Designation: D235 – 02 (Reapproved 2012)

Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)[1]

This standard is issued under the fixed designation D235; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers four types of hydrocarbon solvents, normally petroleum distillates, used primarily in the coatings and dry-cleaning industries. "Mineral spirits" is the most common name for these solvents. They are also called "Stoddard Solvents" when used for dry cleaning.

1.2 For specific hazard information and guidance, see the supplier's Material Safety Data Sheet for materials listed in this specification.

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

1.4 The following applies to all specified limits in this standard; for purposes of determining conformance with this standard, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the rounding-off method of Practice E29.

1.5 The following hazard caveat pertains only to the test method portion, 6.1.10, of this specification. *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:*[2]

D56 Test Method for Flash Point by Tag Closed Cup Tester
D86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure
D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
D156 Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
D268 Guide for Sampling and Testing Volatile Solvents and Chemical Intermediates for Use in Paint and Related Coatings and Material
D1133 Test Method for Kauri-Butanol Value of Hydrocarbon Solvents
D1159 Test Method for Bromine Numbers of Petroleum Distillates and Commercial Aliphatic Olefins by Electrometric Titration
D1209 Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)
D1296 Test Method for Odor of Volatile Solvents and Diluents
D2710 Test Method for Bromine Index of Petroleum Hydrocarbons by Electrometric Titration
D3227 Test Method for (Thiol Mercaptan) Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method)
D3257 Test Methods for Aromatics in Mineral Spirits by Gas Chromatography
D3278 Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E300 Practice for Sampling Industrial Chemicals

2.2 *U.S. Federal Specification:*

PPP-C-2020 Chemical, Liquid, Dry, and Paste: Packaging of[3]

3. Classification

3.1 Mineral spirits shall be of the following types as specified:

3.1.1 *Type I*—Full Range.

[1] This specification is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.35 on Solvents, Plasticizers, and Chemical Intermediates.

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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.

[3] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

***A Summary of Changes section appears at the end of this standard**

3.1.2 *Type II*—High Flash Point.
3.1.3 *Type III*—Odorless.
3.1.4 *Type IV*—Low Dry Point.

3.2 Mineral spirits types may be further differentiated based on aromatics content as follows:
3.2.1 *Class A*—8 to 22 vol % aromatics.
3.2.2 *Class B*—2 to 8 max vol % aromatics.
3.2.3 *Class C*—less than 2 vol % aromatics.

4. Properties

4.1 The physical and chemical properties of the different types and classes of mineral spirits shall conform to the requirements specified in Table 1.

5. Sampling

5.1 The material shall be sampled in accordance with Practice E300.

6. Test Methods

6.1 The properties enumerated in this specification shall be determined in accordance with the following ASTM test methods:

6.1.1 *Bromine Number*—Test Method D1159. Bromine number is expressed as *g* bromine reacted per 100-g sample. For products having low olefin contents, Bromine Index (mg bromine reacted per 100-g sample) by Test Method D2710 may be used.

TABLE 1 Physical and Chemical Properties of Mineral Spirits

	Type I Full Range Mineral Spirits			Type II High Flash Point		
	Class A	Class B[A]	Class C[A]	Class A	Class B[A]	Class C[A]
Aromatic Content, range, vol %	8–22	2–8 max	0–2	8–22	2–8 max	0–2
Commercial reference	regular	rule 66	low aromatic	regular	rule 66	low aromatic
Appearance	clear and free of suspended matter when observed at 60–78°F					
Flash point, °C (°F), min	38 (100)	38 (100)	38 (100)	61 (142)	61 (142)	61 (142)
Color, min	not darker than + 25 on Saybolt Scale or 25 on Pt-Co Scale					
Kauri-Butanol value,						
min	34	29	28	33	29	28
max	43	40	39	43	40	39
Bromine Number, max	5	1	0.1	5	1	0.1
Odor[B]	characteristic, as agreed between purchaser and supplier					
Doctor test	negative					
Distillation, °C (°F)						
Initial boiling point, min	149 (300)	149 (300)	149 (300)	177 (350)	177 (350)	177 (350)
50 % Recovered, max	185 (365)	185 (365)	185 (365)	202 (395)	202 (395)	202 (395)
Dry point, max	213 (415)	213 (415)	213 (415)	213 (415)	213 (415)	213 (415)
Residue from distillation:						
Vol %, max	1.5					
Acidity	neutral					
Copper corrosion, max rating	2A					
Apparent Specific Gravity						
15.6/15.6°C (60/60°F)						
min	0.754	0.754	0.754	0.768	0.768	0.768
max	0.820	0.810	0.800	0.820	0.810	0.810

