Designation: D8211 – 18

Standard Test Method for Hot Surface Ignition Temperature of Gases on Flat Surface[1]

This standard is issued under the fixed designation D8211; 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 This test method covers a means for the discrimination between gases, which will ignite or not ignite when impinged on a hot surface when that surface is heated to 800 °C ± 5 °C (1472 °F) for a period of 2 min in a non-confined environment.

1.2 This test method may be applied to any non-pyrophoric substance that is a gas or liquefied gas at ambient temperature and pressure.

1.3 This test method should be used subject to the limitations that no single fire hazard property such as flash point, auto-ignition temperature (AIT), or the performance under the conditions of the present method shall be used to describe or appraise the fire hazard or fire risk of a material, product, assembly, or system under actual fire conditions. Fire hazard properties measured under controlled laboratory conditions may nevertheless be employed to describe properly the response of materials, products, assemblies, or systems under said controlled conditions. Properties measured under controlled laboratory conditions may be used as elements of hazard or risk assessment only when such assessments takes into account all of the factors that are pertinent to the evolution of the fire hazard of a given situation.

1.4 This standard is used to provide a quantitative measure of a gas's or liquefied gas's realistic surface ignition temperature in a non-quiescent environment.

1.5 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 9.

1.7 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E659 Test Method for Autoignition Temperature of Chemicals

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *auto ignition temperature (AIT), n*—the lowest temperature at which a substance spontaneously ignites in normal atmosphere without an external source of ignition.

3.1.2 *camera, n*—capable of recording at least 30 frames per second.

3.1.3 *chimney, n*—a quartz cylinder tube with the following dimensions: length: 229 mm ± 10 mm (9.02 in. ± 0.39 in.); inner dimension: 70 mm ± 5 mm (2.76 in. ± 0.2 in.).

3.1.4 *environmental chamber, n*—a chamber capable of providing a draft-free environment during testing and able to provide ventilation after testing is completed; the chamber needs to be able to completely remove the test substance and any potential substance decomposition products after testing has completed.

3.1.5 *gap height, n*—the height of the chimney above the insulation and planchet shall be 4 mm.

3.1.6 *heating element, n*—a unit that is capable of heating a surface in contact with the planchet up to temperatures of at least 800 °C ± 5 °C (1472 °F).

3.1.7 *hot surface ignition temperature (HSIT), n*—the lowest temperature at which a substance ignites in normal atmosphere when impinged upon a heated surface.

3.1.8 *ignition, n—for the purposes of this test method*, ignition shall be defined as any visible flame on or directly above the planchet, including the length of the chimney,

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[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.

generated either initially or up to 2 min after the substance is impinged on the planchet.

3.1.8.1 *Discussion*—If no flames are visible within the 2 min span, the test shall be deemed to have no ignition at the temperature tested. Any visible flame outside of the testing chimney shall not be deemed an ignition but shall require a retest at the same conditions until a definitive ignition/non-ignition is determined.

3.1.9 *insulation, n*—ceramic non-RCF insulation board with a minimum density of 0.3665 g/cm^3 (0.01324 lb/in.^{3}).

3.1.9.1 *Discussion*—Insulation board shall have a minimum thickness of 8 mm ± 0.5 mm (0.315 in. ± 0.02 in.) with a hole cut out in the center to allow room for the planchet. The planchet should fit tight within the opening, but should also fit such that all portions of the bottom of the planchet evenly make contact with the heating element.

3.1.10 *lower flammability limit (LFL), n*—the minimum concentration in air of a substance that is capable of propagating a flame through a homogenous mixture of the substance and air under specified test conditions.

3.1.11 *planchet, n*—a flat 316 stainless steel tapered disc having a top section diameter of: 50.8 mm ± 1.0 mm (2 in. ± 0.039 in.) and a height of 8.0 mm ± 0.5 mm (0.315 in. ± 0.02 in.).

