Designation: D5363 – 16

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

This standard is issued under the fixed designation D5363; 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 U.S. Department of Defense.

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]

A109/A109M Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled

B36/B36M Specification for Brass Plate, Sheet, Strip, And Rolled Bar

B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate

B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel

D56 Test Method for Flash Point by Tag Closed Cup Tester

D439 Specification for Automotive Gasoline (Withdrawn 1990)[3]

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D770 Specification for Isopropyl Alcohol

D907 Terminology of Adhesives

D1084 Test Methods for Viscosity of Adhesives

D1193 Specification for Reagent Water

D2693 Specification for Ethylene Glycol

D3951 Practice for Commercial Packaging

D4562 Test Method for Shear Strength of Adhesives Using Pin-and-Collar Specimen

D4800 Guide for Classifying and Specifying Adhesives

D5648 Test Method for Torque-Tension Relationship of Adhesives Used on Threaded Fasteners (Lubricity)

D5649 Test Method for Torque Strength of Adhesives Used on Threaded Fasteners

D5657 Test Method for Fluid Tightness Ability of Adhesives Used on Threaded Fasteners

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

2.2 *Military Standards:*

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes [4]

MIL-STD-129 Marking for Shipment and Storage [4]

MIL-STD-810 Environmental Test Methods and Engineering Guides [4]

MIL-STD-118 Commercial Packaging of Supplies and Equipment [4]

2.3 *Federal Standards:*

FED-STD-313 Material Safety Data Sheets, Preparation and Submission of [4]

2.4 *Federal Specifications:*

FF-N-836 Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat [4]

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[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.

Current edition approved April 1, 2016. Published May 2016. Originally approved in 1993. Last previous edition approved in 2008 as D5363 – 03 (2008). DOI: 10.1520/D5363-16.

[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] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

PPP-B-636 Box, Shipping, Fiberboard [4]
QQ-P-416 Plating, Cadmium, Electrodeposited [4]

2.5 *Military Specifications:*

MIL-R-46082 Retaining Compounds, Single-Component, Anaerobic [4]
MIL-S-22473 Sealing, Locking, Retaining Compounds; Single-Component [4]
MIL-S-46163 Sealing, Lubricating, and Wicking Compounds: Thread-Locking, Anaerobic, Single-Component [4]
MIL-T-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5 [4]

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 Articles [5]

2.7 *Society of Automotive Engineers:*

SAE J311 Fluid for Passenger Care Type Automatic Transmissions, Information Report [6]
SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners [6]
SAE AMS 2629 Jet Reference Fuel [6]

3. Terminology

3.1 *Definitions:*

3.1.1 Some terms in this specification are defined in Terminology D907.

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

3.1.3 *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.

3.1.4 *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*.)

3.1.5 *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*.)

3.1.6 *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.

3.1.6.1 *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, n*—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 static 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 static 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 1.

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

AN	=	anaerobic adhesive (from Guide D4800),
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 1 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 1. 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 1. The viscosity shall increase no more than 50 % above the uppermost limit for the given grade in Table 1 when tested in accordance with 7.12.

5.1.5 *Toxicity*—The supplier shall furnish a Safety Data Sheet (SDS) 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 1.

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 1.

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 1.

[5] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

[6] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

TABLE 1 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 2 3 4 0	red orange red red	11.3–28.2 11.3–28.2 11.3–28.2 11.3–28.2	10–25 40–80 100–250 1000–10000	11.3 11.3 11.3 11.3	6.8[A] 6.8[A] 6.8[B] 6.8[B]	5.6[A] 5.6[A] 5.6[A] 5.6[A]	11.3 11.3 11.3 11.3	5.6 5.6 5.6 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 2 3 0	blue blue blue	4.5–11.3 4.5–11.3 4.5–11.3	10–25 100–250 1000–10000	4.5 4.5 4.5	2.7[A] 2.7[B] 2.7[A]	2.3[A] 2.3[A] 2.3[A]	4.5 4.5 4.5	2.3 2.3 2.3
		5		1 2 0	purple purple	2.3–5.6 2.3–5.6	10–25 100–250	2.3 2.3	1.3[A] 1.3[B]	1.1[A] 1.1[A]	2.3 2.3	1.1 1.1
		6		1 2 3 0	brown brown brown	1.1–2.8 1.1–2.8 1.1–2.8	10–25 100–250 1000–10000	1.1 1.1 1.1	0.7[A] 0.7[B] 0.7[A]	0.6[A] 0.6[A] 0.6[A]	1.1 1.1 1.1	0.6 0.6 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 1 AN
Groups 2 and 3 Products
(continued)

