NATO OTAN

NATO STANDARDIZATION AGENCY
AGENCE OTAN DE NORMALISATION

NSA

Military Committee Air Standardization Board
(MCASB)

13 May 2008 NSA(AIR)0393(2008)AA/3585

MCASB

STANAG 3585 - AA (EDITION 6) -20 MM AMMUNITION AND LINKS FOR AIRCRAFT GUNS

References:
A. NSA(AIR)0633(2007)AA/3585 dated 26 June 2007 (Edition 6)(Ratification Draft 1)
B. NSA(AIR)0289-AA/3583 dated 26 March 2003. (Edition 5)

1. The enclosed NATO Standardization Agreement which has been ratified by nations as reflected in the **NATO Standardization Document Database (NSDD),** is promulgated herewith.

2. The references listed above are to be destroyed in accordance with local document destruction procedures.

ACTION BY NATIONAL STAFFS

3. National staffs are requested to examine their ratification status of the STANAG and, if they have not already done so, advise the Air Board, NSA, through their national delegation as appropriate of their intention regarding its ratification and implementation.

Juan A. MORENO
Vice Admiral, ESP(N)
Director, NATO Standardization Agency

Enclosure:
STANAG 3585 (Edition 6)

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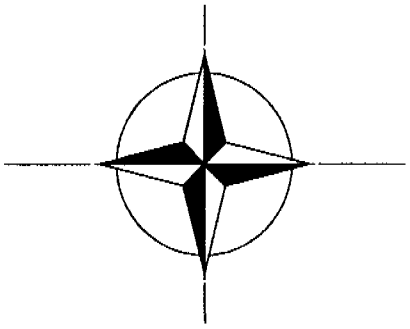
STANAG 3585
(Edition 6)

NORTH ATLANTIC TREATY ORGANIZATION
(NATO)



NATO STANDARDIZATION AGENCY
(NSA)

STANDARDIZATION AGREEMENT
(STANAG)

SUBJECT: 20 MM AMMUNITION AND LINKS FOR AIRCRAFT GUNS

Promulgated on 13 May 2008

Juan A. MORENO
Vice Admiral, ESP(N)
Director, NATO Standardization Agency

RECORD OF AMENDMENTS

No.	Reference/date of Amendment	Date Entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Director NATO Standardization Agency under the authority vested in him by the NATO Standardization Organisation Charter.

2. No departure may be made from the agreement without informing the tasking authority in the form of a reservation. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

4. Ratification, implementation and reservation details are available on request or through the NSA websites (internet http://nsa.nato.int; NATO Secure WAN http://nsa.hq.nato.int).

FEEDBACK

5. Any comments concerning this publication should be directed to NATO/NSA – Bvd Leopold III - 1110 Brussels - BEL.

STANAG 3585
(Edition 6)

NATO STANDARDIZATION AGREEMENT
(STANAG)

20 MM AMMUNITION AND LINKS FOR AIRCRAFT GUNS

Annexes : A. Ammunition characteristics
B. Link and belt characteristics
C. Inspection for Re-use and Storage

Related Documents:

STANAG 4110 LAND	DEFINITION OF PRESSURE TERMS AND THEIR INTER-RELATIONSHIP FOR USE IN THE DESIGN AND PROOF OF CANNONS OR MORTARS AND AMMUNITION
STANAG 4157 PPS	FUZING SYSTEMS: TEST REQUIREMENTS FOR THE ASSESSMENT OF SAFETY AND SUITABILITY FOR SERVICE
STANAG 4187 PPS	FUZING SYSTEMS – SAFETY DESIGN REQUIREMENTS
STANAG 4234 PPS	ELECTROMAGNETIC RADIATION (RADIO FREQUENCY) – 200kHz TO 40 GHz ENVIRONMENT – AFFECTING THE DESIGN OF MATERIEL FOR USE BY NATO FORCES
STANAG 4235 PPS	ELECTROSTATIC DISCHARGE ENVIRONMENT
STANAG 4236 PPS	LIGHTNING ENVIRONMENT
STANAG 4240 PPS	LIQUID FUEL/EXTERNAL FIRE, MUNITION TEST PROCEDURES
STANAG 4370 PPS	ENVIRONMENTAL TESTING
STANAG 4375 PPS	SAFETY DROP, MUNITION TEST PROCEDURE
STANAG 4382 PPS	SLOW HEATING, MUNITIONS TEST PROCEDURES
STANAG 4423 PPS	CANNON AMMUNITION (12.7 TO 40mm) SAFETY AND SUITABILITY FOR SERVICE EVALUATION
STANAG 4439 PPS	POLICY FOR INTRODUCTION; ASSESSMENT AND TESTING OF INSENSITIVE MUNITIONS (MURAT)