Type III Odorless[C]			Type IV Low Dry Point		
	Class C-1[A]	Class C-2[A]	Class A	Class B[A]	Class C[A]
Aromatic Content, range, vol %	0–0.25	0–0.25	8–22	2–8 max	0–2
Commercial Reference	odorless	odorless	regular	rule 66	low aromatic
Appearance	clear and free of suspended matter when observed at 60–78°F				
Flash Point, °C (°F), min	38 (100)	38 (100)	38 (100)	38 (100)	38 (100)
Color, min	not darker than + 25 on Saybolt Scale or 25 on Pt-Co Scale				
Kauri-Butanol value,					
min	...	...	34	29	28
max	29	29	43	41	40
Bromine Number, max	0.1	5	5	1	0.1
Odor[B]	characteristic as agreed between purchaser and supplier				
Doctor Test	negative				
Distillation, °C (°F)					
Initial boiling point, min	149 (300)	149 (300)	149 (300)	149 (300)	149 (300)
50 % Recovered, max	196 (385)	196 (385)	174 (345)	174 (345)	174 (345)
Dry point, max	213 (415)	213 (415)	185 (365)	185 (365)	185 (365)
Residue from distillation					
Vol% , max	1.5				
Acidity	neutral				
Copper Corrosion, max rating	2A				
Apparent Specific Gravity					
15.6/15.6°C (60/60°F)					
min	0.740	0.740	0.754	0.754	0.754
max	0.775	0.775	0.810	0.800	0.790

[A] Mineral Spirits of Types I, II, III, and IV may be commercially available as Classes B and C to meet certain air pollution regulations (for example, "Rule 66") which set maximum limits on certain constituents as follows: toluene and ethylbenzene 20 vol %, C_8 and higher aromatics 8 vol %, olefins 5 vol %; the sum of all restricted constituents not to exceed 20 vol %.
[B] Optional: Test for odor only when agreed as necessary by purchaser and supplier.
[C] Only products that have a very high isoparaffinic hydrocarbon content, that is, approaching 100 %, are considered to fit the odorless category. Type III Class C-1 is hydrogenated product; Class C-2 is a distillation fraction.

6.1.2 *Color*—Test Method D156 or Test Method D1209. In case of dispute, Test Method D156 shall be the referee method.

6.1.3 *Corrosion*—Test Method D130. Perform test under the prescribed conditions for 3 h at 100°C.

6.1.4 *Distillation*—Test Method D86.

6.1.5 *Flash Point*—Test Method D56 or Test Methods D3278. In case of dispute, Test Method D56 shall be the referee method.

6.1.6 *Kauri-Butanol Value*—Test Method D1133.

6.1.7 *Odor*—Test Method D1296. Samples of particular types of products being tested, having odor characteristics satisfactory to consumer and producer, are to be used as reference standards for comparison.

6.1.8 *Mercaptan Sulfur*—Test Method D3227.

6.1.9 *Apparent Specific Gravity*—Determine the apparent specific gravity by any convenient method that is accurate to the third decimal place, the temperature of both specimen and water being 15.6°C. See Guide D268.

6.1.10 *Doctor Test:*

6.1.10.1 *Preparation of Doctor (Sodium Plumbite) Solution*—Dissolve approximately 125 g of sodium hydroxide (NaOH) in 1 L of reagent water. Add 60 g of lead monoxide (PbO) and shake vigorously for 15 min., or let stand with occasional shakings for at least a day. Allow to settle and decant or siphon off the clear liquid. If the solution does not settle clear, filter it through filter paper. Keep the solution in a tightly corked bottle and refilter before use if not perfectly clear.

6.1.10.2 *Procedure*—Shake vigorously together in a test tube 10 mL of the solvent being tested and 5 mL of sodium plumbite solution for about 15 s. Add a small amount of pure, dry flowers of sulfur so that practically all of it floats on the interface between the solvent and the sodium plumbite solution after shaking. Again shake for 15 s, allow to settle and observe within 2 min.

6.1.10.3 *Interpretation of Results*—If the solvent is discolored or if the yellow color of the sulfur film is noticeably masked, consider the test positive and the solvent as "sour." If the sample remains unchanged in color and the sulfur film is bright yellow or only slightly discolored with gray or flecked with black, consider the test negative and the solvent as "sweet."

6.1.10.4 If the doctor test result is positive, mercaptan content may be determined using Test Method D3227 and reported.

6.1.11 *Aromatics*—Test Methods D3257.

7. Packaging and Package Marking

7.1 Package size shall be agreed upon by the purchaser and the supplier.

7.2 Packaging shall conform to applicable carrier rules and regulations or when specified shall conform to Fed. Spec. PPP-C-2020.

8. Keywords

8.1 Doctor test; hydrocarbon dry cleaning solvents; mineral spirits; solvents; Stoddard Solvent

SUMMARY OF CHANGES

Committee D01.3 has identified the location of selected changes to this standard since the last issue (D235 – 02) that may impact the use of this standard. (Approved June 1, 2007.)

(1) Added SI units to the Scope section.

(2) Reversed values in Table 1 to show SI units first.