MIL-STD-320A
30 JUNE 1975

SUPERSEDING
MIL-STD-320
2 JULY 1962

MILITARY STANDARD

FUZE EXPLOSIVE COMPONENT TERMINOLOGY, DIMENSIONS AND MATERIALS

FSC: 1390

MIL-STD-320A
30 June 1975

DEPARTMENT OF DEFENSE
WASHINGTON, D.C. 20301

MIL-STD-320A
Fuze Explosive Component Terminology, Dimensions and Materials

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Recommended corrections, additions or deletions should be addressed to the Commander, Picatinny Arsenal, Dover, New Jersey 07801, ATTN: SARPA-QA-A-M.

FOREWARD

This standard is one in the 300-399 series assigned to fuze testing and explosive train devices.

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1. Scope

1.1 Scope. This standard establishes terminology, external and internal dimensions, and preferred structural materials and color identification for explosive components for use in fuzes.

1.2 Application. This standard is applicable to explosive components used in rocket, guided missile, bomb and projectile fuzes, and other fuzes where pertinent. The explosive components considered are primers, detonators, delays, relays and leads.

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of initiators for bids or request for proposal, form a part of this standard to the extent specified herein.

SPECIFICATIONS

FEDERAL

QQ-A-250/1	Aluminum 1100, plate & sheet
QQ-A-250/2	Aluminum Alloy 3003, plate & sheet
QQ-A-250/8	Aluminum 5052, plate & sheet
QQ-A-225/5	Aluminum Alloy, Bars, Rods & Wire (Rolled or Drawn) 2017

MILITARY

MIL-S-5059	Steel, Corrosion-Resistant plate, sheet and strip
MIL-I-23011	Kovar - Iron Nickel Alloys for sealing to glass and ceramics

STANDARDS

MILITARY

ANSI-114.5	Y14.5	Dimensioning and Tolerancing
ANSI-46.1	B46.1	Surface Roughness, Waviness, and Lay

2.2 Other Publications

Picatinny Arsenal Technical Report
No. 1783 Effects of Materials on the Properties of Explosives, dated November 1950, 2 volumes, Confidential

Naval Ordnance Laboratory Report
No. 1111 Ordnance Explosive Train Designers Handbook

Military Handbook 127, "Fuze Catalog, Fuze Explosive Components" - Explosive Trains, Volume 3. Confidential

Sandia Report SC-M-70-355 Aug 1970
"Compatibility of Explosives with Structural Materials of Interest" R.J. Buxton & TM Massis

AMC Pamphlet 706-179 Engineering Design Handbook, Explosive Series, Explosive Trains, Volume 3

3. Definitions

3.1 Terminology. The following terms are applicable to this standard.

3.1.1 Detonator. - An explosive train component which can be activated by either a non-explosive impulse or the action of a primer and is capable of reliably initiating high order detonation in a subsequent high explosive component of the train. When actuated by a non-explosive impulse, a detonator includes the function of a primer. In general, detonators are classified in accordance with the method of iniation such as percussion, stab, electric, friction, flash, chemical, etc.

3.1.2 Fuze explosive train. - An arrangement of a series of combustible and explosive elements consisting of a primer, a detonator, a delay, a relay and booster charge, one or more of which may be either omitted or combined. The function of the explosive train is to accomplish the controlled augmentation of a relatively small impulse into one of sufficient energy to cause the main charge of the munition to function.

3.1.3 Lead. - An explosive train component which consists of a column of high explosive usually small in diameter, used to transmit detonation from one detonating component to a succeeding high explosive component. It is generally used to transmit the detonator from a detonator to a booster charge.

3.1.4 Primer. - A relatively small and sensitive initial explosive train component which on being actuated initiates functioning of the explosive train and will not reliably initiate high explosive charges. In general, primers are classified in accordance with the method of initiation such as percussion, stab, electric, friction, chemical, etc.

3.1.5 Relay. - An element of a fuze explosive train which augments an outside and otherwise inadequate output of a prior explosive component so as to reliably initiate succeeding train component. Relays, in general, contain a small single charge such as lead azide and are not usually employed to initiate high explosive charges.

