



Designation: D 5363 – 03

Standard Specification for Anaerobic Single-Component Adhesives (AN)¹

This standard is issued under the fixed designation D 5363; 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 specification covers single-component anaerobic adhesives suitable for locking, sealing, and retaining threaded or cylindrical assemblies. The adhesives are cured to a solid state when confined between closely fitting active metal surfaces.

1.2 This specification is intended to be a means of classifying anaerobic adhesives. It is not intended for engineering design purposes.

1.3 This specification is intended to replace Military Specifications MIL-S-22473, MIL-S-46163, and MIL-R-46082.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 The following safety hazards caveat pertains only to the test methods portion, Section 7, 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

- A 109/A 109M Specification for Steel, Strip, Carbon, (0.25 Maximum Percent) Cold-Rolled
- B 36/B 36M Specification for Brass Plate, Sheet, Strip, and Rolled Bar
- B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- B 633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- D 56 Test Method for Flash Point by Tag Closed Tester
- D 439 Specification for Automotive Gasoline³
- D 445 Test Method for Kinematic Viscosity of Transparent

and Opaque Liquids (and the Calculation of Dynamic Viscosity)

- D 770 Specification for Isopropyl Alcohol
- D 907 Terminology of Adhesives
- D 1084 Test Methods for Viscosity of Adhesives
- D 1193 Specification for Reagent Water
- D 2693 Specification for Ethylene Glycol
- D 3951 Practice for Commercial Packaging
- D 4562 Test Method for Shear Strength of Adhesives Using Pin-and-Collar Specimen
- D 4800 Guide for Classifying and Specifying Adhesives
- D 5648 Test Method for Torque-Tension Relationship of Adhesives Used on Threaded Fasteners (Lubricity)
- D 5649 Test Method for Torque Strength of Adhesives Used on Threaded Fasteners
- D 5657 Test Method for Fluid Tightness Ability of Adhesives Used on Threaded Fasteners
- E 122 Practice for Calculating Sample Size to Estimate, With a Specified Tolerable Error, the Average for a Characteristic of a Lot or Process

2.2 Military Standards:

- MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes⁴
- MIL-STD-129 Marking for Shipment and Storage⁴
- MIL-STD-810 Environmental Test Methods and Engineering Guides⁴
- MIL-STD-118 Commercial Packaging of Supplies and Equipment⁴

2.3 Federal Standards:

- FED-STD-313 Material Safety Data Sheets, Preparation and Submission of⁴

2.4 Federal Specifications:

- FF-N-836 Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat⁴
- PPP-B-636 Box, Shipping, Fiberboard⁴
- QQ-P-416 Plating, Cadmium, Electrodeposited⁴

2.5 Military Specifications:

- MIL-R-46082 Retaining Compounds, Single-Component, Anaerobic⁴
- MIL-S-22473 Sealing, Locking, Retaining Compounds; Single-Component⁴

¹ This specification is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.60 on Adhesive Material Classification System.

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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 Withdrawn.

⁴ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

MIL-S-46163 Sealing, Lubricating, and Wicking Compounds: Thread-Locking, Anaerobic, Single-Component⁴
 MIL-T-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5⁴

2.6 U.S. Department of Transportation (DOT):
Code of Federal Regulations, Parts 100 to 199, Department of Transportation Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles⁵

2.7 Society of Automotive Engineers:
 SAE J311 Fluid for Passenger Care Type Automatic Transmissions, Information Report⁶
 SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners⁶
 SAE AMS 2629 Jet Reference Fuel⁶

3. Terminology

3.1 *Definitions*—Some terms in this specification are defined in Terminology D 907.

3.1.1 *active metal surface, n*—relative to anaerobic adhesives, a metal surface that initiates the formation of free radicals within anaerobic adhesives.

3.1.2 *anaerobic adhesive, n*—an adhesive that is kept in the uncured state by oxygen, as in air, and that cures in the absence of oxygen when exposed to metal ions, especially copper or iron.

3.1.3 *Newtonian behavior, n*—the property of a liquid in which its viscosity is constant over a stated range of strain rates. (Compare *non-Newtonian behavior*.)

3.1.4 *non-Newtonian behavior, n*—the property of a liquid in which its viscosity is not constant over a stated range of strain rates. (Compare *Newtonian behavior*.)

3.1.5 *thixotropy, n*—in a liquid, the property of thinning when subjected to strains greater than the yield strain and of rethickening with time upon subsequent rest.

3.1.5.1 *Discussion*—The liquid must exhibit yield to be thixotropic. If the liquid is deformed more than the yield strain, the underlying elastic network is disrupted and its viscosity is reduced. The network reestablishes itself in time when at rest.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *breakaway torque*—the initial torque required to break the bond, measured at the first movement between the nut and the bolt, when unscrewing an unseated assembly.

3.2.2 *prevailing torque, n*—the torque measured at 180° rotation of the nut.