3.1.11.1 *Discussion*—The bottom section has a diameter of: 63.5 mm ± 1.0 mm (2.5 in. ± 0.039 in.), with a height of 4.7 mm ± 0.5 mm (0.19 in. ± 0.02 in.).

3.1.12 *scale, n*—method of weighing amount of substance that is released onto the hot surface.

3.1.13 *spray nozzle, n*—a 0.3175 cm (0.125 in.) stainless steel cylindrical tubing with an opening at the release end.

3.1.13.1 *Discussion*—The tip of the spray nozzle shall have a 45° angle. The tubing shall be 152 mm ± 5 mm (5.98 in. ± 0.2 in.) in length. The outside diameter of the tubing shall be 3.2 mm ± 0.2 mm (0.125 in. ± 0.007 in.) with in inside diameter of 1.6 mm ± 0.1 mm (0.06 in. ± 0.003 in.).

3.1.14 *substance, n*—any gas or liquefied gas at ambient pressure and temperature being tested in this standard.

3.1.15 *thermocouple, n*—two K type thermocouples are connected to the hot plate to record the surface temperature.

3.1.16 *upper flammability limit (UFL), n*—the maximum concentration in air of a substance that is capable of propagating a flame through a homogenous mixture of the substance and air under specified test conditions.

4. Summary of Test Method

4.1 With no external ventilation or fan operating, 5 g of the substance is released from the spray nozzle onto a planchet heated to 800 °C ± 5 °C. The environmental chamber containing the test equipment should be quiescent with the exception of the convection effect from the planchet.

4.2 Ignitions are observed during the initial surface impingement of the substance and during the 2 min following release of the substance in the event any ignition occurs post impingement.

5. Significance and Use

5.1 The autoignition temperature (AIT) of a gas mixture is the minimum temperature at which a gas mixture spontaneously ignites without an external ignition source. AIT is typically determined at atmospheric pressure, using small test vessels open to the atmosphere where gas is quickly injected into the test vessel and heated for a pre-determined time observing ignition or non-ignition (Test Method E659). AIT is often not directly applicable to real world conditions. Therefore, there is need for a test that determines if a gas or liquefied gas ignites or does not ignite when released onto a hot surface in a more unconstrained environment.

6. Interferences

6.1 *Air Velocity*—External air movement in the vicinity of the planchet can skew the results.

6.2 *Planchet Fouling*—The planchet can be fouled such that there are highs and lows on the surface from repeated refrigerant releases which can create localized hot spots on the surface, which can skew the results. If the operator feels excessive fouling may be affecting test results, the planchet may be cleaned by running 60 to 100 grit sandpaper, or another fine coarse media, over the surface of the planchet until all fouling is removed.

7. Apparatus

7.1 A diagram of the test apparatus is shown in Fig. 1.

7.2 Testing is to be performed in a standard laboratory fume hood or environmental chamber that has ventilation capability. Since testing is performed without ventilation, the chamber needs to be able to deactivate ventilation during testing.

7.3 The heated surface providing temperature to the planchet is generically described in this standard to allow the researcher flexibility in design options. The heated surface shown below is only an example and the design may be used at the researcher's discretion.

7.4 The chimney shall be elevated at a height of 4 mm over the top surface of the insulation and planchet. The top of the planchet shall be flush with the top of the insulation. Care should be taken when selecting insulation such that the insulation does not swell or expand once the test is at temperature, thus reducing the gap between the chimney and the insulation.

7.5 The chimney shall be placed such that the planchet is directly in the center of the chimney.

7.6 The tip of the spray system line shall be placed 38 mm ± 13 mm above the hot plate and shall point at the center of the planchet with a tolerance of ±15 mm. The distance from the end of the tube to the plate shall be kept constant for all testing. The spray system line shall be held in place by a mechanical system, such as clamps, such that the spray line does not move when the substance being tested is discharged.

7.7 Type K thermocouples are attached directly to the top of the planchet. The thermocouple may be attached by either direct wielding to the planchet or by mechanical connection such as being compressed between a screw and the surface of