

DoD Energetics Qualification Program

Primary Explosives

A	Primary Explosives	Required	Special Requirements	References	Sample Weight
1.1	Modified Vacuum Thermal Stability (MVTs)	Y	Update being made to AOP-7/STANAG 4556 for Henry Grau/ATK MVTs Method	(01) AOP-7 ED 2 (U.S. 202.01.022), STANAG 4556	1 gram
1.2	Thermal Stability - 75 Degrees C (For Hazard Classification)	Y	Modified for primaries	(02) TB-700-2 Para. 5-3e, UN Test No. 3(c)	12 grams
2.1	TGA		Y (03)	AOP-7 ED 2 (202.01.008)	1 mg
2.2	DSC	Y		AOP-7 ED 2 (202.01.020)	1 mg
3.1	Modified Vacuum Thermal Stability			(05) AOP-7 ED 2 (202.01.022)	1 gram/test
3.2	DSC			AOP-7 ED 2 (203-01-001)	1 mg/test
3.3	CRT			AOP-7 ED 2 (204.01.001)	1 mg/test
3.4	DTA			AOP-7 ED 2 (202.01.007)	1 mg/test
3.5	Must do either 3.1, 3.2, 3.3 or 3.4	Y			
3.7	TGA (06)		Y (06)	AOP-7 ED 2 (202.01.008)	1 mg/test
4.2	Woods Metal Bath (5 sec Time to Explosion Test)		Y [Army]	MIL-STD-650 [515.1], AOP-7 ED 2 (202.01.024 ARDEC Method; 202.01.016 Std Method)	30 mg
4.3	Autoignition DSC			AOP-7 ED 2 (202.01.020)	1 mg
4.4	DTA			AOP-7 ED 2 (202.01.007)	1 mg
4.5	TGA			AOP-7 ED 2 (202.01.008)	1 mg
4.6	Either 4.3, 4.4 or 4.5				
5.4	Small Scale Burn Test	N/A	EMQB Waives this test due to violent results from primaries	TB-700-2 Para. 5-3f, UN Test No. 3(d)	220 grams
6.1	Small Scale ESD Test	Y		AOP-7 ED2 (U.S. 201.03.001), (U.S. 201.03.002), or (U.S. 201.03.003)	5 grams
7.3	BOE		For Shipping	AOP-7 ED 2 (201.01.003)	5 grams
7.4	Ball Drop	Y (11)		AOP-7 ED 2 (201.01.002)	5 grams
8.1	Small BAM	Y (13)		AOP-7 ED 2 (201.02.006)	5 grams
	No Tests or Data Required				
10.1	Hot Wire Initiability	Omitted (14)	Only needed for Electric Primers, not for Percussion Primers	OD44811; AOP-7 ED 2 (202.01.024)	10 grams
11.9	Dead Pressing Susceptibility		Y (15) - Due to the sensitive nature of the materials being pressed, this test might be waived	OD44811 (Section 1.5.5)	10 grams
11.10	Density / Bulk Density	Y		MIL-STD-286C [510.3.1]	5 mg
11.12	Composition Analysis	Y	For mixtures only	MIL-DTL-46225D/MIL-DTL-757C/MIL-L-163553	1 gram

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12.1	Variation of Properties with Age	Y (16)		NAVSEA 8020.5C	
	Need to test Ball Drop, Friction, ESD, Composition Analysis, Priming Ability, and Hot Wire Ignition at each aging interval	Composition Analysis only for mixtures	6 month 70°C, 12 month 70C, 12 month 25C 30% RH		
13.1	Products of Combustion / Detonation	Y		Calculation by Appropriate Computer Code (e.g. CHEETAH, PEP, NASA-Lewis)	
13.2	Evaluated on a Case by Case Basis to Determine Toxicity Data Required	Y		Federal Statutes, DoD 5000 Series and DAD / Guidebook, AOP-7 ED 2	
14.2	Priming Ability	Y		OD44811 (Section 1.5.3)	
15.1	Qualification Recommendation	Y		NAVSEA 8020.5C	
15.2	Qualification Justification	Y		NAVSEA 8020.5C	
15.3	Draft Technical Report on Qualification Testing	Y		NAVSEA 8020.5C	
15.4	Draft Explosive Specification or STANAG	Y		NAVSEA 8020.5C	
15.5	Draft MSDS	Y (17)		NAVSEA 8020.5C	
15.6	Interim Hazard Classification (or Final Hazard Classification)	Y		NAVSEA 8020.5C	
15.7	Preliminary Environmental Analysis Statement	Y (18)		NAVSEA 8020.5C	
15.8	SWO10-AG-ORD-010 Data Sheet	Y		NAVSEA 8020.5C	
15.9	NATO AOP-26 Data Sheets	Y		NAVSEA 8020.5C	
15.10	Qualification Data Compared with 2 Qualified Materials of the Same Category	Y		NAVSEA 8020.5C	
15.1	Producibility Statement	Y		NAVSEA 8020.5C	
15.1	Formal Qualification Certification Issued by the National Service Authority	Y		NAVSEA 8020.5C	

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WARNING and CAUTION: Qualification only determines general safety and suitability of an energetic material for due consideration for a specific application within the specified category / role of energetic material. Qualification of a particular energetic material does NOT guarantee that it is totally safe or suitable for all possible applications. Additional tests and Final Type Qualification need to be performed to establish final safety and suitability for the specific application / system use.

