Designation: E 1079 – ~~97~~00

~~An American National Standard~~

Standard Practice for Calibration of Transmission Densitometers[1]

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[1] This practice is under the jurisdiction of ASTM Committee ~~E-7~~ E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.01 on Radioglogy (X and Gamma) Method.

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1. Scope

1.1 This practice[2] covers the calibration of transmission densitometers used to perform radiographic film density measurements (Ssee Note 1.)

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—For further information on the design and use of densitometers, the following literature is suggested as additional background information: Guide E 94 and ANSI documents PH2.19 and PH2.36.

2. Referenced Documents

2.1 *ASTM Standards:*

E 94 Guide for Radiographic ~~Testing~~ Examination[3]

E 1316 Terminology for Nondestructive Examinations[3]

2.2 *ANSI Documents:*

ANSI/NAPM IT 2.19–1994–Density Measurements—Part 2: Geometric Conditions for Transmission Density[4]

ANSI/IT 2.16–1996–Photography Density Measurements—Part 1: Terms, Symbols, and Notations[4]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, see Terminology E 1316.

4. Significance and Use

4.1 This practice provides a means for calibrating transmission densitometers used for the measurement of radiographic film density. A transmission densitometer calibrated in accordance with this practice provides the assurance that accurate density values of radiographs are obtained.

5. Apparatus

5.1 Apparatus should consist of the following:

5.1.1 A calibrated step tablet shall be used. The step tablet may be a NIST X-ray Step Tablet (Standard Reference Material SRM 1001)[5] or alternately a step tablet from another supplier which is traceable to the NIST SRM 1001 X-ray Step Tablet. The step tablet shall have at least five step densities ranging from 0.3 through 3.9. The step tablet may have additional step densities less than 0.3 and greater than 3.9. A calibration certificate shall be provided with the step tablet indicating the tablet ID and recorded values for each step density. For suppliers of step tablets other than NIST, the certificate shall indicate conformance of traceability to NIST instrumentation used in the calibration process, applicable ANSI standards used, verification of measurement on a NIST SRM 1001 step tablet, the ID number of the SRM 1001 step tablet, and calibration date of the step tablet. Precautions should be taken in the storage, handling, and use of the step tablet. In the event it becomes scratched, blemished, or exhibits other signs of deleterious wear, it should be replaced immediately. The SRM 1001 (or alternate, if used) step tablet shall be replaced four years from the date of first use.[6]

5.1.2 *Transmission Densitometers* , with either direct-scale readout or digital readout displays specifically manufactured for the purpose of measuring the range of film densities described in 5.1.1 may be used.

5.1.3 *Manufacturer's Operating Instructions for Appropriate Transmission Densitometer*.

6. Calibration

6.1 Full-scale linearity calibration should be performed at least every 90 days during use as follows:

6.1.1 Allow a minimum of 30-min "warm-up" time (or the manufacturer's recommended warm-up time) to stabilize circuitry before starting the calibration procedure or the periodic verification checks described in Section 8. Adjust the "0" reading of the densitometer after the warm-up period.

6.1.2 Select and position for reading the neutral density closest to 0.3, 3.0, and 3.9 on the calibrated step tablet. Read and record the density for each step.

6.1.3 Compare the densities recorded with the actual density values on the calibrated step tablet or the density values listed on the calibration certificate. If the densitometer has been calibrated properly, the densities at 0.3, 3.0 and 3.9 steps should not vary more than ± 0.05 density units. If any of the recorded density values vary more than ± 0.05 density units from the density values on the calibrated step tablet, the linearity of the densitometer is out of tolerance and should be corrected.

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[2] For ASME Boiler and Pressure Vessel Code applications see related Practice SE-1079 in Section II of that Code.

[3] *Annual Book of ASTM Standards*, Vol 03.03.

[4] Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

[5] Standard Reference Material 1001 is available from the National Institute of Standards and Technology, Gaithersburg, MD.

[6] Expiration interval of the SRM 1001 or alternate step tablet may be different than the requirements of this practice. Unless otherwise specified, requirements of this practice shall apply.

7. Records and Associated Documentation

7.1 Note and record the calibration readings, required by 6.1.2 in an appropriate calibration log. A pressure-sensitive label or tag that indicates the date the calibration was performed, and the identification of the individual performing the calibration, may be applied to the densitometer to verify the calibration reference check recorded in the calibration log.

7.2 An alternative calibration documentation system may be used provided the calibration traceability requirements identified in 7.1 can be satisfied and documented properly.

8. Periodic Verification

8.1 Periodic calibration verification checks using the procedure described in Section 6 should be performed at the beginning of each shift, after 8 h of continuous operation, or change of apertures, whichever occurs first.

8.1.1 If the verification reading is within ±0.05 of the density values recorded in the calibration log required by 7.1, the densitometer is ready for continued use. It is not necessary to record density values when they are within the acceptable tolerance. If the density values are not within the tolerance, recalibration is required and it shall be performed in accordance with Section 6.

8.1.2 If the calibration verification check shows a variation greater than ±0.05, then all radiographs examined since the last acceptable daily density check should be subject to a reverification for density after the densitometer has been recalibrated.

8.2 Consult the Manufacturer's Technical Manual for troubleshooting information.

9. Keywords

9.1 calibration; densitometer; density; periodic verification; radiographic film