4. General Requirements

4.1 General. - To provide uniformity of design for primers, detonators, relays, and leads, specific outside diameters and lengths have been standardized for the finished (loaded) components. Effective with publication of this military standard, no new components will be developed having dimensions other than those specified. The design engineer responsible for a particular end item application will specify a standard outside diameter and length for each component. When this has been accomplished the appropriate cup dimensions, as specified in this military standard, will be used for each component. In addition, only those materials specified in Table V will be used for fabrication of metal parts. Use of materials shall be consistent with the compatibility requirements of paragraph 5.3.

5. Detailed Requirements

5.1 Dimensions and tolerance

5.1.1 Loaded primers, detonators, relays and leads. - Tables I and II set forth various standard finished diameters and lengths, together with the applicable tolerances for primers, detonators, relays and leads. A design of any of these components must meet the dimension and tolerance requirements as selected from the appropriate tables.

5.1.2 Cups for primers, detonators, relays and leads. - Table III and IV set forth the various cup dimensions and tolerances associated with the finished (loaded) dimensions for the specific item being developed. Selection of the finished (loaded) dimensions will enable the designer to select appropriate cup dimensions from Table III and IV.

5.1.2.1 Additional characteristics for stab, electric, flash and percussion initiated components. The following additional characteristics shall be specified. (Figures 1 through 4 show the outline form of the component cups for reference purposes).

(a) The surface finishes shall be 32 for inside surfaces and 63 for outside surfaces.

(b) The inside corner radius shall be equal to 1 to 1 1/2 times the bottom thickness.

(c) The outside corner radius shall not exceed 1 1/2 times the bottom thickness.

(d) Eccentricity of bottom hole to inside diameter shall not exceed .004 inch.

(e) The cup drawing shall specify the a "pinch trim" is permitted on the cup edge. Dimensioning of the thickness of the edge or amount of radius or chamfer allowed on the inside lip of the cup shall be avoided.

5.1.2.2 Additional characteristics for leads cups. The following additional characteristics shall be specified. (Figure 3 shows the outline form of these cups for reference purposes).

(a) All surface finishes shall be 125.

(b) The inside corner radius shall be equal to 1 to 1 1/2 times bottom thickness.

(c) The outside corner radius shall not exceed twice the bottom thickness.

(d) The flange diameter to outside diameter eccentricity shall not exceed .008 inch.

5.1.3 Coined Bottom Cups. - The coined thickness to be 1/5 the uncoined bottom thickness but not less than .005 inch. See Fig 4. The coined diameter shall not exceed 75% of the Cup inside diameter.

5.2 Material. - Metal parts shall be fabricated only from materials specified in Table V.

5.3 Compatibility. - In the design of explosive trains and components for use in fuzes, consideration must be given to the compatibility between all materials used and -

(a) The fuze parts which hold the explosive component and -

(b) The explosive contents

5.3.1 Compatibility between the explosive component and adjacent fuze parts is required to reduce the corrosive effects of moisture, galvanic action; etc., on the explosive component. The Galvanic Series may be considered as a reference.

5.3.2 Compatibility between all materials used and the explosives contained therein is required to prevent any chemical reaction which may cause spontaneous initiation or degrading of the component and related explosive train.

5.3.3 The following references should be considered in this respect:

(a) Picatinny Arsenal Technical Report No. 1783, Effects of Materials on the Properties of Explosives, dated November 1950, 2 volumes.

(b) Table 2-14, Naval Ordnance Laboratory Report No. 1111, Ordnance Explosive Train Designers Handbook.

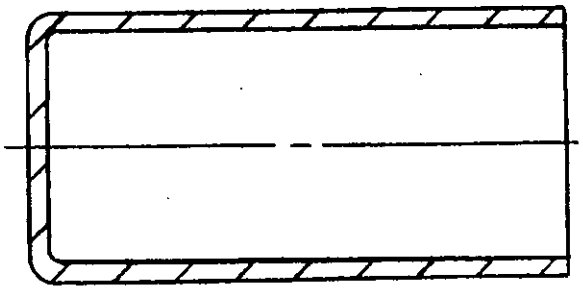
(c) AMC Pamphlet 706-179, Engineering Design Handbook, Explosives Series, Explosive Trains. Volume 3.

