Designation: D3483 – 14 (Reapproved 2022)

Standard Test Methods for Accumulated Deposition in a Steam Generator Tube[1]

This standard is issued under the fixed designation D3483; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods cover the determination of the weight per unit area of waterside deposits on heat-transfer surfaces of steam generator tubes. The following test methods are included:

	Sections
Test Method A—Mechanical removal by scraper or vibrating tool-removed deposit weight method	7 to 16
Test Method B—Chemical removal by solvent-tube weight loss method	17 to 27
Test Method C—Mechanical removal by glass-bead blasting-tube weight loss method	28 to 37

1.2 Test Method A is a procedure generally applicable to deposits ranging from 1 to 100 g/ft^2. The precision was determined in the collaborative study over the range of 16 to 76 g/ft^2. This procedure allows the discretionary selection of the area on the tube to be sampled. The removed deposit allows for further chemical analysis.

1.3 Test Method B is a procedure generally applicable to deposits ranging from 1 to 100 g/ft^2. The precision was determined in a collaborative study over the range of 28 to 73 g/ft^2. The procedure averages out the heavier and lighter deposited areas. The solvent solution produced allows for further chemical analysis.

1.4 Test Method C is a procedure generally applicable to deposits ranging from 1 to 100 g/ft^2. The precision was determined in a collaborative study over the range of 17 to 88 g/ft^2. The procedure averages out the heavier and lighter deposited areas. The removed deposit does not allow for further chemical analysis.

1.5 These test methods have been generally evaluated on the types of waterside deposits generally found on heat-transfer surfaces of steam generator tubes. It is the user's responsibility to ensure the validity of these test methods for other types of deposits or high temperature scale.

1.6 These methods are sometimes used for accumulated deposition in rifled steam generator tubes. Experience has shown that there is a significant difference in the deposition in the grooves and on the lands on some rifled steam generator tubes. The grooves have been shown to hold more deposit. Test Method B and Test Method C will average out this difference. In Method A the choice exists, either to choose to remove the deposition from the groove if it is visually determined to be more heavily deposited, or to remove equally over the grooves and lands. It is important that it be understood what choices were made and that the report reflect the choices made when using Test Method A on rifled steam generator tubes.

1.7 There are some steam generator tubes where it is apparent that half of the tube is exposed to the flame from the external appearance, this side is typically called the fireside or hot side. The other half of the tube is not exposed to the flame from the external appearance is typically called the casing side or cold side. These test methods also require that the tube be split in half, so the tube is generally split along these lines. On these tubes it is generally found that more internal deposition exists on the fireside or hot side. Some users of these methods will determine the deposition only on side where it appears visually that more deposition exists. Some users will determine the deposition on both sides and report the results separately and some will average the two results. It is important that the user of the data be aware of the choices made and that the report of the results be specific.

1.8 The values stated in either SI or inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.9 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.10 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

[1] These test methods are under the jurisdiction of ASTM Committee D19 on Water and are the direct responsibility of Subcommittee D19.03 on Sampling Water and Water-Formed Deposits, Analysis of Water for Power Generation and Process Use, On-Line Water Analysis, and Surveillance of Water.

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2. Referenced Documents

2.1 *ASTM Standards:*[2]

D887 Practices for Sampling Water-Formed Deposits

D1129 Terminology Relating to Water

D1193 Specification for Reagent Water

D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water

G1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens

2.2 *Other Documents:*

NACE Standard TM0199-99, Item No. 21236, Standard Test Method for Measuring Deposit Mass Loading ("Deposit Weight Density") Values for Boiler Tubes by the Glass-Bead-Blasting Technique[3]

NACE International Publication 7H100, Item No. 24206 Evaluation of Boiler Tube Deposit Mass Loading (Deposit Weight Density) Methodology[3]

3. Terminology

3.1 *Definitions*—For definitions of terms used in these test methods, refer to Terminology D1129.

4. Significance and Use

4.1 The weight per unit area measurement is an indication of the relative cleanliness or dirtiness of the boiler. It is used to determine the effectiveness of the boiler chemical treatment program and to determine the need for chemically cleaning the boiler systems. Allowing the internal deposition to accumulate unchecked will likely lead to boiler tube failures by mechanisms of under deposit corrosion and tube metal overheating.

5. Reagents and Materials

5.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all regents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society.[4] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Specification D1193, Type 4.

6. Sampling

6.1 Select a tube section likely to have the heaviest deposit. Experience has shown that deposit accumulation is usually heaviest on tube surfaces that receive the highest heat transfer. Representative areas of especially high heat transfer are:

6.1.1 The center of the division wall at the top burner elevation in a boiler with a division panel wall where firing occurs on opposite sides.

6.1.2 The side wall near the top burner elevation, at about ⅓ furnace depth from the burner wall, in a boiler without a division wall.

6.1.3 Other high heat transfer areas in a more complex boiler design as indicated by the boiler manufacturer.

6.2 Areas in the boiler where impaired circulation is suspected may also be sampled.

6.3 The optimal tube removal method is by dry cutting. No oil or water is to be used in the tube cutting process. The length of sample should be 24 to 36 in., but allow an extra 12 in. on each end if the sample is cut out by torch.

6.4 After the tube sample is removed, provide suitable identification, showing location in the boiler, orientation of tube, and the hot and cold sides of the tube in accordance with Practices D887.

TEST METHOD A—MECHANICAL REMOVAL BY SCRAPER OR VIBRATING TOOL

7. Scope

7.1 This test method covers the determination of accumulated deposition in a steam generator tube by the mechanical removal of the deposit by scraper or vibrating tool, the collection and weighing of the dry deposit. This collected deposit is then available for further chemical analysis, if desired. The method also allows for discretionary removal of the deposit from the tube in areas of the most interest.

8. Summary of Test Method

8.1 The tube is split and the area to be tested is determined after examination; usually the area judged to be most heavily deposited. The deposits are removed mechanically by scraping or vibrating from a measured area. The collected deposit is weighed and the result is usually reported as grams of deposit per square foot of boiler tube surface.

9. Interferences

9.1 There are no interferences, only errors in collecting the deposit, removing sufficient deposit, not removing base metal, determination of the sample weight and the sampled area.

10. Apparatus

10.1 *Cutting Tool or Torch,* for removing a suitable portion of the boiler tube.

10.2 *Tube Cutter.*

10.3 *Tube End Sealers,* to protect the sample until the determination can be made.

10.4 *Milling Machine or Band Saw,* to separate the tube into halves by longitudinal sectioning (dry cut).

10.5 *Magnet,* to remove cutting metal chips from the deposited material.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Association for Materials Protection and Performance (AMPP), 15835 Park Ten Place, Houston, TX 77084, https://www.ampp.org.

[4] *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.