AOP-2	THE IDENTIFICATION OF AMMUNITION
AOP-15	GUIDANCE ON THE ASSESSMENT OF THE SAFETY AND SUITABILITY FOR SERVICE OF NONNUCLEAR MUNITIONS FOR NATO ARMED FORCES
AOP-20	MANUAL OF TESTS FOR THE SAFETY QUALIFICATION OF FUZING SYSTEMS
AECTP-200	ENVIRONMENTAL CONDITIONS

AIM

1. The aim of this agreement is to ensure operational interchangeability through the adoption of a standard 20 mm ammunition, links and linked ammunition for use in NATO aircraft guns.

AGREEMENT

2. Participating NATO nations agree that when 20 mm weapons are introduced as aircraft guns deployed within their armed forces, they will use as a standard, 20 mm ammunition, and the associated links if applicable, in accordance with this STANAG.

DETAILS OF THE AGREEMENT

3. The ammunition and links shall comply with the following requirements:

a. The principal characteristics of 20 mm ammunition in the Type 1 Low Drag and Type 2 High Drag series, shall conform to those detailed in Annex A.

b. The principal characteristics of the links shall conform to those detailed in Annex B.

c. Until STANAG 4423 is promulgated, the ammunition shall be designed, tested and assessed in accordance with national requirements. (e.g., OB Pillar Proc P107). Pressure terms shall be in accordance with STANAG 4110.

d. The ammunition containing fuzes shall be designed, tested and assessed in accordance with STANAGs 4187 and 4157.

e. The ammunition shall be accepted as safe and suitable for service by the appropriate National Authority in accordance with AOP-15.

f. The ammunition shall be tested and assessed in accordance with STANAG 4439 for slow and fast cook-off.

g. The ammunition shall be manufactured in accordance with specifications prepared by national government agencies, which as a minimum should reflect the requirements of this agreement

h. Stocks of ammunition shall be periodically inspected in accordance with surveillance criteria approved by national government agencies. Ammunition lots not meeting the performance or safety criteria prescribed in this STANAG shall be considered not suitable for use by NATO forces.

4. Ammunition that meets these requirements shall be marked with the NATO symbol of operational interchangeability in accordance with AOP-2.

IMPLEMENTATION OF THE AGREEMENT

5. This STANAG is implemented when a nation has issued the necessary orders or instructions to the forces concerned putting the procedures detailed in this agreement into effect.

ANNEX A to
STANAG 3585
(Edition 6)

AMMUNITION CHARACTERISTICS

PHYSICAL CHARACTERISTICS

1. Dimensions. See pages A-5 and A-6.

2. Mass. (For currently fielded ammunition; to be used as a reference, only, for new design ammunition):

a.	Cartridge	Type 1 Low Drag	TP	260.7 g + 2 g
			TP-T	261.2 g + 2 g
			SAPHEI	260.0 g + 2 g
		Type 2 High Drag	TP	255.0 g max
			TP-T	256.9 g max
			HEI	256.9 g max
			SAPHEI	256.9 g max
b.	Projectile	Type 1 Low Drag	TP	106.0 g + 2 g
			TP-T	101.5 g + 2 g
			SAPHEI	101.5 g + 2 g
		Type 2 High Drag	TP	100.5 g max
			TP-T	101.4 g max
			HEI	101.4 g max
			SAPHEI	101.4 g max

3. Initiation. Electrical.

   a. Primer Sensitivity.

      (1) All fire threshold 10 µs discharge from 2 microfarad capacitor charged at 160 VDC.

4. Bullet Pull. The force required to extract the projectile from the cartridge shall be between 12.5 kN and 4.9 kN.

5. Projectile Torque. The projectile shall withstand a torque of not less than 1.13 Nm without rotation movement in the case.