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		10	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		10	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		10	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	10	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	10	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	10	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		10	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		10	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		10	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 1 AN
Groups 2 and 3 Products
(continued)

Group	Description	Class	Description	Grade	Color (5.1.2)	Heat Aging (5.1.8), N·m, min[A] Steel		Cold Strength (5.1.9), N·m, min Steel		Speed of Cure (5.2.2), N·m, min Steel	
						Break	Prevail	Break	Prevail	Break	Prevail
02	Threadlocking adhesives; fast curing; Newtonian flow properties	1		10	red	8.4	8.4[C]	8.4	8.4	8.4	8.4
		2		10	red	8.4	8.4[A]	8.4	8.4	8.4	8.4
		3		10	blue	5.6	2.8[C]	5.6	2.8	5.6	2.8
		4	wicking	10	blue	1.1	1.1[C]	1.1	1.1	1.1	1.1
		5	wicking	10	blue	1.1	5.6[C]	1.1	5.6	1.1	5.6
		6	wicking	10	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		10	purple	1.7	0.5[C]	1.7	0.5	1.7	0.5
		2		10	blue	3.9	1.1[B]	3.9	1.1	3.9	1.1
		3		10	red	5.6	5.6[A]	5.6	5.6	5.6	5.6
		0	other	0							

TABLE 1 AN
Group 4 Products *(continued)*

Group	Description	Class	Description	Grade	Color (5.1.2)	Strength at Standard Conditions, Shear Strength (5.2.3.2), ASTM D4562 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 2 0	green green	13.8 13.8	100–500 400–800	10.3 10.3	6.9[A] 10.3[A]	10.3[A] 12.4[A]	13.8 13.8	
		2		1 0	green	24.1	1500–2500	10.3	6.9[A]	10.3[A]	17.2	
		0	other	0								
00	other[B,C]	0	other	0								

[A] Test temperature = 150°C.
[B] Test temperature = 93°C.
[C] Test temperature = 121°C.

TABLE 2 Wicking Requirements for Group 02 Products, N · m min

	Pretorqued		Non-Pretorqued			
	Steel	Plated	Steel		Plated	
	Prevail	Prevail	Break	Prevail	Break	Prevail
Class 4	1.1	0.6	1.1	1.1	0.6	0.6
Class 5	5.6	0.8	1.1	5.6	0.8	0.8
Class 6	8.5	4.2	1.1	8.5	0.6	4.2

TABLE 3 Cure Time for Speed-of-Cure Test

Group	Class	Time
01	all	6 h
02	1, 2, 3	90 min
02	4, 5, 6	15 min
03	all	60 min

TABLE 4 Primer Qualification Requirements % of Strength at Standard Conditions

Grade N		Grade T			
Plated		Steel		Plated	
Cure	Strength	Cure	Strength	Cure	Strength
6 h 24 h	50 % 100 %	10 min 40 min	50 % 100 %	30 min 2 h	50 % 100 %

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 1.

5.1.10 *Lubricity*—Group 03 products shall show lubricity on the thread flanks to within ±10 % of an as-received phosphate and oil, ⅜ in.-16 grade 5 bolt, when tested in accordance with 7.14.

5.1.11 *Fluid Tightness*—Groups 01, 02, and 03 products shall be capable of making leak-tight assemblies when tested in accordance with 7.15.

5.1.12 *Wicking*—The average breakaway and prevailing torque strength for Group 02, Class 4, 5, and 6 products, when tested in accordance with 7.16, shall meet the requirements specified in Table 2.

5.2 *Detail Requirements*—Detail requirements are properties which are adjusted in each lot of adhesive produced to provide different groups, classes, and grades, and are tested on every lot in accordance with Table 1 to verify specification conformance.

5.2.1 *Viscosity*—The uncured adhesive shall have a viscosity within the range given in Table 1 for the grade specified when tested in accordance with 7.4.

5.2.2 *Speed of Cure*—The average strength of each adhesive, when tested in accordance with 7.7, shall meet the requirements specified for the given class in Table 1.