5.4 Color Identification.

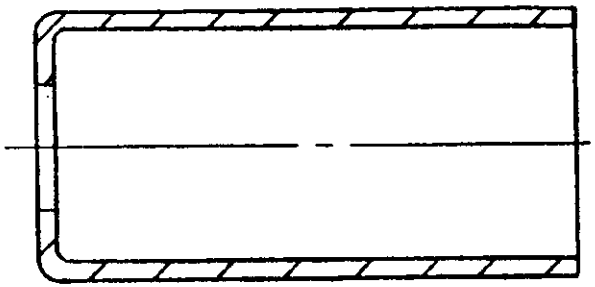
5.4.1 Primers, detonators, delays, relays and leads. Color identification of the ends of finished primers, detonators, delays, relays and leads shall be as set forth in Table IV.

5.4.1.1 Inert. The ends of finished inert components shall be black.

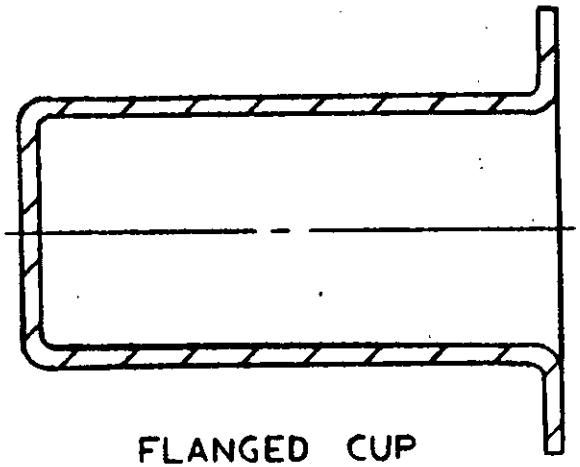
OUTLINE FORM OF COMPONENT CUPS



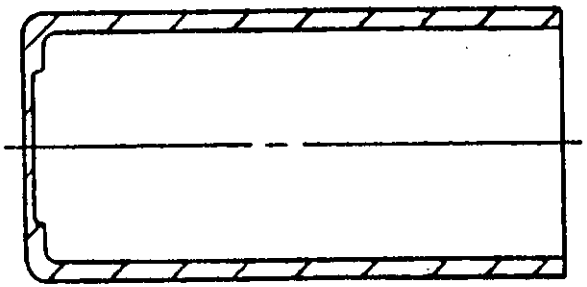
SOLID BOTTOM CUP
FIGURE 1



PIERCED CUP
FIGURE 2



FLANGED CUP
FIGURE 3



COINED BOTTOM CUP
FIGURE 4

TABLE 1. Finished Diameters of Primers, Detonators, Relays and Leads (Dimensions in Inches)

PRIMERS, DETONATORS AND RELAYS						LEADS	
Stab & Flash Initiated		Electric Initiated		Percussion Initiated			
Diameter	Tolerance	Diameter	Tolerance	Diameter	Tolerance	Diameter	Tolerance
0.112	-0.004	0.080	-0.004	0.1756	-0.0010	0.112	-0.004
0.125	-0.004	0.100	-0.004	0.2105	-0.0015	0.135	-0.004
0.147	-0.004	0.115	-0.004	0.2112	-0.0015	0.145	-0.004
0.161	-0.004	0.128	-0.004			0.161	-0.004
0.192	-0.004	0.148	-0.006			0.171	-0.004
0.241	-0.004	0.164	-0.006			0.192	-0.004
0.275	-0.004	0.194	-0.006			0.200	-0.004
		0.244	-0.006			0.224	-0.004
		0.278	-0.006				
		0.285	-0.006				
		0.317	-0.006				

TABLE II. Finished Lengths of Primers, Detonators, Relays and Leads
(Dimensions in Inches)

