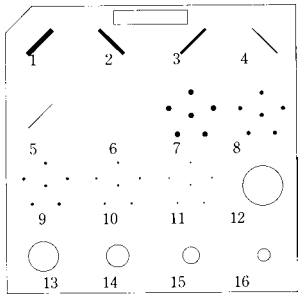
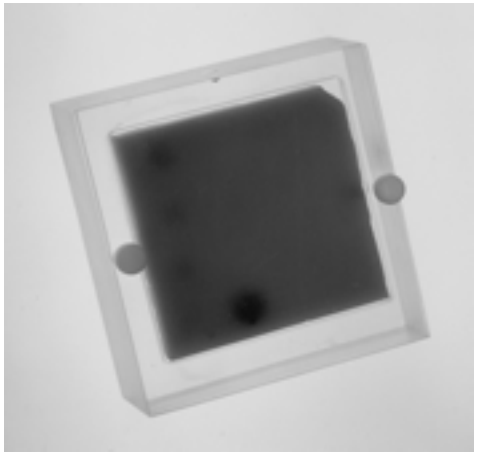
Mammographic Accreditation Phantom

Nuclear Associates Model 18-220

DI Diagnostic Imaging





- Helps ensure optimum image quality and peak performance of the mammographic system
- Essential for MQSA compliance

Introduction

The Mammographic Accreditation Phantom will assist you in complying with MQSA and the American College of Radiology (ACR) Quality Control Programs. This phantom is intended for use as an integral part of the Mammographic Quality Control Program, and when used to perform routine mammographic QC, it will help you quickly, easily, and accurately evaluate the overall imaging performance of your mammographic system. This phantom will detect imaging changes so you can make the necessary corrections in order to maintain your system at peak performance.

Applications

The Mammographic Accreditation Phantom was designed to test the performance of a mammographic system by a quantitative evaluation of the system's ability to image small structures similar to those found clinically. Objects within the phantom simulate calcifications, fibrous calcifications in ducts, and tumor masses.

The phantom is also designed to determine if a mammographic system can detect small structures that are important in the early detection of breast cancer. Test objects within the phantom range in size from those that should be visible on any system, to objects that will be difficult to see even on the best mammographic system.

Features

- Complies with ACR phantom specifications and QC requirements
- Contains test objects to simulate indications of breast cancer...punctuate calcifications, tissue fibrillar extensions in adipose tissue, and tumorlike masses
- Ideal for monitoring the overall performance of your mammographic imaging system, x-ray generator, film processor, and screen-film combination
- Equivalent in x-ray attenuation to a 4.5 cm compressed "average" breast

Specifications

Phantom body

Material Acrylic

Dimensions

Overall 10.15 (w) x 10.8 (d) x 4.4 cm (h)

Acrylic base 1.375 in thick (3.4 cm)

Cover 0.128 in thick (3 mm)

Acrylic contrast test disk 1 cm Ø x 4 mm

Weight 1.2 lb (0.55 kg)

NOTE: The 4.4 cm-thick phantom is made of a 7 mm wax block insert containing 16 sets of test objects, a 3.4 cm thick acrylic base, and a 3 mm thick cover. The phantom approximates a 4.5 cm compressed breast of average glandular/adipose composition. Included in the wax insert are aluminum-oxide (Al_2O_3) specks that simulate microcalcifications. Six different nylon fibers simulate fibrous structures and five different size lens-shaped masses simulate tumors

Each phantom includes a 4 mm x 1 cm diameter acrylic contrast test disk, faxitron x-ray image, and magnifying glass

Wax insert

Nylon fibers	Al_2O_3 Specks	Masses (thickness)
1) 1.56 mm	7) 0.54 mm	12) 2.00 mm
2) 1.12 mm	8) 0.40 mm	13) 1.00 mm
3) 0.89 mm	9) 0.32 mm	14) 0.75 mm
4) 0.75 mm	10) 0.24 mm	15) 0.50 mm
5) 0.54 mm	11) 0.16 mm	
6) 0.40 mm		

Optional accessories

Optional are two 2 cm acrylic plates to check the automatic exposure control of the mammography unit. The addition of these two plates, when combined with the overall 4.4 cm thickness of the phantom, will allow the system to be checked in varying thicknesses of 2 to 8.5 cm. Both of these items are recommended by ACR in their Mammography Quality Control Procedure

Acrylic Plates, 10 x 10 x 2 cm thick, set of 2 (Model 18-237)

Acrylic Contrast Test Disc, 1 cm Ø x 4 mm (Model 18-205)

Carrying Case (Model 89-220)

Available model(s)

18-220 Mammographic Accreditation Phantom, includes acrylic contrast test disk, faxitron x-ray image, and magnifying glass

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

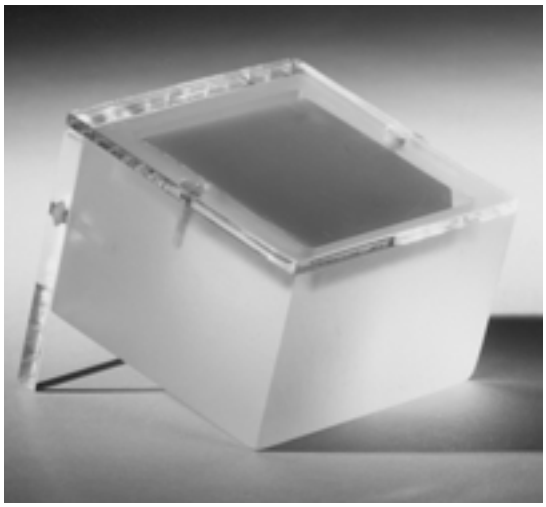
18-220-ds rev 1 10 mar 03

Diagnostic Imaging DI

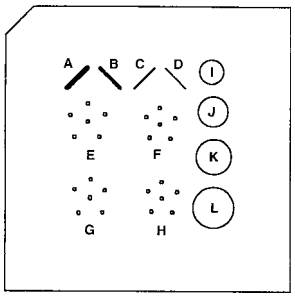
Digital Stereotactic Breast Biopsy Accreditation Phantom*

Nuclear Associates Model 18-250

- The fast, easy way to test image quality on digital biopsy mammography units and qualify for ACR accreditation
- Accepted by the ACR for use in its Stereotactic Breast Biopsy Accreditation Program
- One exposure is all you need



Phantom with image evaluation insert



Digital image demonstrating image evaluation insert

Features

- The phantom contains test objects that are similar to those found in the Mammographic Accreditation Phantom specified by the ACR
- The extended top edge of the phantom allows ease of positioning on recumbent biopsy units
- The phantom's small size allows it to be imaged in its entirety in a single exposure when used with a digital biopsy unit
- Enables you to determine if the images are similar to or better than screen-film

Introduction

In the past, there was not an easy way to compare the image quality of conventional and digital biopsy mammography units, because the field of view on the digital system is typically much smaller than the 24 x 30 cm field of view on conventional mammography units. In order to image the Mammographic Accreditation Phantom specified by the American College of Radiology (ACR) on the biopsy units, the user has to move the phantom to various positions in order to obtain four separate images, to be sure all objects were imaged. This is a very inconvenient, time consuming task.

Applications

The small size of the phantom permits fast, easy comparison of conventional and digital image quality, because you can attain an image of the entire unit in a single exposure. The objects are some of the same ones found in the Mammographic Accreditation Phantom specified by the ACR, so it makes comparison of the two imaging systems easy.