5.2.3 *Strength at Standard Conditions*—Standard conditions are 21 to 25°C (69.8 to 77°F) and 45 to 55 % relative humidity.

5.2.3.1 *Groups 01, 02, and 03 Products*—The average strength of each adhesive, when tested in accordance with 7.5, shall meet the requirements specified for the given class in Table 1.

5.2.3.2 *Group 04 Products*—The minimum strength of each adhesive, when tested in accordance with 7.6, shall meet the requirements specified for the given class in Table 1.

6. Other Requirements

6.1 *Suffixes*—When requirements are needed that supersede or supplement Table 1, they shall be specified through the use of suffixes.

6.2 When using the callout for materials covered by this specification, the suffixes that are found in Annex A1 may be used for the specific requirements for the material for the application intended. In general, the suffix letter gives the general requirement needed, the first digit following gives the test condition, and the second digit gives the specific requirement.

6.3 Additional suffixes will be added to this specification as test methods and requirements are developed. A further list of suffixes can be found in Guide D4800 and may be used for additional requirements as appropriate.

NOTE 2—Using the information from Note 1, an example of the suffix system follows. The designation AN 0411 H11 P15 would indicate:

AN 0411	=	information from Note 1,
H	=	hot strength,
1	=	to be tested in accordance with 7.8 at a test temperature of 204°C,
1	=	hot strength shall meet the requirement stated in Table 3,
P	=	package/container,
1	=	bottle (plastic), and
5	=	250 mL.

6.4 *Qualification of Primers*—Primers Grade N and Grade T shall be tested in accordance with 7.17 with adhesive specified by the adhesive manufacturer, and shall meet the requirements specified in Table 4.

7. Test Methods

7.1 *Ultraviolet Fluorescence*—Place two to five drops of adhesive to be examined on a microscope slide and expose to long-wavelength blacklight at standard conditions. (Generally, a wavelength of 365 nm and an intensity of 400 to 800 μW/cm^2 is an accepted standard.)

7.2 *Examination for Color and Workmanship*—Shake or mix the adhesive. Visually examine the adhesive for workmanship and color in accordance with 5.1.2 at standard conditions.

7.3 *Flash Point*—Measure the flash point of the uncured adhesive using a tag closed tester in accordance with Test Method D56.

7.4 *Viscosity*—Measure the viscosity of the uncured adhesive in accordance with Test Methods D1084 (Method B) or Test Method D445.

7.5 *Torque Strength*—Conduct all torque strength tests on Groups 01, 02, and 03 in accordance with Test Method D5649. Cure specimens for 24 to 26 h at standard conditions. Zinc-plated or cadmium-plated nuts and bolts shall conform to Specifications B633, QQ-Z-325 (Class 2, Type II), or QQ-P-416, (Class 2, Type II), respectively.

7.5.1 *Group 01 Products*—Test Group 01 products for prevailing torque strength only using ⅜-in. size, 24 threads per inch, Unified National Fine thread series, Class 2 fit (⅜ –24

UNF2) Grade 2 bolts in accordance with SAE J429. Nuts shall conform to Federal Specification FF-N-836. The bolt shall have a minimum length of 1 in. (25.4 mm) with hexagonal head. The nut shall be Type II, Style 4, nominally 21⁄64 in. (8.3 mm) thick. For purposes of this specification, the following nut and bolt assembly procedure for Group 01 products may be used as an alternative to that described in Test Method D5649.

7.5.1.1 Screw the nut onto the bolt such that 0.5 to 0.5625 in. (12.7 to 14.3 mm) of the threaded end protrudes.

7.5.1.2 Apply sufficient adhesive to the bolt to completely cover the protruding threads of the bolt.

7.5.1.3 Unscrew the nut over the adhesive until the end of the nut is flush with the end of the bolt. Flip the nut over.

7.5.1.4 Screw the nut back until 0.125 to 0.1875 in. (3.2 to 4.8 mm) of threads protrude to ensure complete coverage of the adhesive in the engaged area.