PERFORMANCE CHARACTERISTICS

6. General

a. Test Weapon. The nominated test weapon for this ammunition is the Gun, Automatic, 20 mm, M61A1 or M61A2, or the Mauser Ammunition Test Equipment (MATE). For the functioning, casualty test the M61A1 or M61A2 automatic gun shall be used.

b. Test Barrel. The performance measurements are to be taken using Part Number 11075229 test barrel or the MATE; or an approved alternative with rifling and chamber as defined in Annex A, pages A-6 and A-7, may be used.

c. Temperatures. Performance measurements are to be taken with ammunition conditioned as follows:

Temperature	Time
Ambient: 21°C	2 hours minimum
Cold: -54°C	12 hours ± 30 min.
Hot: 71°C	12 hours ± 30 min

71°C is the maximum temperature that can be reached by the effect of kinetic heating alone. On removal from the conditioning chambers the ammunition must be fired as soon as possible and the ammunition should not sit in the chamber of the test weapon for more than 30 seconds.

d. Operating Temperature Range. The temperature range over which this ammunition is expected to operate is -54°C to 71°C. This is in accordance with relevant Climatic Categories A*, B*, C*, as defined in STANAG 2895 and takes into account kinetic heating and gun firing effects.

7. Pressure. All pressure measurements shall be taking using piezo-electric transducers. All pressure terms shall be in accordance with STANAG 4110.

a. Chamber Pressure. The Extreme Service Condition Pressure (ESCP) + 3sd shall be less than 450 MPa piezo (the Maximum Operating Pressure (MOP)) which shall be less than the System Permissible Maximum Pressure. The standard chamber pressure measurement location shall be 46.0 mm from the rear face of the test barrel.

b. Projectile Permissible Maximum Pressure. The Projectile Permissible Maximum Pressure shall be greater than 450 MPa piezo.

c. Muzzle Pressure. At all points within the operating temperature range, the mean muzzle pressure shall be less than 41 MPa.

8. Action Time

Temperature	Each Cartridge Action Time	Test Sample Mean Action Time Plus 4 Standard Deviation
Hot: 71°C ± 1°C	< 4.0 ms	<4.0 ms
Ambient: 21°C ± 1°C	< 4.0 ms	<4.0 ms
Cold: -54°C ± 1°C	< 4.0 ms	<4.0 ms

9. Exterior Ballistics

a. Dispersion. At 21°C ± 2°C, the pooled dispersion of five ten-round groups shall not exceed 0.4 milliradians, 1-σ when measured at a range of 200 m.

b. Time of Flight. At 21°C ± 2°C when fired through the test barrel at a range of 1000 m the time of flight shall be as follows:

Cartridge	Time of Flight
Type 1 Low Drag, all projectile types	1.236 sec
Type 2 High Drag, all projectile types	1.349 sec

The Standard Deviation of the time of flight shall not exceed 2%. (Corrections may be applied when the atmospheric conditions are not those of the International Standard Atmosphere).

10. Stability. The projectile when fired in the operating temperature range from a barrel near to the wear limits (4th quarter of its life) must be stable out to a range of 1000 m.

11. Arming Distance. The arming distance of fuzed ammunition at all temperatures within the operating temperature range shall be:

a. The HEI shall have armed within 6 to 11 m of the muzzle.
b. This parameter is not applicable to SAPHEI rounds.

12. Tracer Performance. Tracered rounds shall produce a continuous trace visible by day throughout the burning range viewed from points behind the gun. The tracer must show full brilliance from the muzzle and retain it up to a time of 2.5 seconds.

13. System Function. The functionality of the rounds shall be evaluated using the highest rate of fire anticipated at any point in the life cycle of the ammunition.

a. Linked. The ammunition and its link when fired in the nominated test weapon with a delinking feeder, must enable the gun to operate at a rate of fire of 3000 ± 200 shots per minute (spm), and within the performance specifications of the test weapon across the operational temperature range.

b. Linkless. The ammunition, when fired in the nominated test weapon with a linkless ammunition handling system, must enable the gun to operate at a rate of fire of 6000 ± 200 spm, and within the performance specifications of the test weapon across the operational temperature range.

c. Ground Support Equipment. Ammunition shall be capable of undergoing at least two upload and download cycles into an aircraft gun system at nominal loading rates without compromising the ammunition environmental seal or the ammunition performance in any way.