Specifications

Wax insert

Fibers	Al_2O_3 Specks	Masses
A. 0.93 mm nylon fiber	E. 0.54 mm speck	I. 0.25 mm (thickness) mass
B. 0.74 mm nylon fiber	F. 0.32 mm speck	J. 0.50 mm (thickness) mass
C. 0.54 mm nylon fiber	G. 0.24 mm speck	K. 0.75 mm (thickness) mass
D. 0.32 mm nylon fiber	H. 0.20 mm speck	L. 1.00 mm (thickness) mass

Phantom body

Dimensions (cast acrylic base block) 2.63 (w) x 2.50 (d) x 11.06 in (h) (6.66 x 6.42 x 4.03 cm)
Weight 8.7 oz (1.20 kg)

Available model(s)

18-250 Digital Stereotactic Breast Biopsy Accreditation Phantom

* *Designed by Carol Mount, R.T. (R) (M), and Joel E. Gray, Ph.D., Department of Diagnostic Radiology, Mayo Clinic®, Rochester, MN 55905. Manufactured under licensing agreement with Mayo Foundation for Medical Education and Research.*

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

18-250-ds rev 2 10 mar 03

CardinalHealth

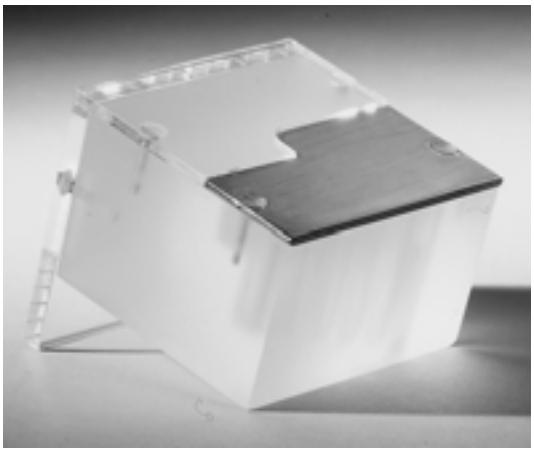
Contrast and Resolution Mammography Phantom*

Nuclear Associates Model 18-251-2000

DI Diagnostic Imaging

Introduction

The Contrast and Resolution Mammography Phantom is designed with an extended top edge to aid the user in positioning it on recumbent biopsy tables.



Applications

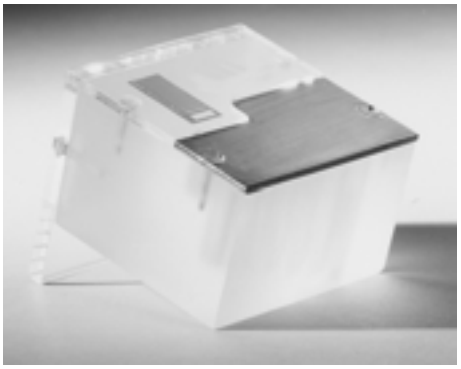
On digital mammography units, this phantom can test the high contrast spatial resolution of the system with the results being viewed on the monitor. The focal spot high contrast resolution can also be determined by placing a conventional mammography cassette behind the phantom and making an appropriate exposure.

It is suggested that a resolution test pattern from 5-20 LP/mm be used to evaluate the condition of the focal spot. Instead of making focal spot measurements which can be ambiguous, an accurate determination of the x-ray tube's resolution ability can be measured by using the optional Resolution Test Pattern (Model 07-555).

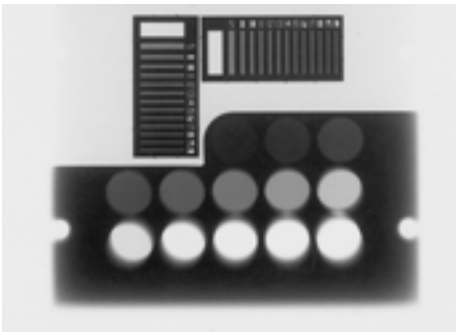
On conventional mammography units, the phantom can be used to meet the ACR guidelines for testing focal spot resolution. The ACR suggests placing a resolution target 4.5 cm above the image receptor and imaging twice: once parallel to the anode-cathode axis and once rotated 90 degrees. With two resolution targets, this can be achieved in a single exposure. The grey scale step wedge can also be used to check the dynamic range of the entire system, indicate processing problems, and variation in film emulsion.

With a single exposure you can:

- Measure the contrast and dynamic range of the imaging system
- Easily measure the system resolution of the focal spot length and width on mammography units (with optional Resolution Test Pattern, Model 07-555)



Phantom with two 5-20 LP/mm test patterns (optional) in parallel and perpendicular orientation. Also includes an air step wedge with aluminum attenuator



A digital image demonstrating the resolution test patterns (optional) and air step wedge

Specifications

Phantom body

Materials Cast acrylic block with aluminum plate
Dimensions 6.66 x 6.4 x 4.3 cm thick
Weight without test patterns 8 oz

Optional Resolution Test Pattern (Model 07-555)

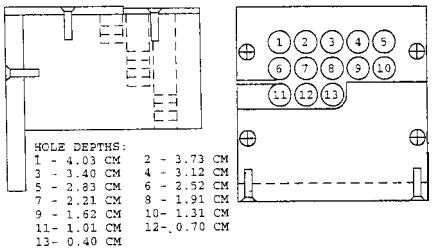
Material Gold nickel construction (equivalent to 25 microns of lead or 2.6 mm of aluminum)
Length 25 mm
Width 12.5 mm
Thickness 0.0175 mm (0.0152 mm gold, 0.0025 mm nickel)

Optional accessories

Resolution Test Pattern (Model 07-555)

Available model(s)

18-251 Contrast and Resolution Mammography Phantom
18-251-1000 Contrast and Resolution Mammography Phantom with one resolution test pattern (Model 07-555)
18-251-2000 Contrast and Resolution Mammography Phantom with two resolution test patterns (Model 07-555)



Drawing showing hole depths

* *Designed by Carol Mount, R.T. (R) (M), and Joel E. Gray, Ph.D., Department of Diagnostic Radiology, Mayo Clinic®, Rochester, MN 55905. Manufactured under licensing agreement with Mayo Foundation for Medical Education and Research.*

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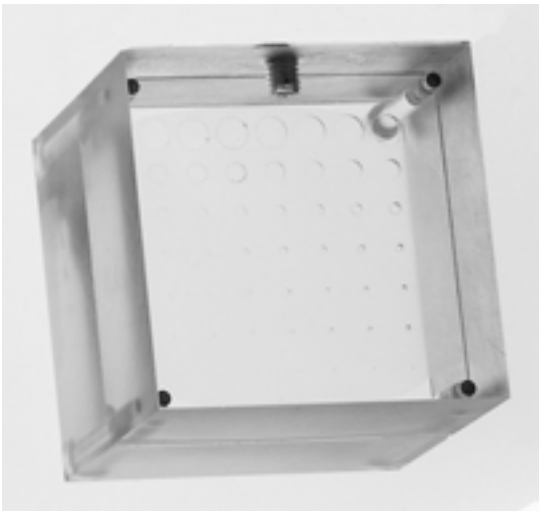
18-251-2000-ds rev 1 10 mar 03

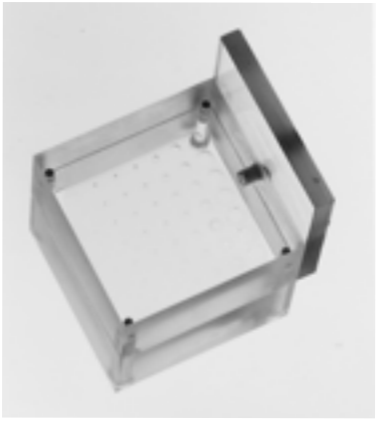
Diagnostic Imaging | DI

Contrast Detail Phantom for Mammography

Nuclear Associates Model 18-252

- Optimized for digital imaging
- Easy-to-use, compact, and lightweight
- Closely simulates scattering conditions of the breast
- Rotatable support plate accommodates prone-position x-ray units. The plate can be returned to a position which does not interfere with placement of the phantom on flat surfaces
- Geometrically-increasing hole depths result in linearly-increasing x-ray transmission
- Geometrically-increasing hole diameters enable quantitative measurement of the contrast threshold of the mammographic system





Rotatable support plate accommodates prone-position x-ray units

Specifications

Phantom material Plexiglas®

Dimensions 2.47 (w) x 2.47 (d) x 1.80 in (t) (6.27 x 6.27 x 4.57 cm)

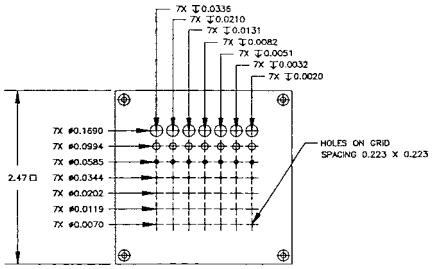
Weight 1.2 lb (0.58 kg)

Available model(s)

18-252 Contrast Detail Phantom for Mammography

A good imaging system should resolve at least the following objects:

Row number	Minimum number of objects detected
1	6
2	6
3	5
4	4
5	2
6	1
7	0
Minimum detectability score: 24/49	



Introduction

The Contrast Detail Phantom for Mammography is designed to provide a means of quantitatively testing and monitoring the total performance of an entire mammographic imaging chain. Its small size, as well as the number and distribution of holes simulating embedded objects, make this phantom particularly useful in evaluating digital spot mammography systems. With 49 holes generating subtle contrast variations, the phantom makes it possible to detect small changes in overall system performance.