7.5.2 *Group 02 and Group 03 Products*—Test Group 02 and Group 03 products for breakaway and prevailing torque strength using 3⁄8-in. size, 16 threads per inch, Unified National Coarse thread series, Class 2 fit (3⁄8-16 UNC) Grade 5 bolts in accordance with SAE J429. Nuts shall conform to Federal Specification FF-N-836. The bolt shall have a minimum length of 1 in. (25.4 mm) with hexagonal head. The nut shall be Type II, Style 4, nominally 21⁄64 in. (8.3 mm) thick.

7.6 *Shear Strength*—Conduct all shear-strength tests on Group 04 adhesives in accordance with Test Method D4562 on steel pin-and-collar specimens. Cure all Group 04 adhesives for 24 to 26 h at standard conditions.

7.7 *Speed of Cure*—Prepare Groups 01, 02, and 03 specimens in accordance with 7.5, using steel fasteners only. Measure the breakaway and prevailing torque strength of each adhesive after curing for the time specified in Table 3. (There is no speed-of-cure requirement for Group 04 adhesives.)

7.8 *Hot Strength*—Prepare Groups 01, 02, and 03 specimens in accordance with 7.5, using steel fasteners only. Prepare Group 04 specimens in accordance with 7.6. Cure the specimens for 24 to 26 h at standard conditions. After curing, heat the specimens in an air-circulating oven for 115 to 125 min at the temperature given in Table 1 for the group, class, and grade product being tested. Test the specimens within 30 s after removal from the oven.

7.9 *Heat Aging*—Prepare Groups 01, 02, and 03 specimens in accordance with 7.5, using steel fasteners only. Prepare Group 04 specimens in accordance with 7.6. Cure the specimens for 24 to 26 h at standard conditions. After curing, heat the specimens in an air-circulating oven for 998 to 1002 h (about 42 days) at the temperature given in Table 1 for the group, class, and grade product being tested. After heat-aging, allow the specimens to equilibrate at standard conditions for 2 h and measure the strength.

7.10 *Cold Strength*—Prepare Groups 01, 02, and 03 specimens in accordance with 7.5, and prepare Group 04 specimens in accordance with 7.6, and cure for 24 to 26 h at standard conditions. After curing, place the specimens in a suitable container at −53 to −55°C for 115 to 125 min (2 h). Remove the specimens from the container and measure the strength within 30 s.

7.11 *Solvent Resistance*—Prepare Groups 01, 02, and 03 specimens in accordance with 7.5, using steel fasteners only. Prepare Group 04 specimens in accordance with 7.6. (This test requires a minimum of 35 specimens for each adhesive tested.) Cure the specimens for 24 to 26 h at standard conditions. After curing, immerse the specimens for 168 h (7 days) at 84 to 90°C in a pressure vessel in each of the test fluids conforming to the specifications listed in Table 5. Measure the strength of the test specimens after removal from the test fluids and cool for 2 h.

7.12 *Storage Stability*—Store five containers of the uncured adhesive, packaged in original containers, at 47 to 50°C. Store Groups 01 and 04 adhesives for ten days. Store Groups 02 and 03 adhesives for four weeks. Measure the viscosity in accordance with 7.4. Determine the torque strength of Groups 01, 02, and 03 adhesives in accordance with Test Method D5649. Determine the shear strength of Group 04 adhesives in accordance with Test Method D4562.

7.13 *Corrosivity*—Degrease sheets of steel (Specification A109/A109M, Grade 2), aluminum alloy (Specification B209, Alloy 2024, T3 temper), and brass (Specification B36/B36M, Alloy 8), and buff with a clean number 400 emery cloth. Apply a few drops of adhesive to the prepared surfaces of each metal plate. Let specimens stand for 24 h in a desiccator at ambient temperature. Remove the adhesive by wiping with a nonabrasive cloth wetted with water. Visually examine the surface with the aid of a five-power magnifying glass for discoloration or other evidence of corrosion.

7.14 *Lubricity*—Test Group 03 products for lubricity in accordance with Test Method D5648.

7.15 *Fluid Tightness*—Test Groups 01, 02, and 03 for fluid tightness in accordance with Test Method D5657.

7.16 *Wicking:*

7.16.1 *Procedure*—Prepare steel and plated specimens in accordance with 7.5 and 7.5.2 without applying adhesive. (These will be the non-pretorqued specimens.) Assemble a second set of specimens around a hardened-steel spacer and washer and pretorque to 30 ft·lbf.

