



Standard Test Method for Determining the Combustion Behavior of Metallic Materials in Oxygen-Enriched Atmospheres¹

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1. Scope

1.1 This test method covers a test apparatus and technique to determine the minimum test gas pressure that supports self-sustained combustion (the threshold pressure) and the average regression rate (apparent burn rate) of a standardized sample of a metallic material that has been ignited using a strong promoter.

1.2 The data obtained from this test method are dependent on the precise test sample configuration and provide a basis for comparing the combustion behavior of materials. No criteria are implied for relating these data to the suitability of a material's use in any actual system. The application of data obtained from this test method is discussed in Guides G 88 and G 94.

1.3 Requirements for an apparatus suitable for this test method are given, as well as an example of such an apparatus. The example, however, is not required to be used.

1.4 This test method is for gaseous oxygen or any mixture of oxygen with diluents that will support combustion, at any pressure within the capabilities of the apparatus.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *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.* Specific hazards statements are given in Section 9.

2. Referenced Documents

2.1 ASTM Standards:

G 88 Guide for Designing Systems for Oxygen Service²

G 93 Practice for Cleaning Methods for Material and Equipment Used in Oxygen-Enriched Environments²

G 94 Guide for Evaluating Metals for Oxygen Service²

TABLE 1 Example Data Set for Type 316 Stainless Steel^A

Material	Pressure, MPa	Number of Samples	
		Partial Burn	Complete Burn
UNS 31600	1.75	10	0
	3.45	8	2
	6.90	0	10

^A These data were produced at NASA White Sands Test Facility, New Mexico, 88004

2.2 Federal Specification:

BB-0-925 Oxygen, Technical, Gas and Liquid³

2.3 Military Standard:

MIL-0-27210E Amendment 1—Oxygen, Aviator's Breathing, Liquid and Gas³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *average regression rate (apparent burn rate)*—the average rate at which the burning/solid-metal interface advances along the test sample length.

3.1.2 *igniter*—a material to ignite the promoter that can burn under an electrical influence, such as a small-diameter wire.

3.1.3 *promoter*—a material that can add supplemental heat and increase the temperature to start combustion of the material being tested.

3.1.4 *self-sustained combustion*—combustion that consumes a sample to the point at which the sample holder affects further combustion (assuming sufficient oxygen).

3.1.5 *threshold pressure*—the minimum gas pressure (at a specified oxygen concentration and ambient temperature) that supports self-sustained combustion of the entire standard sample.

4. Summary of Test Method

4.1 A small rod of the material is suspended in a chamber filled with pressurized test gas. The chamber contains sufficient oxygen so that not more than 10 % of the oxygen will be consumed when the material combusts completely. A promoter (typically aluminum or magnesium) applied to the bottom of the rod starts combustion of the material. The test pressure is

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

³ Available from Standardization Documents Order Desk, Bldg 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.