The Contrast Detail Phantom for Mammography contains a 7 x 7 matrix of objects. The diameter of each row of objects decreases from 0.169 to 0.007 inch. In each row, the subject contrast decreases from approximately 6.6% to 0.41% at mammographic energies.

Applications

The Contrast Detail Phantom for Mammography is easy to use…Simply place the phantom on the image receptor surface in the same position as a breast. Position the x-ray tube and compression device as in a craniocaudal examination. When using the phantom on prone-position breast biopsy systems, use the rotating top plate of the phantom and the compression device to secure the phantom against the image receptor. Choose the appropriate kV and mAs factors (26 kV and 60 mAs works well on most systems), or select automatic exposure control.

Object diameter and contrast		
Column number	Object depth (inches) (mm)	Typical contrast at mammographic energies (%)
1	0.033 0.853	6.60
2	0.021 0.533	4.20
3	0.013 0.332	2.60
4	0.008 0.208	1.70
5	0.005 0.129	1.00
6	0.003 0.080	0.65
7	0.002 0.050	0.41

Object diameter	
Row number	Object diameter (inches) (mm)
1	0.169 4.292
2	0.099 2.524
3	0.058 1.485
4	0.034 0.873
5	0.020 0.513
6	0.011 0.302
7	0.007 0.177

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18-252-ds rev 1 10 mar 03

CardinalHealth

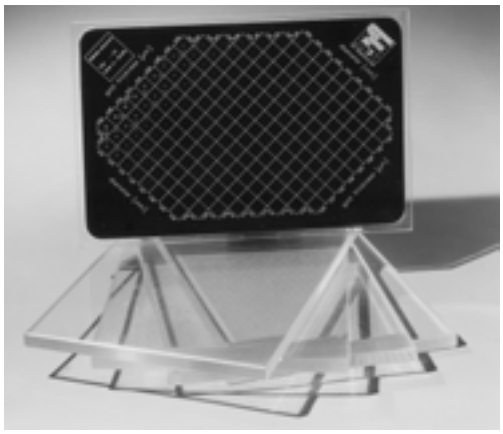
CDMAM Phantom*

Nuclear Associates Model 18-227

DI Diagnostic Imaging

Introduction

The CDMAM (Contrast Detail Mammography) Phantom was developed to evaluate conventional mammographic x-ray equipment, film, and cassettes. However, with the increase of digital imaging in mammography, especially when performing stereotactic breast needle biopsies and preoperative needle localizations, the phantom can aid in achieving improved image quality, processing, display quality, and speed in these new modalities.



- Specifically developed to determine if mammographic images are indicating objects with very low contrast and very small diameter
- For full-field analog and digital units
- Comparison of image quality with various screen-film combinations
- Evaluation of conventional, as well as digital and stereotactic modalities
- Determination of the optimum exposure technique, e.g., by variation of tube potential
- Comparison of image quality at various object thicknesses, by variation of the amount of Plexiglas® at a fixed density

What makes the CDMAM Phantom so special?

The CDMAM Phantom consists of an aluminum base with gold discs (99.99% pure gold) of varying thicknesses and diameters, which is attached to a Plexiglas® cover. The 5 mm thick Plexiglas cover (PMMA plate) has a 2 mm deep cavity which accommodates the aluminum base with gold discs. The assembly (PMMA and aluminum) has a Plexiglas-equivalent thickness of 10 mm, under standard mammography-exposure conditions.

The aluminum base is 0.05 mm thick Al 1050 (99.5% pure aluminum). The base has been polished and anodized black. Precisely measured gold discs of varying thickness (range = 0.05 to 1.60 µm) and diameter (range = 0.10 to 3.20 µm) have been attached to the base by means of evaporization. Finally, the base has been airbrushed to protect the gold discs.

The "Gold Standard" of Mammographic Phantoms

The discs are arranged in 16 rows and 16 columns. Within a row, the disc diameter is constant, with logarithmically increasing diameter. The precision of the disc diameter and thickness makes the CDMAM Phantom an ideal tool for conducting contrast-detail and other image quality experiments.

A line pattern has been engraved onto the Plexiglas cover and treated with paint containing aluminum. The x-ray image will show a number of squares ordered in 16 columns and 16 rows, with the disc diameter shown for each row, and the disc thickness for each column.

About the "Gold Standard" CDMAM Phantom

The CDMAM Phantom includes a set of four Plexiglas plates, which are used for the simulation of different breast thicknesses. The plates are 10 mm thick and the same dimensions as the phantom. The plates are marked in one corner, for identification of the configuration of Plexiglas and phantom in an x-ray image. The phantom and Plexiglas plates match the standard mammography film size (18 x 24 cm).

Under standard mammography-exposure conditions (Mo-anode, 30 µm Mo-filtration, 28 kVp), the phantom has a Plexiglas-equivalent thickness of 10 mm.

The actual attenuation of the CDMAM Phantom depends on the configuration of the phantom and Plexiglas plates. The effective energy of the phantom plane will be higher when more Plexiglas is added to the top and bottom of the phantom.

Using the CDMAM Phantom is easy

To make an x-ray image, the CDMAM Phantom should be positioned on the bucky with the smallest disc diameters at the thorax side, in combination with one or more Plexiglas plates. The markings on the Plexiglas plates should be aligned at the thorax side of the bucky. On digital stereotactic systems with smaller fields of view, specific portions of the phantom can easily be imaged as well.

The density of the image has to be checked after the film has been processed. In a series of CD images, all images should approximately have the same densities in a reference-position on the film.

Specifications

Dimensions

Plexiglas plates 6.38 (w) x 9.45 (d) x 0.40 in (t) (162.5 x 240 x 10 mm)

Aluminum base 162.5 (w) x 240 (d) x 0.5 mm (t)

Weight 4.54 lb (2.06 kg)

Available model(s)

18-227 CDMAM Phantom, including four Plexiglas plates

* *Developed by M.A.O. Thijssen, Ph.D., K.R. Bijkerk, MSc. and J.M. Lindeyer, BSc., Project: Quality Assurance in Mammography (QAMAM), Department of Diagnostic Radiology, University Hospital, St. Radboud, Nijmegen, The Netherlands.*

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

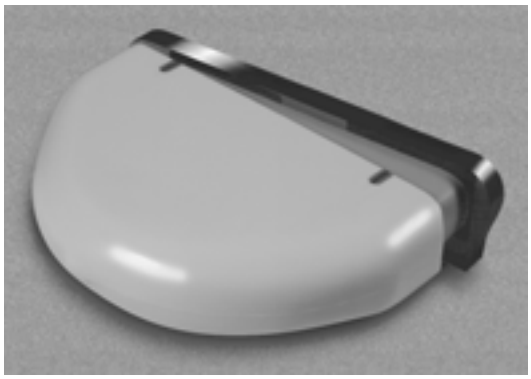
18-227-ds rev 1 10 mar 03

Diagnostic Imaging DI

Tissue-Equivalent Mammography Phantom

Nuclear Associates Model 18-222

- Breast phantom to test new generation of mammography machines
- A refined quality control for today's advanced imaging systems
- Objects within the phantom simulate calcifications, fibrous calcifications in ducts, and tumor masses



Introduction

Proven simulation technology enables the use of tissue-equivalent, realistically-shaped phantoms for mammographic quality control.

This breast phantom contains targets that are engineered to test the threshold of the new generation of mammography machines.

Applications

The phantom is 4.5 cm thick, simulates a 50% glandular tissue composition and is designed to test the performance of a mammographic system by a quantitative evaluation of the system's ability to image small structures similar to those found clinically. The phantom is designed to determine if your system can detect small structures that are important in early detection of breast cancer. Test objects within the phantom range in size from those that should be visible on any system to objects that will be difficult to see in the best mammographic systems.

The phantom includes a 30x hand-held microscope and mammography QA documents for recording image evaluations and scores.

References

Skubic S.E., Fatouros P.P., "Absorbed Breast Dose: Dependence on Radiographic Modality and Technique, and Breast Thickness," *Radiology*, 61 (1986), 263-270.
Fatouros P.P., Skubic S.E., Goodman H., "The Development and Use of Realistically Shaped, Tissue-Equivalent Phantoms for Assessing the Mammographic Process," *Radiology*, 32 (1985), 157.