14. Cook off. Cook-off is the initiation of a round by heat transfer from its surrounding environment. Testing shall be in accordance with STANAG 4439.

a. Slow Cook-off requirement: cartridges shall be tested in accordance with STANAG 4382, Procedure 1. They shall withstand a temperature of 120°C without pyrotechnic function or explosive event.

b. Fast Cook-off requirement: test shall be in accordance with STANAG 4240 Standard Test.

OPERATIONAL ENVIRONMENT

15. Climate. The ammunition shall be capable of being:

a. Stored in climatic categories, from A1 through C2 as defined in STANAG 2895, for 20 years.

b. Used in climatic categories A1 through C2 as defined in STANAG 2895 for 3 months.

16. Packaged Ammunition Environment. Packaged ammunition shall not allow ingress of:

a. Water in conditions of driving rain as defined in STANAG 4370 (AECTP Method 310, Procedure II).

b. Dust or sand as defined in STANAG 4370 (AECTP Method 313, Procedure I and/or II).

17. Packaged Ammunition Handling. Packaged ammunition shall be safe to use the following:

a. Logistic transport vibration and bounce as defined in STANAG 4370 (AECTP Method 401, Procedure 3, and Method 406, Procedure I).

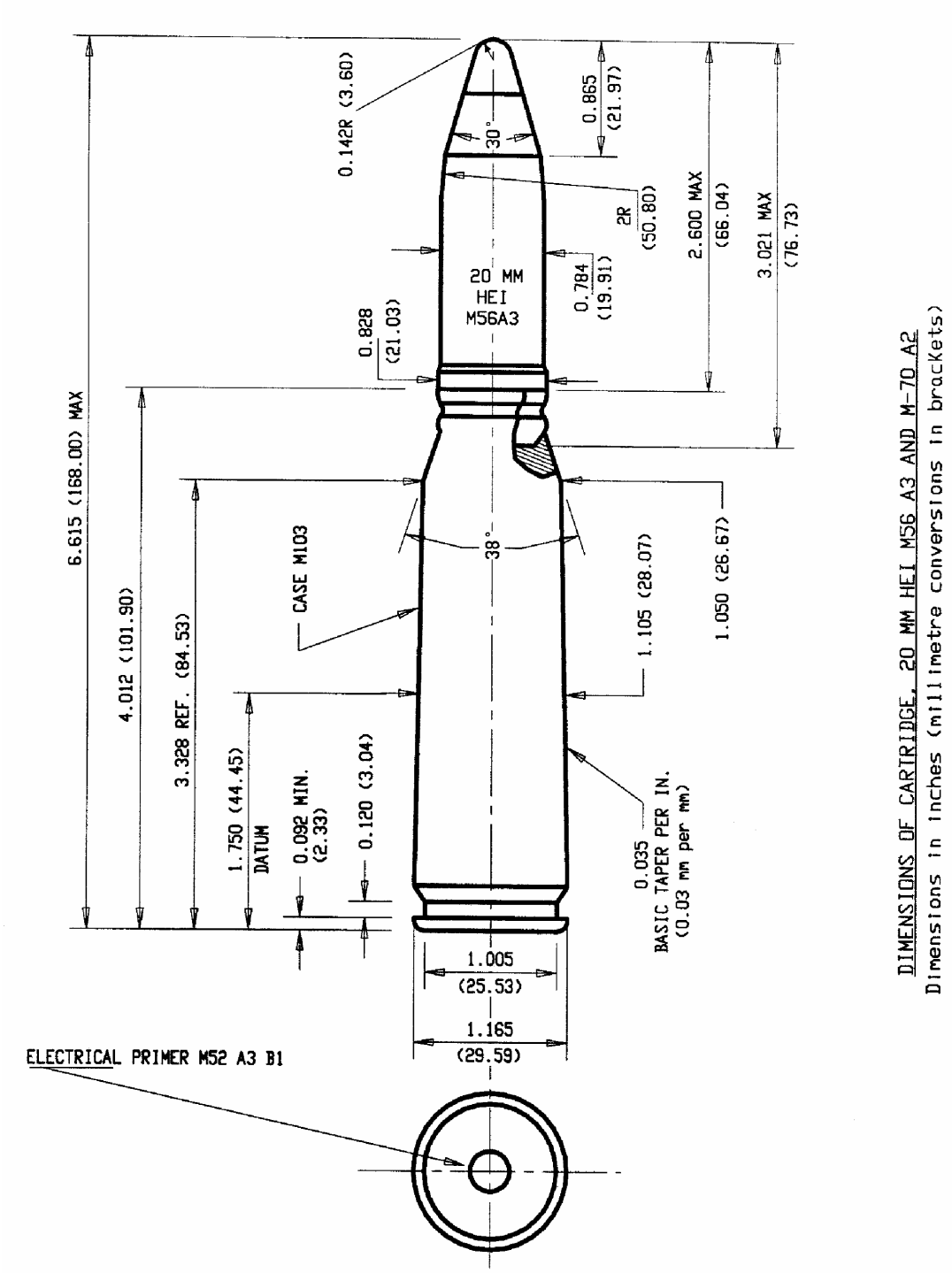
b. Dropping from a height of 12 m onto a hard surface per STANAG 4375, to determine whether the ammunition remains safe for disposal.

