



# Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)<sup>1</sup>

This standard is issued under the fixed designation D 235; 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 ( $\epsilon$ ) 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 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:

- D 56 Test Method for Flash Point by Tag Closed Tester<sup>2</sup>
- D 86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure<sup>2</sup>
- D 130 Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test<sup>2</sup>
- D 156 Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)<sup>2</sup>
- D 268 Guide for Sampling and Testing Volatile Solvents and Chemical Intermediates for Use in Paint and Related Coatings and Materials<sup>3</sup>
- D 1133 Test Method for Kauri-Butanol Value of Hydrocarbon Solvents<sup>3</sup>
- D 1159 Test Method for Bromine Number of Petroleum Distillates and Commercial Aliphatic Olefins by Electrometric Titration<sup>2</sup>
- D 1209 Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)<sup>3</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-1 on Paints 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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<sup>2</sup> Annual Book of ASTM Standards, Vol 05.01.

<sup>3</sup> Annual Book of ASTM Standards, Vol 06.04.

D 1296 Test Method for Odor of Volatile Solvents and Diluents<sup>3</sup>

D 2710 Test Method for Bromine Index of Petroleum Hydrocarbons by Electrometric Titration<sup>4</sup>

D 3227 Test Method for Mercaptan Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method)<sup>4</sup>

D 3257 Test Method for Aromatics in Mineral Spirits by Gas Chromatography<sup>3</sup>

D 3278 Test Method for Flash Point of Liquids by Small Scale Closed-Cup Apparatus<sup>5</sup>

E 300 Practice for Sampling Industrial Chemicals<sup>6</sup>

2.2 U.S. Federal Specification:

PPP-C-2020 Chemical, Liquid, Dry, and Paste: Packaging of<sup>7</sup>

## 3. Classification

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

3.1.1 *Type I*—Full Range.

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 E 300.

<sup>4</sup> Annual Book of ASTM Standards, Vol 05.02.

<sup>5</sup> Annual Book of ASTM Standards, Vol 06.01.

<sup>6</sup> Annual Book of ASTM Standards, Vol 15.05.

<sup>7</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

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

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**TABLE 1 Physical and Chemical Properties of Mineral Spirits**

	Type I Full Range Mineral Spirits			I	Type II High Flash Point		
	Class A	Class B <sup>A</sup>	Class C <sup>A</sup>		Class A	Class B <sup>A</sup>	Class C <sup>A</sup>
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, °F (°C), min	100 (38)	100 (38)	100 (38)		142 (61)	142 (61)	142 (61)
Color, min	not darker than + 25 on Saybolt Scale or 25 on Pt-Co Scale						
Kauri-Butanol value,							
min	29	29	28		29	29	28
max	45	45	40		45	45	40
Bromine Number, max	5	1	0.1		5	1	0.1
Odor <sup>B</sup>	characteristic, as agreed between purchaser and supplier						
Doctor test	negative						
Distillation, °F (°C)							
Initial boiling point, min	300 (149)	300 (149)	300 (149)		350 (177)	350 (177)	350 (177)
50 % Recovered, max	360 (182)	360 (182)	360 (182)		390 (199)	390 (199)	390 (199)
Dry point, max	415 (213)	415 (213)	415 (213)		415 (213)	415 (213)	415 (213)
Residue from distillation:							
Vol %, max				1.5			
Acidity				neutral			
Copper corrosion, max rating				2A			
Apparent Specific Gravity 60/60°F (15.6/15.6°C)							
min	0.754	0.754	0.754		0.768	0.768	0.768
max	0.820	10.810	0.800		0.820	0.810	0.810
	Type III Odorless <sup>C</sup>		I	Type IV Low Dry Point			
	Class C-1 <sup>A</sup>	Class C-2 <sup>A</sup>		Class A	Class B <sup>A</sup>	Class C <sup>A</sup>	
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, °F (°C), min	100 (38)	100 (38)		100 (38)	100 (38)	100 (38)	
Color, min	not darker than + 25 on Saybolt Scale or 25 on Pt-Co Scale						
Kauri-Butanol value,							
min	...	...		29	29	28	
max	29	29		45	45	40	
Bromine Number, max	0.1	5		5	1	0.1	
Odor <sup>B</sup>	characteristic as agreed between purchaser and supplier						
Doctor Test	negative						
Distillation, °F (°C)							
Initial boiling point, min	300 (149)	300 (149)		300 (149)	300 (149)	300 (149)	
50 % Recovered, max	385 (196)	385 (196)		345 (174)	345 (174)	345 (174)	
Dry point, max	415 (213)	415 (213)		365 (185)	365 (185)	365 (185)	
Residue from distillation							
Vol% , max				1.5			
Acidity				neutral			
Copper Corrosion, max rating				2A			
Apparent Specific Gravity 60/60°F (15.6/15.6°C)							
min	0.740	0.740		0.754	0.754	0.754	
max	0.775	0.775		0.810	0.800	0.790	

<sup>A</sup> 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<sub>8</sub> and higher aromatics 8 vol %, olefins 5 vol %; the sum of all restricted constituents not to exceed 20 vol %.

<sup>B</sup> Optional: Test for odor only when agreed as necessary by purchaser and supplier.

<sup>C</sup> 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. 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 D 1159. 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 D 2710 may be used.

6.1.2 *Color*—Test Method D 156 or Test Method D 1209. In case of dispute, Test Method D 156 shall be the referee method.

6.1.3 *Corrosion*—Test Method D 130. Perform test under the prescribed conditions for 3 h at 100°C.

6.1.4 *Distillation*—Test Method D 86.

6.1.5 *Flash Point*—Test Method D 56 or Test Method D 3278. In case of dispute, Test Method D 56 shall be the referee method.

6.1.6 *Kauri-Butanol Value*—Test Method D 1133.

6.1.7 *Odor*—Test Method D 1296. 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 D 3227.

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

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water being 15.6°C. See Guide D 268.

**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 D 3227 and reported.

**6.1.11 Aromatics**—Test Method D 3257.

**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 D-1 has identified the location of selected changes to this standard since the last date of issue that may impact the use of this standard.

(1) Added Test Method D 2710, Test Method for Bromine Index, to Referenced Documents section.

(2) Under Test Methods, 6.1.1 *Bromine Number*, added Test Method D 2710 Bromine Index, as an optional test method that may be used for products having low olefin contents. Defined units of bromine number and bromine index.

(3) In Table 1, changed maximum apparent specific gravity of Type II Class C from 0.800 to 0.810 to reflect current commercial products.

(4) In Table 1, Type III Odorless, changed current Class C to Class C-1, and added Class C-2 (which has much higher olefin content and bromine number) to distinguish it from Class C-1 products. Class C-2 has a bromine number of 5 max.

(5) In Table 1 Footnote<sup>C</sup>, indicated that Type III Class C-1 is hydrogenated product; Class C-2 is a distillation fraction.

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