# Single Exposure High Contrast Resolution Phantom User Guide

Model 016A-BR12



# Single Exposure High Contrast Resolution Phantom User Guide

© 2013–2023 by Computerized Imaging Reference Systems, Inc. All rights reserved.

The information contained in this guide is copyrighted and all rights are reserved by CIRS. Copying, duplicating, selling, or otherwise distributing any part of this product without the prior written consent of CIRS is prohibited.

CIRS reserves the right to make periodic modifications to this guide without obligation to notify any person or entity of such revision.

3 August 2023



CIRS 900 Asbury Ave Norfolk, VA 23513 USA +1-321-259-6862 www.sunnuclear.com



# Contents

Introduction
Use of the Phantom
and Corrective Action4
Support and Maintenance
Hardware Maintenance
Inspection5

Inspection	
Repair	
Cleaning	
Storage	

Disposal and Recycling5 Contacting Sun Nuclear Support5 Support Website6
Specifications   7     Product Specifications   7
References
Regulatory Supplement 9   Sun Nuclear Corporation Symbols 9   Operator Responsibility 10   Reporting Health or Safety
Related Issues or Concerns 10 Modifications to Equipment 10

This page is intentionally left blank.

# **1** Introduction

### **Objective**

Focal spot performance may be evaluated by determining limiting resolution with a high contrast resolution pattern. The resolution pattern should provide a test of at least 16 line pair per millimeter (lp/mm), but a resolution pattern with 20 lp/mm is ideal. The test should be marked to identify the number of lp/mm in the image at appropriate points.

### **Product Description**

Model 016A-BR12 incorporates two 17.5-micron thick gold-nickel bar patterns positioned at 90 degrees. This allows assessment of resolution perpendicular and parallel to anode-cathode axis in just one exposure. Each pattern has 17 segments from 5 lp/mm to 20 lp/mm, equivalent to 25 microns of lead at 20 keV.

The bar patterns are permanently embedded in a thin acrylic wafer to protect them from wear and damage.

The phantom body consists of BR12. The BR12<sup>1,2</sup> is a tissue-simulating epoxy resin with a linear attenuation of 47% glandular and 53% adipose.

The phantom body features a cavity for the acrylic wafer. This design enables consistent, reproducible positioning of the bar pattern at 4.5 cm above the breast support plate and 1 cm from the chest wall, centered laterally (as recommended by the American College of Radiology).



Figure 1-1. Model 016A-BR12

This page is intentionally left blank.

# **2 Use of the Phantom**

- Place the pattern at the desired height above the breast support plate, either with no extraneous materials between the bar pattern and the breast support or with a homogeneous phantom supporting the pattern. Position the pattern within 1 cm of the chest wall edge of the image receptor, centered laterally. It is important that the test pattern be positioned in a reproducible manner. A test stand or jig may be helpful.
- 2 Place the image receptor in the location where it would normally be used for mammography.
- 3 Select the kVp, mA, and focal spot used for imaging an average breast during normal radiography and an exposure time that will produce a background optical density from 1.2 to 1.6.<sup>4</sup> This may be done either manually or in the AEC mode. For specifications regarding digital mammography, refer to the ACR-AAPM-SIIM Practice Guideline for Determinants of Image Quality in Digital Mammography.<sup>3</sup>
- 4 Make an exposure and process for review.



Page 3

Slab Layout with Acrylic Target Figure 2-1. Acrylic Target Layout Acrylic Target (016AW)



Figure 2-2. 20 Line Pair per Millimeter Bar Pattern

### **Data Interpretation and Analysis**

- 1 Under masked conditions, view the high-contrast resolution pattern images using adequate magnification.
- 2 Note the highest frequency pattern whose lines are distinctly visible throughout at least half of the bar length and record the highest frequency visible for each test image.