Specifications

Line-pair target

1) 20 lp/mm

Calcium carbonate specks

2) 0.13
3) 0.165
4) 0.196
5) 0.23
6) 0.275
7) 0.4
8) 0.23
9) 0.196
10) 0.165
11) 0.23
12) 0.196
13) 0.165

Step wedge (1 cm thick)

14) 100% gland
15) 70% gland
16) 50% gland
17) 30% gland
18) 100% gland

Nylon fibers

19) 1.25 mm Ø
20) 0.83 mm Ø
21) 0.71 mm Ø
22) 0.53 mm Ø
23) 0.3 mm Ø

Hemispheric masses (75% glandular / 25% adipose)

24) 4.76 mm thick
25) 3.16 mm thick
26) 2.38 mm thick
27) 1.98 mm thick
28) 1.59 mm thick
29) 1.19 mm thick
30) 0.9 mm thick

Optical density

31) reference zone

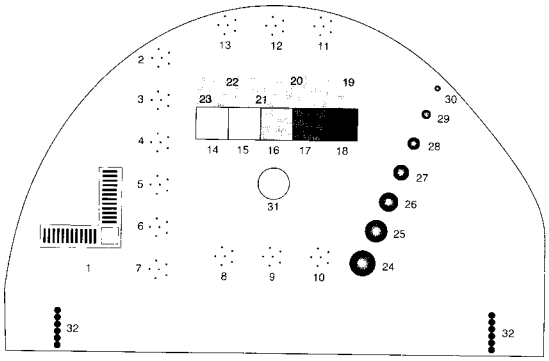
Edge beam

32) localization target

Material Epoxy

Dimensions 7.28 (w) x 4.92 (d) x 1.77 in (h) (18.5 x 12.5 x 4.5 cm)

Weight 2.2 lb (1.0 kg)



Available model(s)

18-222 Tissue-Equivalent Mammography Phantom, includes hand-held microscope and mammography QA recording documents

18-223 Mammography Phantom Research Set, includes tissue-equivalent phantoms 4, 5, and 6 cm thick, and phototimer compensation plates from 0.5 to 7 cm

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

Specifications are subject to change without notice.

18-222-ds rev 2 10 mar 03

CardinalHealth

Single-Exposure High Contrast Resolution Phantom

Nuclear Associates Model 18-216

DI Diagnostic Imaging

- Perform quality control inspections of mammography system resolution with just one exposure
- Meets ACR guidelines
- Meets MQSA requirements
- Rugged, easy-to-use, and cost-effective

Introduction

This phantom incorporates a 17.5 micrometer-thick gold-nickel alloy bar pattern. This allows the assessment of resolution perpendicular and parallel to the anode-cathode axis in just one exposure. This pattern has segments from 5 lp to 20 lp/mm and is equivalent to 25 micrometers of lead, or 2.6 mm of aluminum at 20 keV.

The bar pattern is permanently embedded in a thin acrylic wafer, to protect it from wear and damage.

Applications

The phantom body is available in BR-12 or BR50/50. It enables consistent, reproducible positioning of the bar pattern at 4.5 cm above the breast support plate at 1 cm from the chest wall, centered laterally as recommended by the American College of Radiology.

The bar pattern can also be positioned at a variety of heights for more thorough evaluations.

The phantom includes a 30x hand-held microscope.

Specifications

Material BR12 or BR50/50

Dimensions 100 (w) x 125 (d) x 20 mm (h)

Weight 1.3 lb (0.57 kg)

Optional accessories

Acrylic Wafer Test Pattern (Model 18-216-2555)

Available model(s)

18-216 Single-Exposure High Contrast Resolution Phantom, BR-12, includes hand-held microscope

18-216-1000 Single-Exposure High Contrast Resolution Phantom, BR50/50, includes hand-held microscope

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

Specifications are subject to change without notice.

18-216-ds rev 2 25 feb 03

Diagnostic Imaging DI

Mammography QC Compliance Kit

Nuclear Associates Model 18-290

- Contains all the essential products recommended by the American College of Radiology in their quality assurance program
- Comprehensive mammography kit for the technologist: includes sensitometer, densitometer, compression scale, ACR phantom, and more
- In addition, we offer mammo gowns and capes, please call for details

Features

- Helps keep mammographic equipment working perfectly...delivering optimum quality images at lowest dose possible
- Facilitates compliance with MQSA, ACR, and State quality control requirements
- Easy to use, highly accurate instruments and accessories needed for daily testing

Introduction

Mammograms are only as accurate as the systems that produce them. Keeping these systems in peak working condition is paramount in producing sharp, high quality images. Because every mammography system deteriorates with time, it is important that you maintain an ongoing quality control program; one that can detect even the smallest changes in your imaging chain...from x-ray generator to x-ray film processor.

Applications

This Mammography Quality Control Compliance Kit contains the most needed products that will allow you to implement a comprehensive QC program and comply with MQSA regulations, ACR recommendations, and State requirements.

Specifications

Weight 32 lb (14.4 kg)

Kit components (Model 18-290)

Mammographic Accreditation Phantom (Model 18-220)

Hand-Held Dual-Color Sensitometer (Model 07-417)

Hand-Held Deluxe Digital Clamshell Densitometer (Model 07-443)

Portable Digital Thermometer (Model 07-402)

Mammography Screen-Film Contact Test Tool (Model 18-207)

Mammography Compression Scale (Model 18-241)

Optional High-Precision Electronic Mammography Compression Scale (Model 18-241-4426)

Acrylic Contrast Test Disk, 1 cm Ø x 4 mm (Model 18-205)

Fixer Retention Test Chemical Solution (Model 18-231)

Hypo-Estimator Comparison Strip (Model 18-235)

Mammography Cassette Wipes (Model 18-234)

***Quality Management for Radiographic Imaging* Manual** (Model 95-502)

MQSA Manual on CD (Model 18-268-2000)

Carrying Case (Model 89-290)

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

Specifications are subject to change without notice.

18-290-ds rev 2 10 mar 03

CardinalHealth

Stereotactic Needle Biopsy Tissue-Equivalent Phantom

Nuclear Associates Model 18-228

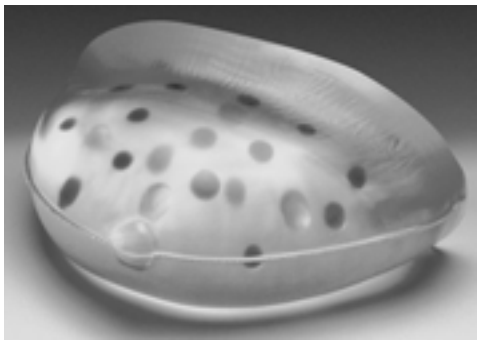
DI Diagnostic Imaging

- The ideal teaching tool and training phantom for practicing mammographic stereotactic needle biopsy
- Compressible
- Contains cysts, dense masses and calcifications
- Proprietary gel simulates physical density and mass attenuation of BR-12
- Gel will not dry out after initial needle punctures, thus extending storage life
- Physical consistency similar to human tissue, combined with an elastic, skin-like membrane, enables palpation of embedded structures and accurately simulates needle resistance
- Anthropomorphic shape allows for accurate simulation of breast compression
- Can also be used for system QC

Introduction

With the increasing use of stereotactic breast biopsy procedures, it is essential that radiology healthcare providers maintain and increase their needle biopsy skills. This tissue-equivalent phantom is a MUST for every mammography facility.

The automated stereotactic breast biopsy procedure depends on several variables for accurate needle placement. Thus, for patient safety, this system must be properly maintained and evaluated.



Applications

This versatile phantom was designed to assist in training technologists and physicians in the use of a stereotactic system, and for verifying the proper operation of mammographic stereotactic biopsy systems.

Because the phantom closely mimics properties of the human breast, it is also an ideal teaching tool and practice medium for mammographic needle biopsy procedures. It should also be used whenever a new system is installed or repaired, to ensure accurate needle placement.

This training phantom is also an excellent research and development/demonstration tool for manufacturers of mammography equipment.

The phantom should be stored in a cool place. The phantom should be discarded after all the tumors have been aspirated.