3.2.2.1 *Discussion*—Prevailing torque was originally defined in MIL-S-46163 and MIL-S-22473 as the average of the four torques measured at 90, 180, 270, and 360° rotation of the nut. Studies have shown that the torque measured at 180° rotation of the nut is statistically equivalent to the average of the torque measured at the four ¼ turns. Since measuring the torque at the one angle of rotation is more efficient, prevailing

torque is most often defined as the torque measured at 180° rotation of the nut. However, for purposes of this specification, the definition of prevailing torque as the average of the four torques measured at 90, 180, 270, and 360° rotation of the nut is also acceptable.

4. Classification

4.1 Anaerobic adhesives are classified into groups in accordance with their performance properties. These groups are subdivided into classes and grades, as shown in Table AN.

NOTE 1—For example, the designation AN 0411 would indicate:

AN	=	anaerobic adhesive (from Guide D 4800),
04 (Group)	=	retaining compound,
1 (Class)	=	low strength, and
1 (Grade)	=	viscosity of 100–500 mPa.

5. Requirements

5.1 *General Requirements*—General requirements are properties that are inherent in every lot of adhesive produced, but may be tested in accordance with Table AN at a frequency agreed on by the purchaser and the manufacturer in order to verify specification conformance.

5.1.1 *Ultraviolet Fluorescence*—The uncured adhesive shall fluoresce under ultraviolet illumination when tested in accordance with 7.1.

5.1.2 *Color and Workmanship*—The color supplied shall be the color for the given group, class, and grade, as specified in Table AN. The uncured adhesive shall be smooth and homogeneous after shaking, free from lumps, caked material, and particles of foreign matter when examined in accordance with 7.2.

5.1.3 *Flash Point*—The uncured adhesive shall have a flash point above 93°C when tested in accordance with 7.3.

5.1.4 *Storage Stability*—The strength shall conform to the properties specified for the given class in Table AN. The viscosity shall increase no more than 50 % above the uppermost limit for the given grade in Table AN when tested in accordance with 7.12.

5.1.5 *Toxicity*—The supplier shall furnish a Material Safety Data Sheet (MSDS) in accordance with FED-STD-313 so that the user can evaluate the safety of the material for the proposed use.

5.1.6 *Solvent Resistance*—The average strength of each adhesive, after solvent immersion testing in accordance with 7.11, shall meet the requirements specified for the given class in Table AN.

5.1.7 *Hot Strength*—The average strength of each adhesive, after hot-strength testing in accordance with 7.8, shall meet the requirements specified for the given class in Table AN.

5.1.8 *Heat Aging*—The average strength of each adhesive, after heat-aging testing in accordance with 7.9, shall meet the requirements specified for the given class in Table AN.

5.1.9 *Cold Strength*—The average strength of each adhesive, after cold-strength testing in accordance with 7.10, shall meet the requirements specified for the given class in Table AN.

⁵ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

⁶ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

**TABLE AN Basic Properties—Anaerobic Adhesives
Group 1 Products**

Group	Description	Class	Description	Grade	Color (5.1.2)	Strength at Standard Conditions, Prevailing Torque Strength (5.2.3.1), N-m	Viscosity (5.2.1), mPa-s	Solvent Resistance (5.1.6), Prevailing Torque, N-m, min	Hot Strength (5.1.7), Prevailing Torque, N-m, min	Heat Aging (5.1.8), Prevailing Torque, N-m, min	Cold Strength (5.1.9), Prevailing Torque, N-m, min	Speed of Cure (5.2.2), Prevailing Torque, N-m, min		
01	Threadlocking and retaining adhesives; slow curing; Newtonian flow properties	1		1 0	green	17.0–42.4	10–25	17.0	10.2 ^A	8.5 ^A	17.0	8.5		
		2		1	red	11.3–28.2	10–25	11.3	6.8 ^A	5.6 ^A	11.3	5.6		
				2	orange	11.3–28.2	40–80	11.3	6.8 ^A	5.6 ^A	11.3	5.6		
				3	red	11.3–28.2	100–250	11.3	6.8 ^B	5.6 ^A	11.3	5.6		
				4	red	11.3–28.2	1000–10000	11.3	6.8 ^B	5.6 ^A	11.3	5.6		
		3		1 0	yellow	7.9–19.8	100–200	7.9	4.7 ^B	3.9 ^A	7.9	3.9		
				4		1	blue	4.5–11.3	10–25	4.5	2.7 ^A	2.3 ^A	4.5	2.3
						2	blue	4.5–11.3	100–250	4.5	2.7 ^B	2.3 ^A	4.5	2.3
		3 0	blue			4.5–11.3	1000–10000	4.5	2.7 ^A	2.3 ^A	4.5	2.3		
5		1	purple	2.3–5.6	10–25	2.3	1.3 ^A	1.1 ^A	2.3	1.1				
		2 0	purple	2.3–5.6	100–250	2.3	1.3 ^B	1.1 ^A	2.3	1.1				
6		1	brown	1.1–2.8	10–25	1.1	0.7 ^A	0.6 ^A	1.1	0.6				
		2	brown	1.1–2.8	100–250	1.1	0.7 ^B	0.6 ^A	1.1	0.6				
		3 0	brown	1.1–2.8	1000–10000	1.1	0.7 ^A	0.6 ^A	1.1	0.6				
7		1 0	yellow	0.8–1.5	100–250	0.8	0.4 ^A	0.4 ^A	0.8	0.4				
0	other	0												