PRIMERS, DETONATORS AND RELAYS				LEADS	
Stab. Flash and Elec. Initiated		Percussion initiated			
Length	Tolerance	Length	Tolerance	Length	Tolerance
0.100	-0.005	0.119	-0.005	0.125	-0.005
0.125	-0.005	0.350	-0.005	0.150	-0.005
0.143	-0.005			0.175	-0.005
0.150	-0.005			0.200	-0.005
0.175	-0.005			0.225	-0.005
0.210	-0.005			0.250	-0.005
0.250	-0.005				
0.290	-0.005			(lead lengths may be increased beyond 0.250 inch in increments of 0.025 as required).	
0.315	-0.005				
0.342	-0.005				
0.370	-0.005				
0.395	-0.005				
0.436	-0.005				
0.475	-0.005				
0.532	-0.005				
0.542	-0.005				
0.560	-0.005				
0.740	-0.005				
0.780	-0.005				

TABLE III. Diameters of cups for Stab, Electric and Flash Initiated Components
(Dimensions in Inches)
(See 5.1.2.1) See Figures 1 through 4

Outside Diameter (Loaded)		CUP DIAMETER			
		OUTSIDE		BOTTOM HOLE	
Stab & Flash Initiated Diameter	Electric Initiated Diameter	Diameter	Tolerance	Diameter	Tolerance
-	0.080				
-	0.100			0.060	+0.004
0.112	0.115	0.110	-0.002	0.060	+0.004
0.125	0.128	0.123	-0.002	0.080	+0.004
0.147	0.148	0.143	-0.002	0.080	+0.004
0.161	0.164	0.159	-0.002	0.100	+0.004
0.192	0.195	0.190	-0.002	0.120	+0.004
0.241	0.244	0.239	-0.002	0.140	+0.004
0.275	0.278	0.273	-0.002		
-	0.285	0.280	-0.002		
-	0.317	0.312	-0.002		

The inside diameter is to be established by the designer to suit individual application. TYPICALLY the inside diameter is toleranced +.002 and the wall thickness usually ranges between .005" and .012".

TABLE IV. Dimensions of Cups for Leads (Dimensions in Inches)
(See 5.1.2.2 and Figures 1 and 3)

Outside Diameter (loaded)	Metal Parts (cups)			
	Outside		Flange	
	Diameter	Tolerance	Diameter	Tolerance
0.112	0.110	-0.002	0.165	-0.006
0.135	0.133	-0.002	0.185	-0.006
0.145	0.143	-0.002		
0.161	0.159	-0.002		
0.171	0.169	-0.002	0.250	-0.006
0.192	0.190	-0.002		
0.200	0.198	-0.002	0.280	-0.006
0.224	0.222	-0.002	0.305	-0.006

The inside diameter and bottom thickness is to be established by the designed to suit individual application. TYPICALLY the inside diameter is tolerranced +.002" and the wall thickness usually ranges between .005" to .012".

TABLE V. Structural Materials for Use in Fabrication of Metal Parts

Part	Material	Specification
Primer & Detonator Cups & Discs & Lead Cups	Aluminum 1100-0	QQ-A-250/1
	Aluminum 3003	QQ-A-250/2
	Aluminum 5052	QQ-A-250/8
	Aluminum 2017	QQ-A-225/5
	Stainless Steel (Annealed) (including AISI 303 & 305- no applicable government spec)	MIL-S-5059
	Kovar - Iron Nickel (Alloys for sealing to glass and ceramics)	MIL-I-23011

TABLE VI. Color Identification of Finished Primers, Detonators, Delays and Relays (See 5.4)

Component	Sensitive End	Output End
Percussion Primers	Red	
Stab Primers	Red	Green
Stab Detonators	Red	Green
Percussion Delays	Red	Green
Stab Delays	Red	Green
Flash Detonators	Red	Yellow
Flash Relays	Red	Yellow
Flash Delays	Red	Yellow
Leads	Blue	Green
Inert	Black	--

Red	=	either No. 11136 or 11105	Spec. MIL-L-10287
Green	=	No. 14110	" MIL-L-10287
Blue	=	No. 15102	" MIL-L-10287
Yellow	=	No. 13655	" MIL-L-10287
Black	=	No. 17038	

6. Notes

The following reports may be helpful in determining dimensions and materials for explosive components.

(a) Military Handbook 127, "Fuze Catalog Fuze Explosive Components" - Explosive Trains, Volume 3 - Confidential

(b) Sandia Report SC-M-70-355 Aug 1970 "Compatibility of Explosives with Structural Materials of Interest" R.J. Buxton & T.M. Massis

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