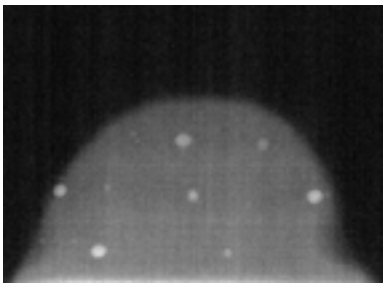
Specifications

Targets	Color	Dimensions	Quantity	Position
Cystic masses	green	5 to 12 mm	6	Random
Dense masses	black	5 to 12 mm	6	Random
Microcalcifications	orange	0.3 to 0.35 mm	two clusters	Mid-plane on right and left sides

Dimensions 10 cm (l) x 5 cm (h); 1500 cc
Weight 2 lb (0.91 kg)

Available model(s)

18-228 Stereotactic Needle Biopsy Tissue-Equivalent Training Phantom



Mammo-Cube Stereotactic Core Biopsy Phantom Model 18-229-1313

- The most cost-effective and economical phantom for teaching, training, and QC

Specifications

Embedded lesions Six dense masses, 5 to 12 mm Ø

Proprietary gel Simulates the physical density and mass attenuation of BR-12. The gel will not dry out after initial needle punctures, thus extending storage life

Physical consistency Similar to human tissue and combined with an elastic, skin-like membrane which enables palpation of embedded structures and accurately simulates needle resistance

Care The phantom should be stored in a cool place, and discarded after all lesions have been biopsied

Dimensions 6.5 (w) x 7 (d) x 4.5 cm (h)

Weight 5 oz *

* *Individual cube dimensions and weights may vary by 10%.*

Available model(s)

18-229-1313 Mammo-Cube Stereotactic Core Biopsy Phantom

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

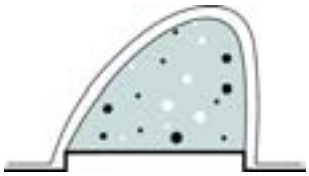
18-228-ds rev 1 10 mar 03

Diagnostic Imaging DI

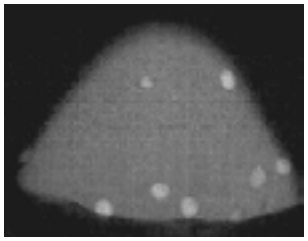
Triple-Modality Biopsy Training Phantom

Nuclear Associates Model 18-229

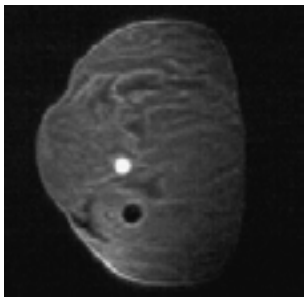
- Tissue-equivalent under x-ray, ultrasound, and MRI
- Compressible
- Ideal for physician and technologist training, and quality control
- Physical density and attenuation characteristics accurately simulate that of an average 50% glandular breast (BR-12 equivalent)
- Flesh-like consistency allows for the palpation of embedded lesions while accurately simulating needle resistance found in human tissue
- Anthropomorphic shape is suitable for compression mammography, ultrasound or MRI examinations
- The American College of Radiology recommends this type of product in their quality assurance program



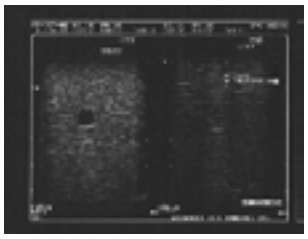
Targets: dense and cystic masses



X-ray mammography



MRI



Ultrasound

Introduction

Suspect lesions discovered in x-ray mammography must often be evaluated under ultrasound to aid diagnosis and in some cases, use of MRI may be indicated. This phantom is an ideal training device because it can be imaged under three modalities and was designed specifically for needle biopsy.

Applications

The Triple-Modality Biopsy Training Phantom is a disposable phantom that was designed to closely mimic the properties of the human breast, making it an extremely useful accessory for training technologists and physicians, as well as for verifying the proper operation of a mammographic biopsy system.

Training

With the increasing use of breast biopsy procedures, it is essential that radiology healthcare providers maintain and increase their needle biopsy skills. This training phantom is a must for every mammography facility.

Quality control

The breast biopsy procedure depends on several variables for accurate needle placement. Thus, for patient safety, the system must be properly maintained and evaluated. A comprehensive mammography quality control program must provide assurances that all aspects of the mammography equipment are operating at optimum levels. The Triple-Modality Biopsy Training Phantom is the ideal tool for such a program. Additionally, the phantom can and should be used whenever a new system is installed or repaired, to ensure accurate needle placement.

Research and development

This cost-effective phantom is also an excellent research and development/demonstration tool for manufacturers of mammography equipment.

Specifications

Material Zerdine®†

Targets

Dense masses 2 and 8 mm Ø for core biopsy

Cystic masses 3 to 10 mm Ø for needle aspiration

Volume 500 cc

Dimensions 3.94 (w) x 4.72 (d) x 3.54 in (h) (10 x 12 x 9 cm)

Weight 1 lb (0.44 kg)

Available model(s)

18-229 Triple-Modality Biopsy Training Phantom

† *US Patent No. 5196343.*

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

18-229-ds rev 1 10 mar 03

CardinalHealth

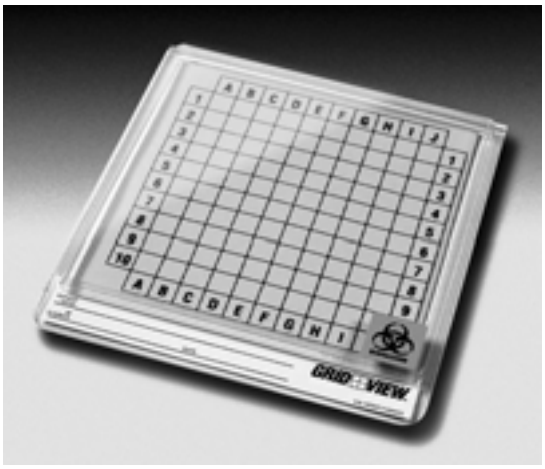
GRID-VIEW™ Breast Biopsy Transport & Imaging System*

Nuclear Associates Model 18-230 Series

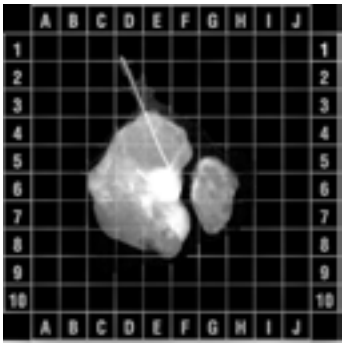
DI Diagnostic Imaging

- An accurate, time-saving system for transporting, imaging and identifying breast biopsies
- Reduces surgery time through improved imaging turnaround
- Improves communication between surgery, radiology and pathology
- Eliminates physical handling of specimen in radiology
- Reduces exposure to blood-borne pathogens
- Eliminates the need for needles or wires
- Meets all OSHA requirements for specimen handling

The GRID-VIEW System enables the breast biopsy procedure to be performed faster, easier and more accurately than ever before! With GRID-VIEW there is no longer an open, exposed specimen which must be handled a number of times. There is no longer a delay between the specimen being brought down from surgery to radiology to be placed on a makeshift imaging board. And with GRID-VIEW, there is no longer any guesswork as to the orientation of the specimen.



The GRID-VIEW System is composed of a sealable plastic container that contains a radiopaque grid which is lettered and numbered for accurate orientation. Once the top of the GRID-VIEW container is closed, the specimen is compressed onto the grid, making it stationary and ready for transport.

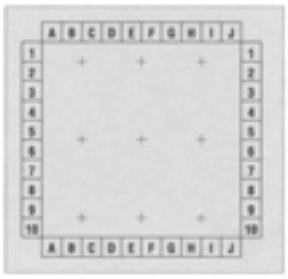


Using GRID-VIEW makes your job easy...

1. Biopsy tissue is placed in the GRID-VIEW container.
2. GRID-VIEW container is delivered to radiology for image confirmation.
3. GRID-VIEW container with biopsy is delivered undisturbed to pathology with the x-ray image.
4. Specimen is compared with x-ray image by pathologist.