7.16.2 After all specimens are assembled, apply several drops of adhesive to each nut adjacent to the threads so that the adhesive wicks into the thread junction.

7.16.3 Cure all specimens for 24 h at standard conditions. After curing, measure the breakaway and prevailing torque strength.

7.17 *Qualification of Primers*—Apply the primer in accordance with the manufacturer's instructions. Prepare steel and plated specimens in accordance with 7.5 and 7.5.1. Cure

TABLE 5 Solvents and Applicable Solvent Specifications

Solvent	Applicable Solvent Specification
Reagent water	ASTM D1193
Isopropyl alcohol	ASTM D770
Automatic transmission fluid	SAE J311
Unleaded gasoline	ASTM D439
Ethylene glycol	ASTM D2693
Jet reference fuel	SAE AMS 2629

specimens at standard conditions for the times specified in Table 4. After curing, measure the prevailing torque strength.

8. Inspection

8.1 *Responsibility for Inspection*—Inspection of the material shall be as agreed upon between the purchaser and the supplier as part of the purchase contract.

8.2 *Source Inspection*—If the purchaser desires to inspect the adhesive or witness the quality-assurance testing of the adhesive prior to shipment, such arrangement shall be made by the purchaser and producer as part of the purchase contract. When source inspection is agreed upon, the purchaser's representative shall be afforded all reasonable facilities to ensure that the material meets the requirements of the specification. Inspection and tests shall be conducted in such a manner that there is no unnecessary interference with the producer's operations.

9. Rejection and Retesting

9.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make a claim for a retest.

10. Certification

10.1 When specified in the purchase order or contract, the manufacturer's or supplier's certification shall be furnished to the purchaser stating that samples representing each lot have been manufactured, tested, and inspected in accordance with this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

11. Packaging and Package Marking

11.1 The following sections shall apply to nongovernmental users of this specification unless otherwise specified or agreed upon between buyer and seller.

11.2 *Marking*—Marking for commercial packages shall be in accordance with Practice D3951.

11.3 *Packaging:*

11.3.1 The compound is packed to ensure safe delivery to its destination in accordance with the Uniform Freight Classification or other carrier regulations applicable to the mode of transport.

11.3.2 The material shall be packaged and packed in accordance with applicable requirements for the transportation of hazardous materials of the Department of Transportation.

12. Special Government Requirements

12.1 *Packaging and Packing:*

12.1.1 Packaging and packing shall be Level A, B, or C, as specified.

12.1.2 Unless otherwise specified, when Level A, B, or C is specified, packaging and packing shall be in accordance with the following criteria:

12.1.2.1 The compound shall be furnished in 10 cm^3 (⅓ fl oz), 50 cm^3 (1⅔ fl oz), 60 cm^3 (2 fl oz), or 250 cm^3 (8⅓ fl oz) plastic squeeze bottles fitted with dispenser nozzles and closure caps with knurlings or facets for easy opening.

12.1.2.2 When primer is required, it shall be packaged in 4 oz (113 g) bottles, 6 oz (170 g) cans, or 1 gal (0.0038 m^3) cans.

12.1.2.3 Bottles for Level A shall be packed in boxes conforming to PPP-B-636, with the weight of contents not to exceed 200 lb (91 kg).

12.1.2.4 Bottles for Level B shall be packed in fiberboard boxes conforming to PPP-B-636, with the weight of contents not to exceed box specifications.

12.1.2.5 Level C packing shall be in accordance with MIL-STD-118.

12.2 *Shipment and Delivery:*

12.2.1 The compound is packed to ensure safe delivery to its destination in accordance with the Uniform Freight Classification or other carrier regulations applicable to the mode of transport.

12.2.2 The material shall be packaged and packed in accordance with applicable requirements for the transportation of hazardous materials of the U.S. Department of Transportation.

12.3 *Marking:*

12.3.1 Marking is as specified in the contract or purchase order. Interior packages and shipping containers for Levels A and B shall be marked in accordance with MIL-STD-129. Marking for commercial packages shall be in accordance with Method D3935.

12.3.2 Special markings, when specified on contracts or purchase orders or by the contracting officer shall include the following:

12.3.2.1 Manufacturer's name, product code number, batch and lot number, and material stock number.

12.3.2.2 Date of manufacture of product and expiration date.

12.3.2.3 Special handling instructions.

12.3.2.4 Special precautions related to toxicity, flammability, pertinent handling, and storage data for the products (for example, storage temperature range).