18. Unpackaged Ammunition. Unpackaged ammunition shall continue to function within specification after:

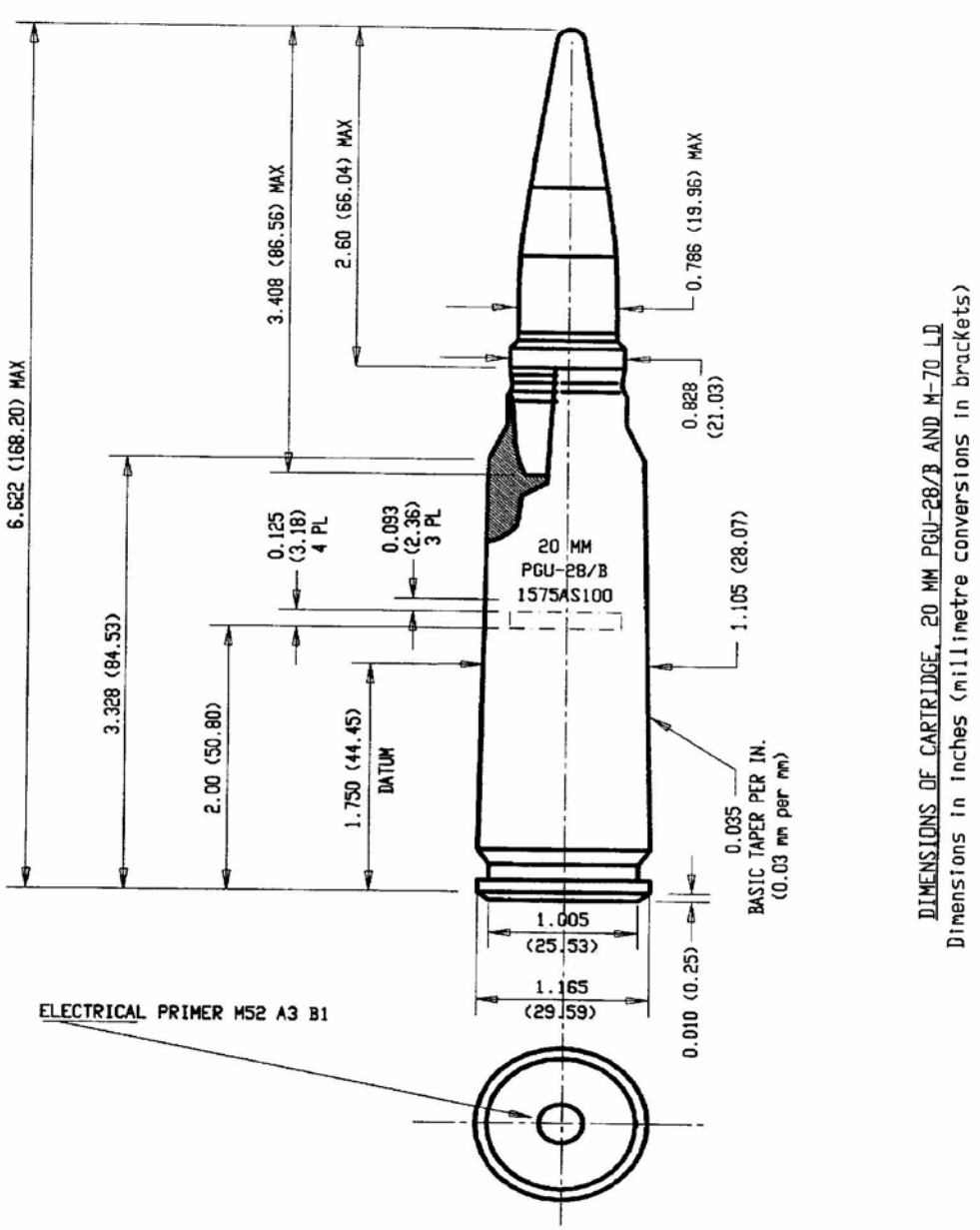
a. Exposure to salt mist for 24 hours as defined in STANAG 4370 (AECTP Method 309).