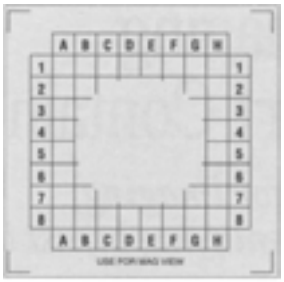
Choose from these grid designs:

18-230-1000
GRID-VIEW System. Package of 12. Weight: 1 lb (0.44 kg)
Also, sold by the case (case contains 12 packages, or 144 units)



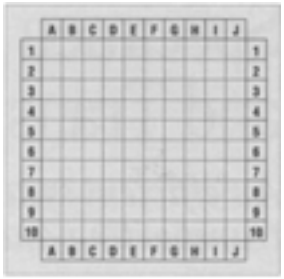
A

18-230-2000
GRID-VIEW System. Package of 12. Weight: 1 lb (0.44 kg)
Also, sold by the case (case contains 12 packages, or 144 units)



B

18-230-3000
GRID-VIEW System. Package of 12. Weight: 1 lb (0.44 kg)
Also, sold by the case (case contains 12 packages, or 144 units)



C

* *US Patent No. 5383472.*

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

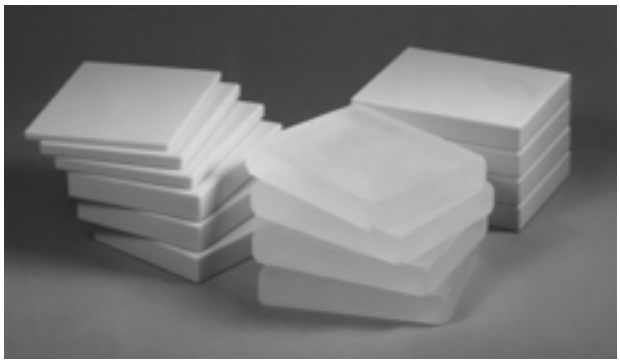
18-230-ds rev 1 10 mar 03

Diagnostic Imaging DI

Mammography Phototimer Consistency Test Tool

Nuclear Associates Model 18-203

- Available in either acrylic or tissue-equivalent BR-12 material*
- Should be used to test thickness tracking
- The American College of Radiology recommends this type of product in their quality assurance program
- Meets MQSA requirements



The mammographic unit's automatic exposure control should be capable of maintaining optical density within ± 0.15 OD as the voltage is varied from 25 to 35 kVp, and as breast thickness is varied from 2 to 8 cm for each technique. Test images taken of uniform phantoms of varying thicknesses should not differ by more than 0.30 OD from each other. These tests should be carried out over the kVp range customarily used by the mammography center.

The Phototimer Consistency Test Tool is available in two materials: acrylic; and, for more accurate results, breast-tissue-equivalent BR-12 material. Both are supplied in uniform 2.0 cm slabs to produce thicknesses of 2, 4, 6, and 8 cm.

Available model(s)

18-203 Mammography Phototimer Consistency Test Tool, set of four acrylic slabs (10 x 12.5 x 2 cm thick). Weight: 3 lb (1.34 kg)

18-204 Mammography Phototimer Consistency Test Tool, set of four BR-12 slabs (10 x 12.5 x 2 cm thick). Weight: 2.2 lb (1 kg)

18-238 Mammography Phototimer Consistency Test Tool Research, set of six BR-12 slabs (includes three 10 x 12.5 x 2 cm thick, two 10 x 12.5 x 1 cm thick, and one 10 x 12.5 x 0.5 cm thick). Weight: 2.6 lb (1.2 kg)

18-238-3070 Mammography Phototimer Consistency Test Tool, set of six slabs, tissue-equivalent, 30% gland/70% adipose

18-238-7030 Mammography Phototimer Consistency Test Tool, set of six slabs, tissue-equivalent, 70% gland/30% adipose

Mammography Phantom Material

Model 18-224

- Available in either acrylic or tissue-equivalent BR-12 material*

For testing…

- Automatic exposure control (AEC)
- Collimator assessment
- Artifact evaluation

The American College of Radiology's Committee on Quality Assurance in Mammography (Medical Physicist's Manual) recommends, as part of the required test equipment, this phantom material.

Available model(s)

18-224 Mammographic Phantom Material, acrylic, one sheet, 18 x 24 x 2 cm. Weight: 2 lb (0.92 kg)

18-225 Mammographic Phantom Material, BR-12, two sheets, 18 x 24 x 2 cm. Weight: 3.8 lb (1.7 kg)

* *BR-12 is a designation (D.R. White, et al.) of certain epoxy resin formulations which react to x-ray in the mammographic energy range (15 to 30 keV) in the same manner as human tissue. The tissue-simulation properties for these slabs are maximized at 20 keV (28 kVp ±). The glandular equivalency of this material is 45% in the mammographic range.*

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

18-203-ds rev 1 10 mar 03

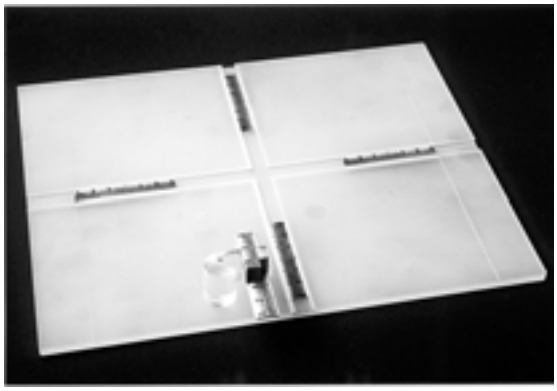
CardinalHealth

Mammography Collimation Assessment Test Tool*

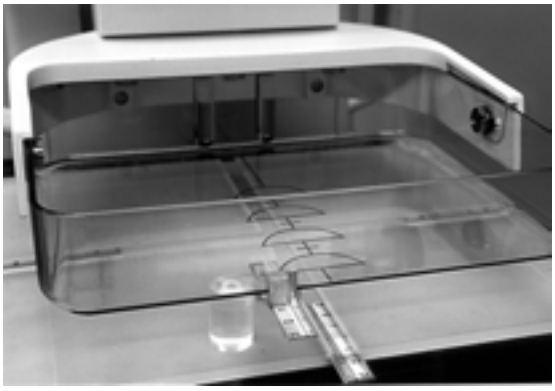
Nuclear Associates Model 18-303

DI Diagnostic Imaging

The ONLY product available on the market specifically designed for this requirement, a self-contained precise QA tool that gives you instant measurements by simply viewing the image. The Mammography Collimation Assessment Test Tool (Model 18-303) is simple to use. Just follow the exact instructions contained in the ACR Mammography QC Manual for the Collimation Assessment. The only difference is instead of using all those hard-to-find coins, you only use our test tool. The "0" point of the metal ruler is placed at the edge of the light field. The compression paddle rests on top of the appropriate size plastic peg (1.7 and 2.2 cm pegs are included to accommodate different cassette thicknesses) and the alignment ruler (generously sized at 3 cm in both directions) fits snugly against the edge of the paddle. It couldn't be much simpler or much quicker.



Mammography Collimation Assessment Test Tool



Mammography Collimation Assessment Test Tool shown in position

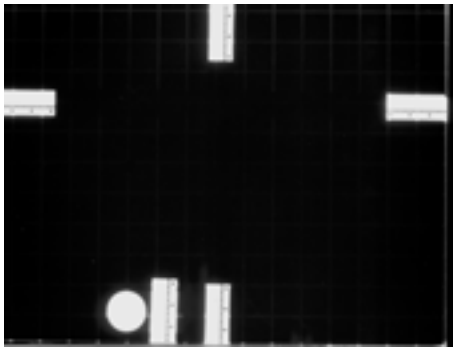


Image of test tool on top of bucky

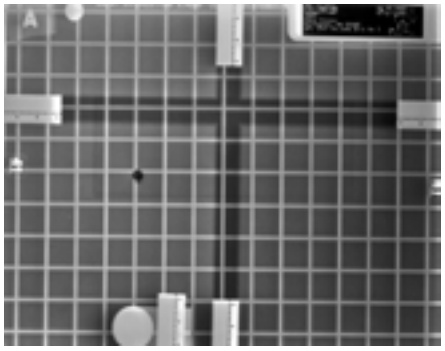


Image of test tool in bucky

- Reduces setup time by half
- Simple to use
- Complies with MQSA testing requirements as contained in the ACR Mammography QC Manual
- Measurement can be quickly and easily repeated
- Compression paddle rests on peg exactly 4.2 cm above the bucky - no measurement of compression paddle height needed
- Stays firmly in place
- Adaptable for 18 x 24 cm, 24 x 30 cm and magnification stand testing

Specifications

Dimensions 24 x 30 cm (9.45 x 11.81 in)

Weight 1.25 lb (0.57 kg)

Available model(s)

18-303 Mammography Collimation Assessment Test Tool, includes one 1.7 cm peg and one 2.2 cm peg