GENERAL COMMENT: Specialty Items will be processed as appropriate; guidelines are cited below:

Blasting Agents: Main Charge Explosives.

CADs / PADs: Booster Explosives / Primary Explosives / Primer Explosives / Pyrotechnics Explosives / Solid Rocket Propellants

Demolition Charges: Main Charge Explosives.

Detonating Cords: Main Charge Explosives / Booster Explosives / Primary Explosives.

Fuel Air Explosives (FAEs):

Linear Shaped Charges (Cutters): Booster Explosives / Primary Explosives.

Thermobaric Explosives: Main Charge Explosives.

Transfer Line Charges (TLCs): Main Charge Explosives / Booster Explosives / Primary Explosives.

GENERAL COMMENT: The matrix only lists the mandatory tests and data requirements. The matrix is intended to be as comprehensive and all inclusive as possible to cover all required and special requirements tests and data (based on specific formulation, intended specific application, special and extreme environments, etc.) for the stated category / role of energetic material. For various reasons, other tests may be performed and data may be collected as part of the qualification process. Also, based on intended specific applications or specific formulations or specific special environments (not foreseen during the development of this matrix), a determination may be made by respective organizations that additional tests and data are mandatory. This matrix is not intended to preclude the exercise of good technical judgment by the responsible Military Services and DoD Energetics Qualification Boards.

GENERAL COMMENT: It is the intent of the U.S. Department of Defense to incorporate as quickly as feasible this matrix, AOP-7 ED 2, other cited Military Standards, and other above referenced sources, into the respective STANAGs and AOPs.

Y = YES (Mandatory Test / Data Requirement); O = OMITTED (No Longer Mandatory Requirement); N/A = Not Applicable (Will fail that test)

Comments; refers to numbers inside parenthesis () in above matrix:

Comment Number, Designated Matrix Cell, Comment Statement

01. 1.1E. Testing may be accomplished using reduced quantities of explosive material.
02. 1.2C. Required by TB 700-2; potential problem with more sensitive pyrotechnics explosives.
03. 2.1D. May be preferable for some primary explosive compositions. TGA test can be valuable if mass is being lost because something is evaporating while other things are occurring that cause the DSC not to pick up the change.
04. 3B. Compatibility among all formulation ingredients is mandatory. Compatibility is also determined between energetic formulation material and all materials it is expected to be in contact with in test and production systems. This latter compatibility testing can be part of the qualification process or done as part of final "type" qualification. Baseline compatibility testing when qualifying energetic material can include basic metals types of aluminum, brass, copper, iron, lead, magnesium, steel, stainless steel, and zinc. NOTE: NAVSEAINST 8020.5 only requires material compatibility testing for common materials when qualifying blasting agents (NAVSEAINST 8020.5, Enclosure 3, page 14, Table I) and the common materials listed are: metals, acids, and bases. The chemical compatibility testing occurs during Final (Type) Qualification testing (NAVSEAINST 8020.5, Enclosure 4, page 3, paragraph 3.d) and the materials are listed as: "...all materials (both energetic and inert) with which it may come in contact in production and in the end-item configuration...".
05. 3.1E. Testing may be accomplished using reduced quantities of explosive material.
06. 3.7D. May be preferable for some primary explosive compositions. TGA may be performed if you suspect changes that the DSC will not pick up that will evidence themselves as mass loss especially when your dealing with two difference substances; for example, you could have one material exotherming while the other is evaporating with a net of no heat change but a mass change would be occurring.

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07. 4B. This section provides additional thermal characterization information for an energetic material. The methods are significantly different and provide different information in that some tests are carried with unconfined samples and some with moderate confinement. Sample weights differ and the data provided are significantly different.
09. 5.6C. Failure expected. Desensitized version prepared for transportation will have to pass (or UN Series 4 tests).
10. 7.6B. Other impact sensitivity tests may be performed as stated in MIL-STD-1751A (methods 1011 to 1017, inclusive); however, only these two are recognized by TB 700-2 / UN Orange Book. Recommend that TB 700-2 / UN Orange Book be changed; any of these methods are okay as long as you relate it to a known standard reference material.
11. 7.6C. Failure expected for extremely sensitive materials. Desensitized versions prepared for transportation will have to pass (or UN Series 4 Tests).
13. 8.4C. Failure expected for extremely sensitive materials. Desensitized versions prepared for transportation will have to pass (or UN Series 4 Tests).
14. 10.4C. There exists conflict among OD44811, MIL-STD-1751A, and NAVSEAINST 8020.5C concerning applicability of this test and its use (safety and / or performance data). Therefore, this test is currently listed as "Optional" for all categories / roles (except it is not applicable for Liquid Propellants). Need to resolve the issue.
15. 11.9D. Yes, for pressed explosives.
16. 12.1C. If the energetic material being qualified is intended for Joint Military Service use, then the aging test plan shall be appropriately coordinated among the Military Services.
17. 17.5C. The MSDS should be prepared very early in the development of an energetic material to facilitate the handling, shipping, and testing of the material. For example, you could not legally ship the material without the MSDS.
18. 17.7C. Analysis of impact of manufacture, storage, testing, and use.