b. Immersion in water for 2 hours as defined in STANAG 4370 (AECTP Method 307, Procedure I).

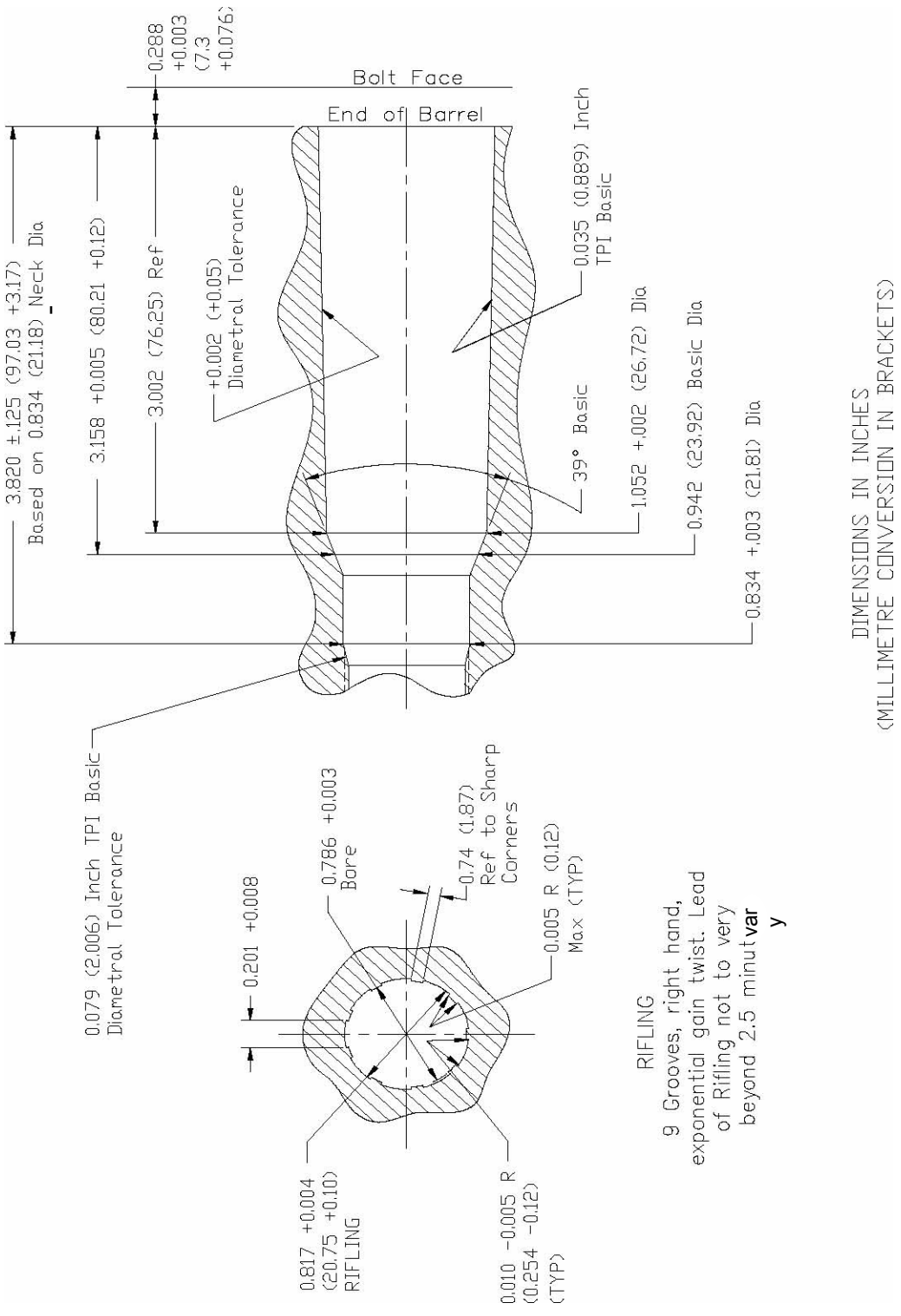
c. Dropping per either STANAG 4370 (AECTP Method 414, Procedure I (handling drop)) or AOP-20 Test A4 (1.5 m drop).