13. Quality Assurance

13.1 *Lot*—For purposes of sampling, a lot shall consist of all adhesive of the same group, class, and grade manufactured at one place from the same batch and offered for inspection at one time.

13.2 *Sample*—The materials shall be sampled in accordance with the sampling procedure described in Practice E122 or MIL-STD-105. Adequate statistical sampling shall be considered an acceptable alternative. Any change or deviation in the formulation or from the lot sample shall be subject to the approval of the user.

13.3 *Quality Conformance Samples*—A sample of the adhesive shall be taken from the lot for quality conformance testing in accordance with 5.2.

14. Keywords

14.1 adhesive; anaerobic; line callout

ANNEX

(Mandatory Information)

A1. SUFFIX TABLE—SUFFIX SYMBOLS AND REQUIREMENTS

Symbol Characteristic

A Color (Unless otherwise shown by suffix, color is understood to be the standard commercially available color for the material.)
- 01 = Brown
- 02 = Red
- 03 = Orange
- 04 = Yellow
- 05 = Green
- 06 = Blue
- 07 = Purple
- 08 = Pink
- 09 = White
- 10 = Black
- 11 = Gray
- 12 = Clear

B Solvent Resistance
- First Digit
- 0 = Test method to be specified by user
- 1 = To be tested in accordance with 7.11
- Second Digit
- 0 = To be specified by user
- 1 = Turbine fuel, Aviation grade JP-5 (see MIL-T-5624), with requirements listed in 5.1.6 as they apply

C Corrosivity
- First Digit
- 1 = To be tested in accordance with 7.13
- Second Digit
- 0 = To be specified by user
- 1 = No permanent discoloration of the metals which does not buff off with a nonabrasive cloth

F Fungus Resistance
- First Digit
- 1 = To be tested in accordance with MIL-STD-810 (Method 508.2)
- Second Digit
- 0 = To be specified by user
- 1 = Will not support growth of fungus

H Hot Strength
- First Digit
- 1 = To be tested in accordance with 7.5.3, at a test temperature of 400°F (204°C)
- Second Digit
- 0 = To be specified by user
- 1 = Hot strength shall meet the requirement stated in Table 1 for the given group, class, and grade product specified

M Military
- First Digit
- 0 = To be specified by user
- 1 = Suitability for use with explosives
- Second Digit
- 0 = To be specified by user
- 1 = The user shall specify the Government laboratory and the particular explosive to be used

N Non-Ultraviolet Fluorescent
- 01 = Shall not be fluorescent and 5.1.1 shall not apply

P Package/Container
- First Digit
- 0 = To be specified by user
- 1 = Bottle (plastic)
- 2 = Tube (plastic)
- 3 = Cartridge (plastic)
- Second Digit
- 0 = To be specified by user
- 1 = 6 mL
- 2 = 10 mL
- 3 = 50 mL
- 4 = 100 mL
- 5 = 250 mL
- 6 = 300 mL
- 7 = 1000 mL

Z Other Special Requirements
These characteristics will be spelled out in detail and identified in sequence, that is 01, 02, 03, etc. (see Guide D4800 for example).

APPENDIX

(Nonmandatory Information)

X1. CROSS REFERENCES TO MIL-S-22473, MIL-S-46163, AND MIL-R-46082

ASTM D5363	MIL-S-22473
0111	Grade AA
AN0121	Grade A
AN0122	Grade D
AN0123	Grade AV
AN0124	Grade AVV
AN0131	Grade B
AN0141	Grade C
AN0142	Grade CV
AN0143	Grade CVV
AN0151	Grade E
AN0152	Grade EV
AN0161	Grade H
AN0162	Grade HV
AN0163	Grade HVV
AN0171	Grade JV

ASTM D5363	MIL-S-46163
AN0211	Type I, Grade L
AN0221	Type I, Grade K
AN0231	Type I, Grade J
AN0241	Type III, Grade P
AN0251	Type III, Grade Q
AN0261	Type III, Grade R
AN0311	Type II, Grade M
AN0321	Type II, Grade N
AN0331	Type II, Grade O

ASTM D5363	MIL-R-46082
AN0411	Type I
AN0412	Type II
AN0421	Type III