

FLUKE®

Biomedical

Nuclear Associates 07-553

Ultra-High Precision Test Pattern

Users Manual

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Table of Contents

Section 1:	General Information.....	1-1
1.1	Introduction	1-1
1.2	Film/Screen Resolution Limits	1-2
1.3	Magnification Geometric Effect Determination.....	1-3

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Section 1 General Information

1.1 Introduction

The 07-553 X-Ray Test Pattern is used to evaluate film screen systems and magnification techniques. It consists of a 50-micron thick lead test pattern encased in plastic. The resolution limit of 10 line pairs per millimeter is more than adequate for analyzing the resolution problems encountered in medical radiography.

Figure 1-1 is an enlarged contact radiograph of the test plate. The spacing of the bar pattern varies in steps between the index marks. For example, the spatial frequency of the pattern between AB is one-half line pair per millimeter and the spatial frequency between CD is 0.85 line pairs per millimeter.

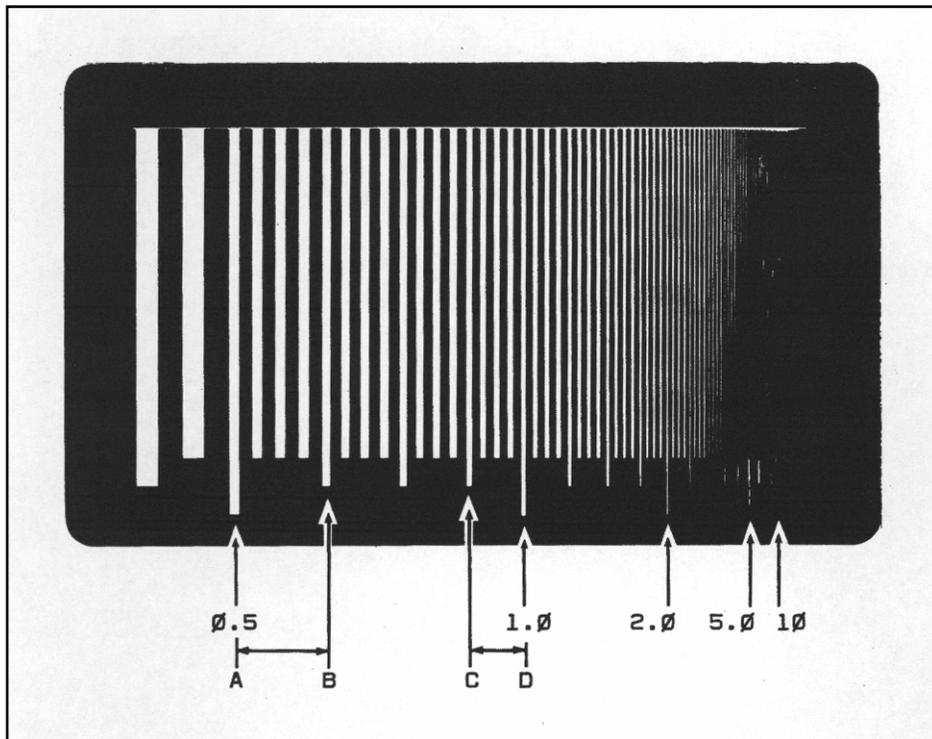


Figure 1-1

Table 1-1 tabulates the spatial frequency associated with each of the index marks. A larger line separates the pattern into a group of line pairs with longer lines corresponding to groups of 0.5, 1, 2, 5, and 10 line pairs per millimeter.

Table 1-1 Line Pairs/mm Value for each Resolution Group

	LP/mm		LP/mm
1	0.25	12	2.9
2	<u>0.5</u>	13	3.5
3	0.6	14	4.2
4	0.7	15	<u>5.0</u>
5	0.85	16	6
6	<u>1.0</u>	17	7
7	1.2	18	8.5
8	1.4	19	<u>10</u>
9	1.7	20	8.5
10	<u>2.0</u>	21	7
11	2.4	22	6

1.2 Film/Screen Resolution Limits

1. Place the test plate on top of a test film. Do not use a grid.
2. Use a 40" focus-film distance and 50-60 kVp. Center the tube over the test plate. Adjust the mAs for a gross optical density of about 1.5 on a portion of the film not covered by the test plate. (These factors give minimum geometric effects and sufficient contrast to assure a reliable test.)
3. Determine the limiting resolution by inspecting the finished radiograph with a 5-10 power magnifying glass.