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

18-303-ds rev 1 10 mar 03

* *Designed by Carol Mount, R.T. (R) (M), Supervisor of Mammography, Mayo Clinic®, Rochester, MN 55905. Manufactured under licensing agreement with Mayo Foundation for Medical Education and Research.*

Diagnostic Imaging DI

Digital X-Ray Field-Size Test Tool*

Nuclear Associates Model 07-607

- Designed specifically to permit quick and accurate collimation assessment of digital stereotactic x-ray machines
- Designed for small-field-of-view mammography units
- Quick and easy checks of compliance with accreditation standards
- Evaluates x-ray field size and position
- Evaluates digital image size
- Evaluates light and x-ray field congruence
- Evaluates compression paddle alignment

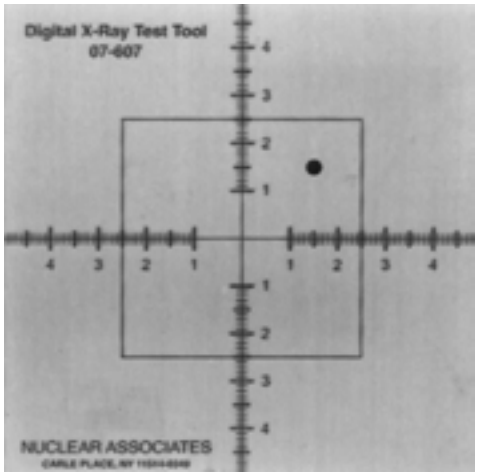
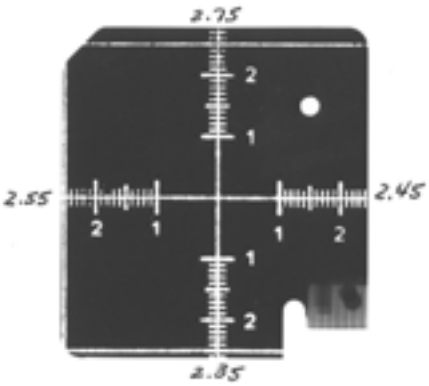


Photo of Digital X-Ray Field-Size Test Tool



Actual image of the test tool

The Digital X-Ray Field-Size Test Tool consists of a copper pattern etched onto fiberglass-printed circuit board material. It provides a ± 5 by ± 5 cm alignment pattern with 1 mm resolution in the x and y directions.

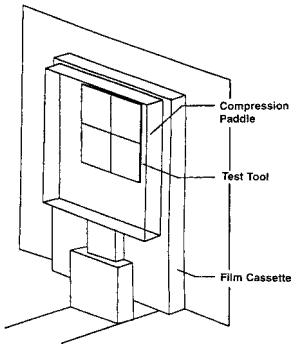
Features

- The image on the film shows the size and position of the x-ray field
- The numbers represent the size and position of the digital image displayed on the monitor
- Both sets of numbers are recorded on the data worksheet and differences can easily be obtained

Specifications

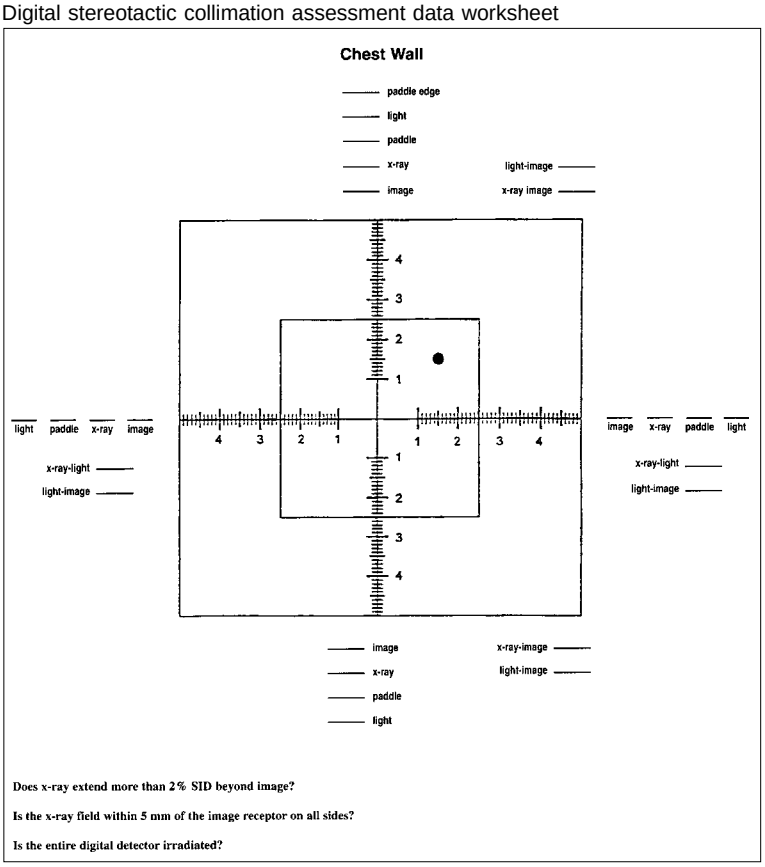
Alignment marks (X and Y) 1.0 mm increments
Material FR4 with 1 ounce copper, tinned
Dimensions 3.94 (w) x 3.94 in (d) (10.0 x 10.0 cm)
Weight 0.06 lb (0.03 kg)
Available model(s)

07-607 Digital X-Ray Field-Size Test Tool, includes data worksheet



The Digital X-Ray Field-Size Test Tool shown mounted between the compression paddle and the film cassette

Digital stereotactic collimation assessment data worksheet



* *Developed by Don Jacobson, Ph.D.*

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

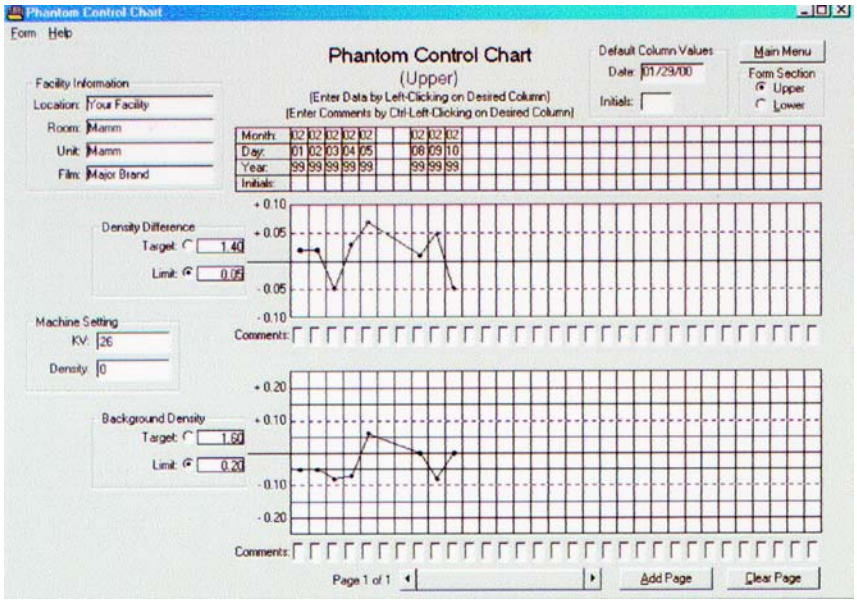
Specifications are subject to change without notice.

