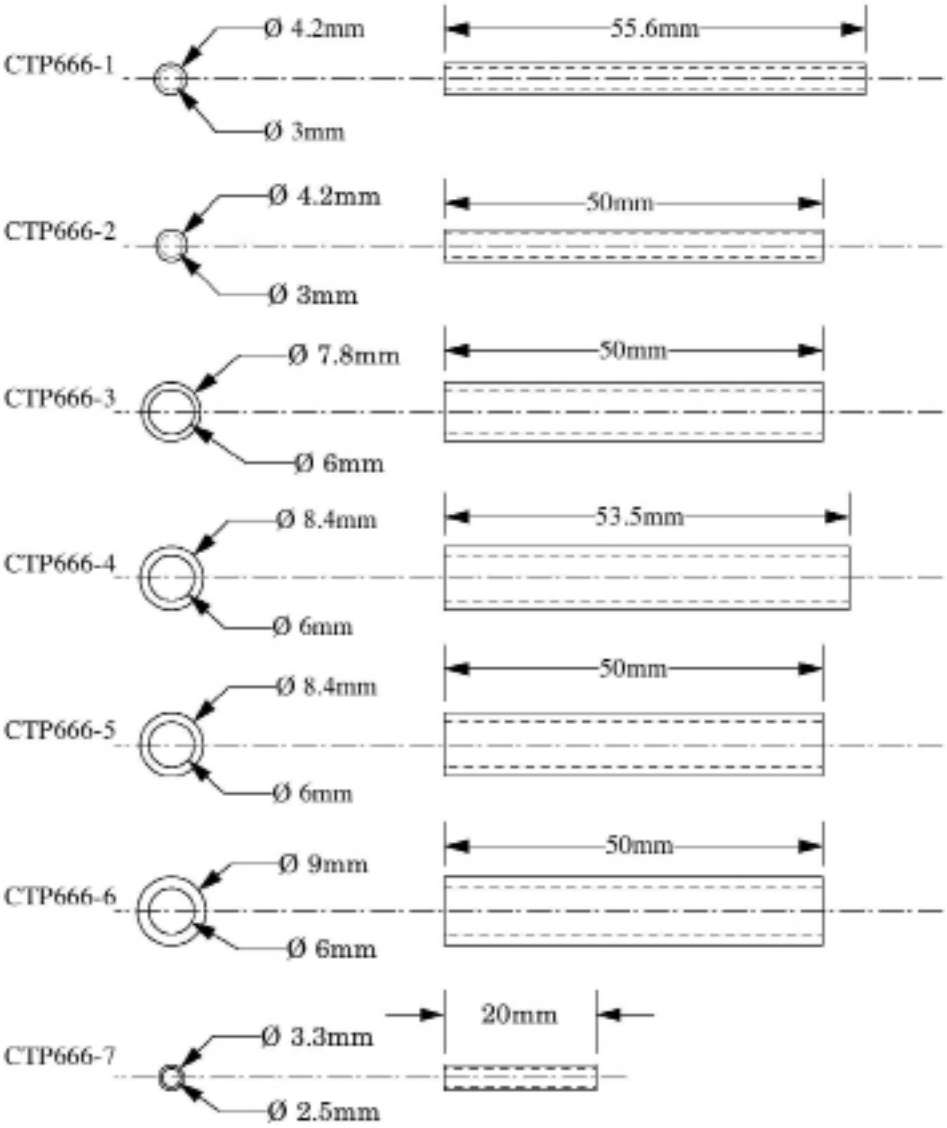


Figure 4.

Vessel tubes CTP666-1 and CTP666-4 are rotated 30° from the scanners z axis.

Linear Attenuation of Air, Water and Acrylic

Linear attenuation coefficient μ [units cm^{-1}]

KEV	Acrylic	Water	Air
40	0.277	0.240	0
50	0.244	0.208	0
60	0.227	0.192	0
62	0.224	0.190	0
64	0.221	0.188	0
66	0.219	0.186	0
68	0.217	0.184	0
70	0.215	0.182	0
72	0.214	0.181	0
74	0.211	0.179	0
76	0.210	0.178	0
78	0.208	0.177	0
80	0.207	0.175	0
90	0.199	0.170	0
100	0.194	0.165	0

Nominal material formulation and specific gravity

Material	Formula	Specific Gravity*	Electron Density (10^{23}e/g)	CT # est.
Air	75%N, 23.2%O, 1.3%A	0.00	3.007	-1000
Water	[H_2O]	1.00	3.343	0
Acrylic	[$C_5H_8O_2$]	1.18	3.248	120

Contrast Scale (CS) is formally defined as

$$CS = \frac{\mu_m (E) - \mu_w (E)}{CT_m (E) - CT_w (E)}$$

where m is reference medium, and w is water, and E is the effective energy of the CT beam.

$$\text{Alternatively, } CS = \frac{\mu_1 (E) - \mu_2 (E)}{CT_1 (E) - CT_2 (E)}$$

where 1,2 are two materials with low z effective, similar to water (eg. acrylic & air).