



National Institute of Standards & Technology

Certificate

Standard Reference Material 1842

X-Ray Stage Calibration Board

(X and Y Dimension)

Serial No. Sample

This calibration board is intended as a reference standard for checking the X and Y dimension accuracy of automated x-ray inspection systems. It was designed especially for producers and users of systems that have 1) variable magnification, 2) a large field of view, or, 3) a stage that translates the part in front of the system's field of view.

The board is constructed of type 316 stainless steel with a thickness of 3 mm, a length of 300 mm, and width of 300 mm. It contains a calibrated pattern of through-thickness holes which can be imaged by the x-ray system. The 3-mm thickness makes the board quite rigid and rugged.

The stainless steel adjacent to the holes was thinned to about 0.25 mm. This thinner stainless steel at the edge of the hole tolerates a greater misalignment with the x-ray beam, while providing acceptable contrast for x-ray energies to at least 160 kV.

It is expected that various x-ray system manufacturers will develop software routines that will perform automatic evaluation of the system and generate a report that can be used to monitor system performance. The manufacturer of a specific system should be contacted to learn if software has been developed for this purpose.

The calibration board was developed at NIST under the sponsorship of the U.S. Army Harry Diamond Laboratories, G.K. Lucey, Program Manager. The board was designed by T.A. Siewert and M.W. Austin of the NIST Materials Reliability Division. The boards were produced under the supervision of D.P. Vigliotti of the NIST Materials Reliability Division. The holes were calibrated by D.L. Fulsos of the Instruments Shops of the NIST Technical Services Division.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, MD 20899
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Thomas E. Gills, Acting Chief
Standard Reference Materials Program

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Translation Stage Calibration and Field of View Calibration: Vertical and horizontal rows with calibrated locations are used to check the accuracy of the X and Y stage encoders in an automated x-ray system or the uniformity of the field of view. The utility of this board has been confirmed by checking the positioning accuracy and hysteresis of the ball screw drives in a high-resolution x-ray system designed for the inspection of small solder joints. The calibration board should also be useful in measuring the long-term drift in the drives or encoders.

The X and Y stage hole diameters are near 0.5 mm and are designed to allow the positioning precision to be measured to the nearest 0.1 mm. A series of 10 holes are evenly spaced in both the X and Y directions, with a separation of 25 mm. The exact positions of the holes were determined optically and are reported on page 3 of this certificate.

Magnification Calibration: The magnification calibration hole has a diameter near 6 mm and is designed to allow the calibration of variable magnification systems (those with microfocus x-ray tubes and a variable tube-object-detector distance). The diameter of the hole has been measured optically and is also reported on page 3 of this certificate.

Each x-ray system is different. For this reason, no guidance has been provided about the use of this calibration board with a quality assurance program. In NIST tests, the calibrated locations were checked against the position where the X and Y stage encoders predicted the locations. A reference corner and reference edge (as marked on the board) were used to develop a separate coordinate frame on the board. This way, the positioning of the board on the automated stage did not develop a misalignment error.

N.I.S.T.

X-RAY STAGE CALIBRATION BOARD - SRM 1842

SERIAL Sample

X AND Y AXES CALIBRATION DATA*

HOLE	X AND Y		X AND Y	
	POSITIONS (MM)		POSITIONS (IN.)	
X1	38.10	88.89	1.500	3.500
X2	63.52	88.89	2.501	3.500
X3	88.90	88.89	3.500	3.500
X4	114.32	88.89	4.501	3.500
X5	139.71	88.89	5.501	3.500
X6	165.12	88.89	6.501	3.500
X7	190.50	88.89	7.500	3.500
X8	215.88	88.89	8.499	3.500
X9	215.91	88.90	8.500	3.500
X10	266.69	88.91	10.500	3.500
Y1	88.91	38.04	3.500	1.498
Y2	88.91	63.45	3.500	2.498
Y3	88.92	88.86	3.501	3.498
Y4	88.89	114.25	3.500	4.498
Y5	88.87	139.66	3.499	5.499
Y6	88.86	165.08	3.498	6.499
Y7	88.87	190.45	3.499	7.498
Y8	88.87	215.87	3.499	8.499
Y9	88.86	241.26	3.498	9.499
Y10	88.84	266.67	3.498	10.499
MAG HOLE	38.05	38.09	1.498	1.500

MAGNIFICATION CALIBRATION HOLE DIAMETER = 6.34 MM = 0.250 IN.

* ALL DISTANCES MEASURED FROM THE REFERENCE CORNER AND REFERENCE EDGE (IDENTIFIED ON THE BOARD), WHICH IS ASSIGNED A VALUE OF (0,0).