07-607-ds rev 1 10 mar 03

CardinalHealth

AutoMAMM Deluxe Quality Control Compliance Software

Nuclear Associates Model 18-129



- AutoMAMM Mammography QC Compliance Software and AutoSTPP Film Processor QC Software in one program
- Window® based program designed to assist the mammography technologist in documenting, plotting, and presenting MQSA QA data
- Performs x-ray film processor quality control IN SECONDS with any Nuclear Associates sensitometer and densitometer and virtually all other brands
- Hassle-free, stress-free, paper-free record-keeping software program that almost makes Quality Control FUN

AutoMAMM and AutoSTPP

(Mammography and X-Ray Film Processor QC Software)

- AutoMAMM Deluxe provides all the charts you are familiar with:
  - Visual checklist
  - Daily checklist
  - Monthly checklist
  - Phantom control charts
  - Repeat analysis
  - Technique charts
- Reprint charts any time you like
- Date checking feature identifies which tests are past due
- Allows you to enter comments for any line item
- Mouse-controlled entry of data: Pass, Fail, Pass with Comment, Fail with comment, or no entry
- Identifies out-of-band points
- Automatically performs all calculations of the repeat analysis
- Construct your own mammography technique chart
- Charts mammography phantom test results
- Allows you to plot up to five phantom films for a given day
- Lets you quickly and easily change your target values without having to begin a new chart
- Handles an unlimited number of mammographic units
- Allows the export and/or import of data files
- Analyzes the data according to ACR recommendations
- Facilitates compliance with MQSA, ACR, JCAHO, and state requirements

Available model(s)

18-129 AutoMAMM Deluxe, consists of both AutoMAMM Mammography QC Compliance Software and AutoSTPP Film Processor QC Software in one program

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

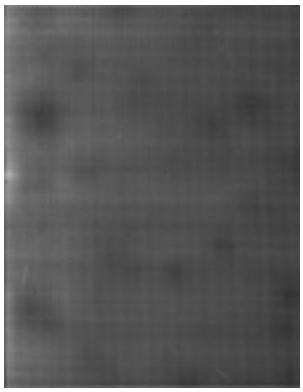
18-129-ds rev 1 10 mar 03

Diagnostic Imaging DI

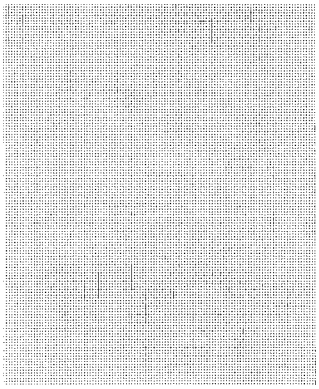
Mammography Screen Film Contact Test Tool

Model 18-207

- Identifies poor screen-film contact in cassettes
- Identifies problems that can affect image sharpness



The dark areas in this image indicate poor screen-film contact



This image demonstrates good screen-film contact

Proper screen-film contact is essential for optimum image quality. The loss of contact and resolution is critical in areas of tiny calcifications or very subtle nodules. Contact testing should be performed on a routine basis to ensure the best possible image quality.

Because of the high resolution imaging capabilities of mammographic screen-film systems (16 to 20 cycles/mm vs. a conventional system with 4 to 8 cycles/mm), a fine mesh contact tool should be used to detect areas of poor contact. The Mammography Screen-Film Contact Test Tool consists of a copper screen with 40 wires per inch, laminated in white vinyl-covered plastic (with the equivalent density of 4 cm thickness of acrylic).

Just lay the contact tool over the cassette. Move the compression device as close as possible to the x-ray tube, and make an exposure. Process the film and look for screen-film clarity across the film. Dark areas indicate poor screen-film contact.

Specifications

Dimensions 28.5 x 33.5 cm

Weight 1.05 lb (0.48 kg)

Available model(s)

18-207 Mammography Screen-Film Contact Test Tool

18-201 Mammography Screen-Film Contact Test Tool, 8.5 x 10 inch

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

18-207-ds rev 1 10 mar 03

CardinalHealth

View Markers for Mammography

Nuclear Associates Model 18-210-8000

DI Diagnostic Imaging

- Meets all requirements for standardized terminology set forth by the MQSA and American College of Radiology
- Standardized labeling of mammography films is essential to ensure that films are not misinterpreted

As stated in the American College of Radiology Mammography Quality Control Manual, it is required that all mammography films are labeled to prevent misinterpretation. These View Markers are in accordance with ACR requirements.

The markers are radiopaque, and each is equipped with an attached "super hold" suction cup. Firm, gentle pressure will hold the suction cup in place on the side of the mammography unit.

Choose from the following kits:

- **Standard Kit** (normal requirement) Consists of eight markers for the most frequently used positions. Weight is 0.50 lb (0.24 kg).
- **Specialty Kit** Consists of 14 specialty markers. Weight is 1.0 lb (0.5 kg).
- **Full-Service Kit** Consists of 22 markers (Standard Kit plus 14 specialty markers) for use with all possible positions. Weight is 1.75 lb (0.78 kg).

Each marker includes a suction cup. Each set includes a holder (the small set gets a small holder, the larger sets get a larger holder).

Individual markers, holders, and replacement suction cups are also available.

Available model(s)

18-210-8000 Standard Kit of 8 View Markers

18-210-1400 Specialty Kit of 14 View Markers

18-210-2200 Full-Service Kit of 22 View Markers

Labeling codes for positioning*

	Labeling code	Purpose
Laterally		
Right	R**	
Left	L**	
Projection position		
Mediolateral oblique	MLO	Standard view
Craniocaudal	CC	Standard view
90° Lateral		
Mediolateral	ML	Localize, define
Lateromedial	LM	Localize, define
Spot compression	SPOT	Define
Magnification	M**	Define
Exaggerated craniocaudal	XCCL	Localize
Cleavage	CV	Localize
Axillary tail	AT	Localize, define
Tangential	TAN	Localize, define
Rolled lateral	RL (rolled lateral)†	Localize, define
Rolled medial	RM (rolled medial)†	Localize, define
Caudocranial	FB (from below)	Define
Lateromedial oblique	LMO	Define
Superolateral to infermedial oblique	SIO	Define
Implant displaced	ID	Augmented breast

† *Used as a suffix after the projection. For example, LCCRL equals Left Craniocaudal Upper Breast Tissue Rolled Laterally.*

* *Taken from ACR Mammography Quality Control Radiologic Technologist Manual.*

** *Used as a prefix before the projection. For example, RMMLO equals Right Magnification Mediolateral Oblique.*

Personal ID Marker

Model 18-210-1407

In order to comply with MQSA and ACR requirements for labeling mammograms, it is required that technologists who perform the examination be identified.

This ID marker enables you to conform to this requirement. Weight is less than one pound.

Available model(s)

18-210-1407 Personal ID Marker

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

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Diagnostic Imaging DI

Mamchex/AEC
Model 07-MCX

- An intelligent meter that monitors daily quality control and calibration of mammographic x-ray machines
- Separates x-ray machine from film processing quality control
- Convenient, fast, and accurate assessment of the AEC Systems' performance

Mamchex system without cable

Features

- Diagnostic power-up sequence to indicate operational status
- Manual reset using the Power/Reset button
- Automatic power-down when meter is not used for more than one minute
- Displays when an exposure is being made
- Displays exposure time in milliseconds
- Low battery indication

Specifications

Reset Manual using Power/Reset button
Operating temperature 59° to 95°F (15° to 35°C)
Dynamic range 0 to 999.9
Power requirements Two 9 V batteries
Radiation exposure time accuracy ± 1 millisec or 1%, whichever is greater
Short/long term drift < 0.5%
Typical battery life > 40 hr

Introduction

The Mamchex/AEC separates x-ray machine from film processing quality control. The x-ray machine output can be surveyed daily or at any time to tell whether the machine is ready to make human exposures safely and diagnostically. The Mamchex meter looks at the light output from the intensifying screen in the cassette (the same light the film sees); and displays digitally whether any factor has caused the machine x-ray beam to change since the last time it was checked. The Mamchex can detect mammographic machine drift and/or beam change and can tell the operator whether the machine should/should not be used.

The Mamchex intelligent meter uses a microcontroller to track the output of the machine and displays a digital number (QC number) that can be compared to a calibrated output; if the number changes significantly over the short or long term, the machine may need re-calibration. If the digital number does not change but the image quality has changed, then other components of the imaging chain should be investigated.

Applications

Technologists can use this meter at any time to indicate calibration status or calibration drift.

The Mamchex is easy to operate:

1. Slip Mamchex into the Bucky, the same as the film/screen cassette, until it locks into place.
2. Turn it on.
3. Push the reset button, wait till the LCD says "Ready for Exposure."
4. Expose it.
5. Read the number and compare it to a calibration number. The number tells whether the operator has a "go" or "no go" situation.

Size 7.5 x 14.37 x 0.5 in (1.9 x 36.5 x 1.3 cm)
Weight 6.2 lb (2.8 kg)
Available model(s)

07-MCX Mamchex/AEC, consists of M/R Interface and Mammographic Cassette and Adapter

For additional information, please contact Cardinal Health, Radiation Management Services customer service at 440.248.9300, 800.850.4608, or fax: 440.349.2307; located at 6045 Cochran Road, Cleveland, Ohio 44139-3303, USA.

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For AEC-6 complete radiographic system package, see AEC-6 Mammo/Rad Systems (Model 07-AEC6).

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