Figure 1-2 is a study of a par-speed film and par-speed screen system. The technical factors were 60 kVp, 3 phase, 4 mAs, normal processing. The limiting resolution, as measured on the original radiograph was 7 line pairs per millimeter.

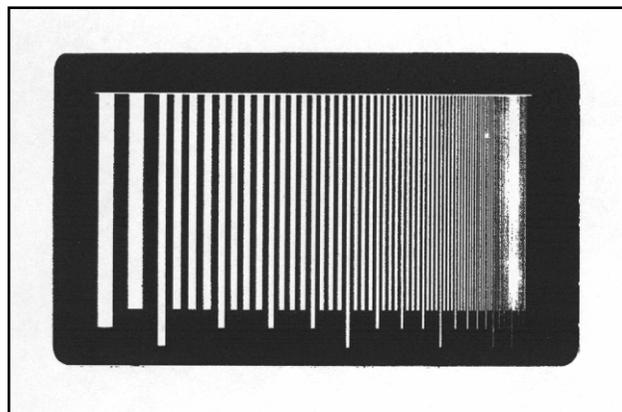


Figure 1-2

1.3 Magnification Geometric Effect Determination

1. Place the test plate in the position of the part to be radiographed. Align the test plate so that it is at right angles to the anode-cathode direction of the tube.
2. To eliminate film-screen effects, a non-screen film should be used in the normal film location.
3. Place the x-ray tube in the position normally used for magnification and center it over the test plate. Use the kV settings appropriate to the clinical study. Adjust the mAs to give a gross optical density of about 1.5 on a portion of the film not covered by the test plate.
4. Determine the limiting resolution by inspecting the finished radiograph with a magnifying glass. It is very important to scan in the direction of increasing resolution and to define the limiting resolution as the lowest frequency at which the contrast becomes zero.
5. Repeat with the test plate parallel to the anode-cathode axis of the x-ray tube. It is not unusual for these two measurements to disagree. This effect is due to the asymmetric nature of the focal spot.

Figure 1-3 is a study of the resolution, under magnified conditions, of a large (1.3 mm) and a small (0.3 mm) focal spot. The technical factors are: Magnification – 3.7, 60 kVp, 3-phase; type RP/M film, 100 cm FFD; 100 mA; small focus; 100 mAs; large focus; 80 mAs; test plate perpendicular to the tube.

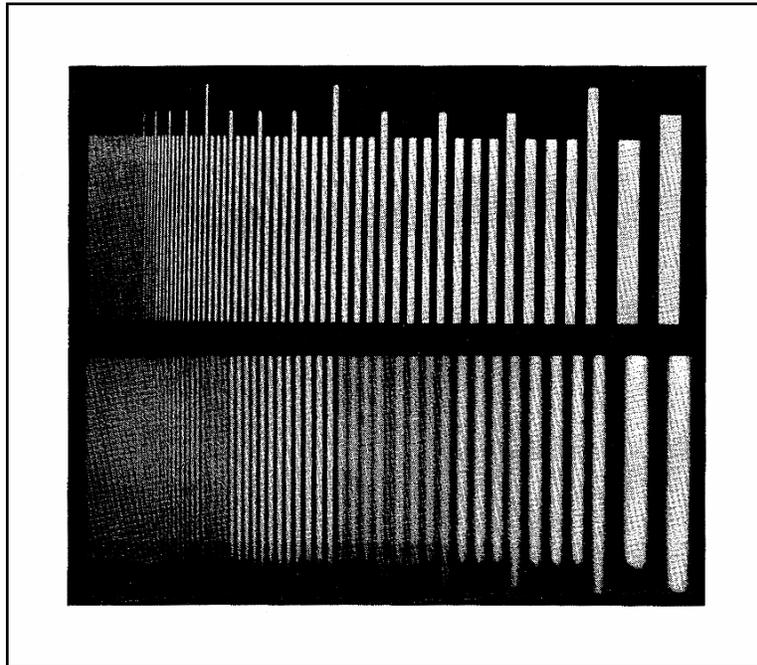


Figure 1-3

The limiting resolution is seen to be 3.5 line pairs per millimeter for the small focal spot and 0.6 line pairs per millimeter for the large focal spot.

NOTE

The images beyond these limiting resolutions are due to both the structure of the focal spot and the periodicity of the test plate. They must be disregarded in an evaluation of the true limiting resolution.

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