# Suggested Performance Criteria and Corrective Action

In the contact mode, measurements made with the bars parallel to the anodecathode axis should be at least 13 lp/mm; measurements with the bars perpendicular to the anode-cathode axis should be at least 11 lp/mm. In magnification mode, the limiting spatial resolution should be no lower than the above specification.<sup>1</sup>

# **3 Support and Maintenance**

### Hardware Maintenance

#### Inspection

Periodically inspect your phantom 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 Sun Nuclear Support* below.

#### Repair

The phantom and the parts provided with the phantom cannot be repaired by the user. Most phantoms can be easily repaired, and if damaged, contact Sun Nuclear Support.

#### Cleaning

Cleaning may be accomplished by using mild soap and water solutions. Avoid contact with corrosive substances and with radiographic contrast media. Wash thoroughly if such contact occurs.

#### Storage

The phantom is manufactured from epoxy resin. Various other chemicals and fillers have been added to the resin using a proprietary, tissue-simulation technology. As with most other epoxy plastics, your phantoms may discolor over time. This process can be accelerated by direct exposure to sunlight or extreme temperatures. Discoloration does not affect tissue-equivalent performance. Epoxy is quite durable, but can still be damaged if it is dropped on a hard surface so handle with care.

#### **Disposal and Recycling**



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

### **Contacting Sun Nuclear Support**

You may request support in two ways:

- Submit a support request using our online form. See *Support Website* below.
- Contact the Sun Nuclear Support team by telephone:
  - U.S.A.: +1 321-259-6862, Option 3
  - Netherlands: +31 20 399 90 41, Option 1
  - Germany: +49 61 02 50 49 500, Option 2

#### **Support Website**

- **1** Open an internet browser and navigate to <u>sunnuclear.com/support</u>.
- 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**

### **Product Specifications**

Table 4-1. Phantom Specifications

Characteristic	Specification
Set Dimensions	12.5 cm x 10 cm x 4.5 cm
	(4.9" × 3.9" × 1.7")
Phantom Weight	2 lb (0.7 kg)
Materials	Phantom: BR12
	Target: Gold-nickel construction (equivalent to 25 microns lead or 2.6 mm aluminum) embedded in acrylic

## **5** References

- 1. Hammerstein R., Miller D., White D., et al.; *Absorbed Dose in Mammography; RADIOLOGY*;130:485-491, 1979.
- 2. White, D.R., R.J. Martin, and R. Darlison; *Epoxy resin based tissue substitutes, British Journal of Radiology*, 5, 814-821, 1977.
- 3. Kanal K., Krupinski, E., Berns, E., et al.; *ACR–AAPM–SIIM Practice Guideline for Determinants of Image Quality in Digital Mammography*; 2012.
- 4. American College of Radiology Guidelines on Mammographic Screening; 1999.

# **Appendix A: Regulatory Supplement**

In addition to the regulatory information contained in the body of this manual, the following supplemental regulatory information is provided.

#### **Sun Nuclear Corporation Symbols**

The following symbols are used in this guide and in Sun Nuclear Corporation's product labels.



WARNING: This symbol indicates a hazard that could result in major injury or equipment damage. (EN ISO 7010, W001)



CAUTION: This symbol indicates a potential hazard that could result in minor injury or equipment damage. (EN ISO 15223-1, 5.4.4)



CAUTION: This symbol indicates a pinch hazard. (EN ISO 7010, W024)



Note: Important or supporting information.



Manufacturer's Identification (name and address). (EN ISO 15223-1, 5.1.1)



Date of Manufacture. (EN ISO 15223-1, 5.1.3)



Temperature limitation. (EN ISO 15223-1, 5.3.7)



Humidity limitation. (EN ISO 15223-1, 5.3.8)



Atmospheric pressure limitation. (EN ISO 15223-1, 5.3.9)



Serial Number. (EN ISO 15223-1, 5.1.7)



Catalog Number. (EN ISO 15223-1, 5.1.6)



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**

Any serious incident that has occurred in relation to the device should be reported to the manufacturer and the competent authority of the Member State in which the user and/or patient is established.

To report any safety or health related issues or concerns regarding the use of Sun Nuclear products, contact Sun Nuclear directly.

### **Modifications to Equipment**

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



