



Designation: E 1953 – 02

Standard Practice for Description of Thermal Analysis Apparatus¹

This standard is issued under the fixed designation E 1953; 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 approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers generic descriptions of apparatus used for thermal analysis measurements and its purpose is to achieve uniformity in description of thermal analysis instrumentation throughout standard test methods. These descriptions should be incorporated into any test method where the thermal analysis instrumentation described herein is cited.

1.2 Each description contains quantifiable instrument performance requirements to be specified for each test method.

1.3 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 473 Terminology Relating to Thermal Analysis²

E 1142 Terminology Relating to Thermophysical Properties²

SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System²

3. Terminology

3.1 Technical terms used in this document are found in Terminologies E 473 and E 1142 and Practice SI 10.

4. Significance and Use

4.1 Section 5 identifies essential instrumentation and accessories required to perform thermal analysis for a variety of different instruments. The appropriate generic instrument description should be included in any test method describing use or application of the thermal analysis instrumentation described herein.

4.2 Units included in these descriptions are used to identify needed performance criteria and are considered typical. Other units may be used when including these descriptions in a specific test method. Items underlined constitute required

inputs specifically established for each test method (for example, sensitivity of temperature sensor).

4.3 Additional components and accessories may be added as needed, with the appropriate performance requirements specified. Items listed in these descriptions but not used in a test method (for example, vacuum system) may be deleted.

5. Apparatus

5.1 *Differential Scanning Calorimeter (DSC)*—The essential instrumentation required to provide the minimum differential scanning calorimetric capability for this method includes:

5.1.1 *DSC Test Chamber* composed of:

5.1.1.1 A furnace(s) to provide uniform controlled heating or cooling of a specimen and reference to a constant temperature or at a constant rate within the applicable temperature range of this method.

5.1.1.2 A temperature sensor to provide an indication of the specimen temperature to \pm _____ K.

5.1.1.3 Differential sensors to detect a heat flow (power) difference between the specimen and reference with a range of _____ mW and a sensitivity of \pm _____ μ W.

5.1.1.4 A means of sustaining a *test chamber environment* of _____ at a purge rate of mL/min \pm _____ mL/min.

NOTE 1—Typically, _____ % pure nitrogen, argon, or helium is employed when oxidation in air is a concern. Unless effects of moisture are to be studied, use of dry purge gas is recommended and is essential for operation at subambient temperatures.

5.1.2 A *temperature controller*, capable of executing a specific temperature program by operating the furnace(s) between selected temperature limits at a rate of temperature change of _____ K/min constant to \pm _____ K/min (list cooling requirements separately if different) or at an isothermal temperature constant to \pm _____ K.

5.1.3 A *recording device*, capable of recording and displaying on the Y-axis any fraction of the heat flow signal (DSC curve) including the signal noise as a function of any fraction of the temperature (or time) signal on the X-axis including the signal noise.

5.1.4 *Containers* (pans, crucibles, vials, lids, closures, seals, etc.) that are inert to the specimen and reference materials and that are of suitable structural shape and integrity to contain the specimen and reference in accordance with the specific requirements of this test method including:

¹ This practice is under the jurisdiction of Committee E37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.01 on Test Methods and Recommended Practices.

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² *Annual Book of ASTM Standards*, Vol 14.02.