TABLE AN Continued
Groups 2 and 3 Products

Group	Description	Class	Description	Grade	Color (5.1.2)	Strength at Standard Conditions, Torque Strength (5.2.3.1), N-m				Viscosity (5.2.1), mPa-s	Solvent Resistance (5.1.6), N-m, min		Hot Strength (5.1.7), N-m, min ^A	
						Steel		Plated			Steel		Steel	
						Break	Prevail	Break	Prevail		Break	Prevail	Break	Prevail
02	Threadlocking adhesives; fast curing; Newtonian flow properties	1		1 0	red	16.9–39.5	16.9–56.5	5.6–39.5	4.5–56.5	6000–8000	8.4	8.4	8.4	8.4 ^C
		2		1 0	red	16.9–39.5	16.9–56.5	4.5–39.5	4.5–56.5	400–600	8.4	8.4	8.4	8.4 ^A
		3		1 0	blue	11.3–22.6	5.6–17.0	3.4–22.6	2.3–22.6	110–150	5.6	2.8	5.6	2.8 ^C
		4	wicking	1 0	blue	2.3–11.3	2.3–11.3	1.1–11.3	1.1–11.3	10–30	1.1	1.1	1.1	1.1 ^C
		5	wicking	1 0	blue	2.3–11.3	11.3–22.6	1.7–22.6	1.7–22.6	10–30	1.1	5.6	1.1	5.6 ^C
		6	wicking	1 0	green	2.3–16.9	17.0–56.5	1.1–11.3	8.5–56.5	10–30	1.1	8.5	1.1	8.5 ^A
		0	other	0										
03	Threadlocking adhesives; fast curing; thixotropic flow properties; lubricating	1		1 0	purple	3.4–11.3	1.1–11.3	1.1–11.3	0.6–11.3	at 2 rpm ≥ 5000 at 20 rpm 800–1600	1.7	0.5	1.7	0.5 ^C
		2		1 0	blue	7.9–22.6	2.3–22.6	1.1–22.6	0.6–22.6	at 2 rpm ≥ 5000 at 20 rpm 800–1600	3.9	1.1	3.9	1.1 ^B
		3		1 0	red	11.3–28.2	11.3–33.9	5.6–28.2	5.6–28.2	at 2 rpm ≥ 5000 at 20 rpm 1200–2400	5.6	5.6	5.6	5.6 ^A
		0	other	0										

TABLE AN Continued
Groups 2 and 3 Products

Group	Description	Class	Description	Grade	Color (5.1.2)	Heat Aging (5.1.8), N-m, min ^A		Cold Strength (5.1.9), N-m, min		Speed of Cure (5.2.2), N-m, min	
						Steel		Steel		Steel	
						Break	Prevail	Break	Prevail	Break	Prevail
02	Threadlocking adhesives; fast curing; Newtonian flow properties	1		1 0	red	8.4	8.4 ^C	8.4	8.4	8.4	8.4
		2		1 0	red	8.4	8.4 ^A	8.4	8.4	8.4	8.4
		3		1 0	blue	5.6	2.8 ^C	5.6	2.8	5.6	2.8
		4	wicking	1 0	blue	1.1	1.1 ^C	1.1	1.1	1.1	1.1
		5	wicking	1 0	blue	1.1	5.6 ^C	1.1	5.6	1.1	5.6
		6	wicking	1 0	green	1.1	8.5 ^A	1.1	8.5	1.1	8.5
		0	other	0							
03	Threadlocking adhesives; fast curing; thixotropic flow properties; lubricating	1		1 0	purple	1.7	0.5 ^C	1.7	0.5	1.7	0.5
		2		1 0	blue	3.9	1.1 ^B	3.9	1.1	3.9	1.1
		3		1 0	red	5.6	5.6 ^A	5.6	5.6	5.6	5.6
		0	other	0							

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TABLE AN Continued
Group 4 Products

Group	Description	Class	Description	Grade	Color (5.1.2)	Strength at Standard Conditions, Shear Strength (5.2.3.2), ASTM D 4562 MPa, min	Viscosity (5.2.1), mPa·s	Solvent Resistance (5.1.6), MPa, min	Hot Strength (5.1.7), MPa, min	Heat Aging (5.1.8), MPa, min	Cold Strength (5.1.9), MPa, min	Speed of Cure (5.2.2), MPa, min
04	retaining adhesives	1		1	green	13.8	100–500	10.3	6.9 ^A	10.3 ^A	13.8	
				2	green	13.8	400–800	10.3	10.3 ^A	12.4 ^A	13.8	
				0								
		2		1	green	24.1	1500–2500	10.3	6.9 ^A	10.3 ^A	17.2	
				0								
		0	other	0								
00	other ^{B,C}	0	other	0								

^A Test temperature = 150°F.

^B Test temperature = 93°C.

^C Test temperature = 121°C.

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