

## **Q.A. Collectible**

*Sponsored by CRCPD's Committee on Quality Assurance  
in Diagnostic X-Ray (H-7)*

### **Quality Assurance Tips for Fluoroscopic Image Evaluation High Contrast Resolution**

#### **Rationale**

In any fluoroscopic system, the ability to see anatomic detail is proportional to the overall resolution properties of the system. This test allows for a simple evaluation of system resolution to ensure that optimal anatomic detail is visible to the practitioner. High contrast resolution is important for all fluoroscopic procedures.

#### **Equipment Required**

- 1) The test tool is a mesh pattern (e.g., Gammex-RMI Test Tool, RMI 141) consisting of eight pie sections, 16, 20, 24, 30, 35, 40, 50, 60 holes/inch in a total area of 7 x 7 inches, with lead numbers to identify each mesh resolution section. A pattern such as this allows easy measurement of central, general, and edge resolution of an imaging system. See Figure 1.
- 2) For photospot and cine units one 7 x 7 x 3/4 inch type 1100 aluminum block is used.

#### **Measurement Protocol**

- 1) The test pattern is placed as close as possible to the input surface of the image intensifier. Use adhesive tape to attach the pattern to the bottom of the spot-film device or image intensifier assembly of a C-Arm. The pattern must be oriented 45 degrees to the horizontal raster lines on the TV monitor (otherwise, the raster lines, which are the TV scan lines, can be mistaken for the system resolution). The fluoroscopic grid should be removed from the field if possible. The shutters should be collimated to the size of the test tool. Do not place the pattern on the tabletop because an inaccurate reading will result from excessive image magnification. The bottom of the spot-film device should be 14" from the tabletop. See Figure 2.
- 2) If the system has an automatic brightness control with fixed kVp and variable mA to achieve proper brightness, set the kV at 55-60. If the system is co-directional (both mA and kVp vary depending upon object thickness), the kV will automatically start out at 55-60. If the system has a manual only control, select 55-60 kVp and approximately 1 mA. Do not operate the system with a kVp value greater than 70 kV, since little attenuation is in the beam and the excessive brightness could damage the imaging system. If the system has magnification

modes, such as 14-10-6 or 9-6-4.5 sizes, each mode should be evaluated. Activate the fluoroscope and record the highest values of the mesh pattern that you can actually differentiate. Read the values for both the center of the field and edge of the field and compare to this chart:

<u>Image Intensifier Size</u> (inches)	<u>Viewing</u> (Edge / Center)	<u>Film Recording</u> (Edge/Center)
12 - 14	20 / 24	24 / 30
9 - 10	20 / 24	30 / 40
6 - 7	24 / 35	40 / 50
4 - 5	35 / 40	50 / 60

- 3) This test allows for overall evaluation of the system resolution. If poor resolution is seen, e.g., 16 holes/inch, this does not mean that the image tube is defective. It does, however, indicate that some component(s) in the imaging chain is out of adjustment or defective. Small changes in the electron-focusing system of the image intensifier will cause deterioration of system resolution.
- 4) Dual or tri-field image intensifier should be expected to yield the same performance in a reduced size mode as a single-field image intensifier of the same size. For example, a 9-6-4.5 inch in the six inch mode of operation should yield visualization of the 24/35 holes/inch objects on the TV.
- 5) Photospot (100 mm or 105 mm) and 35 mm cine resolution can also be evaluated using this pattern. Place a 7 x 7 x 3/4 inch type 1100 aluminum block on the tabletop. Center the spot-film device or image intensifier assembly over the aluminum block with the pattern attached to the spot-film device. The distance should be 14" between the bottom of the spot-film device or image intensifier assembly and the tabletop. Select the small focal spot and a low mA setting. The kVp should be set at 60 kVp. If a cine system is being evaluated, the pulse-width should be set as low as possible (typically 1-2 milliseconds). Make a run of exposures and process the film. You should also note the kVp and mA as well as exposure time if it is displayed for future reference. This will allow for consistent duplication of testing procedures should any problem be found.

The values given are based on the use of an RMI Pattern #141. Similar or the same values are found in the Center for Devices and Radiological Health's FDA-80-8095, *Quality Assurance for Fluoroscopic X-Ray Units and Associated Equipment* or *Quality Control in Diagnostic Imaging* by Gray, Winkler, Stears and Frank, University Park Press.

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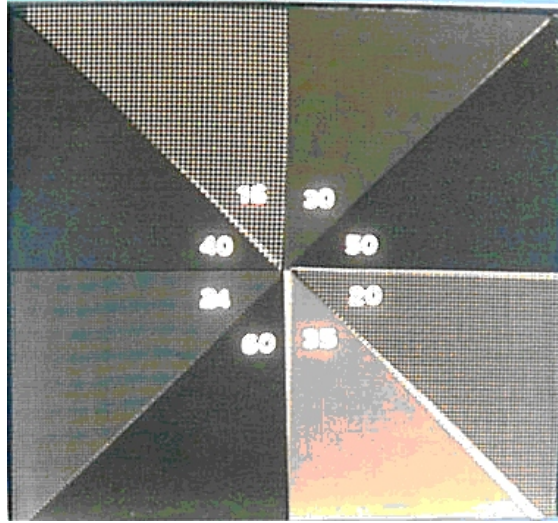


Figure 1. Resolution test tool.



Figure 2. Proper position of resolution test tool on image intensifier of under-table fluoroscopy unit.

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