EXTERNAL DIMENSIONS, TYPE 2 HIGH DRAG 20 MM CARTRIDGE
(Typical values, for reference only)

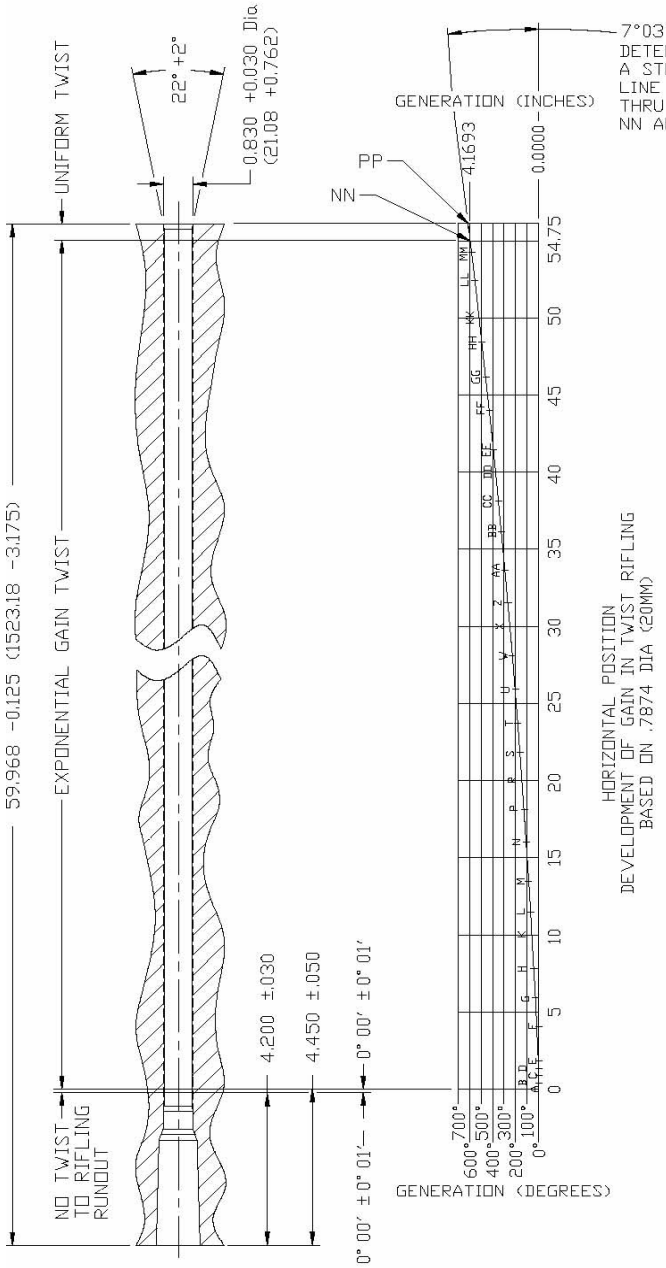


EXTERNAL DIMENSIONS, TYPE 1 LOW DRAG 20 MM CARTRIDGE
(Typical values, for reference only)



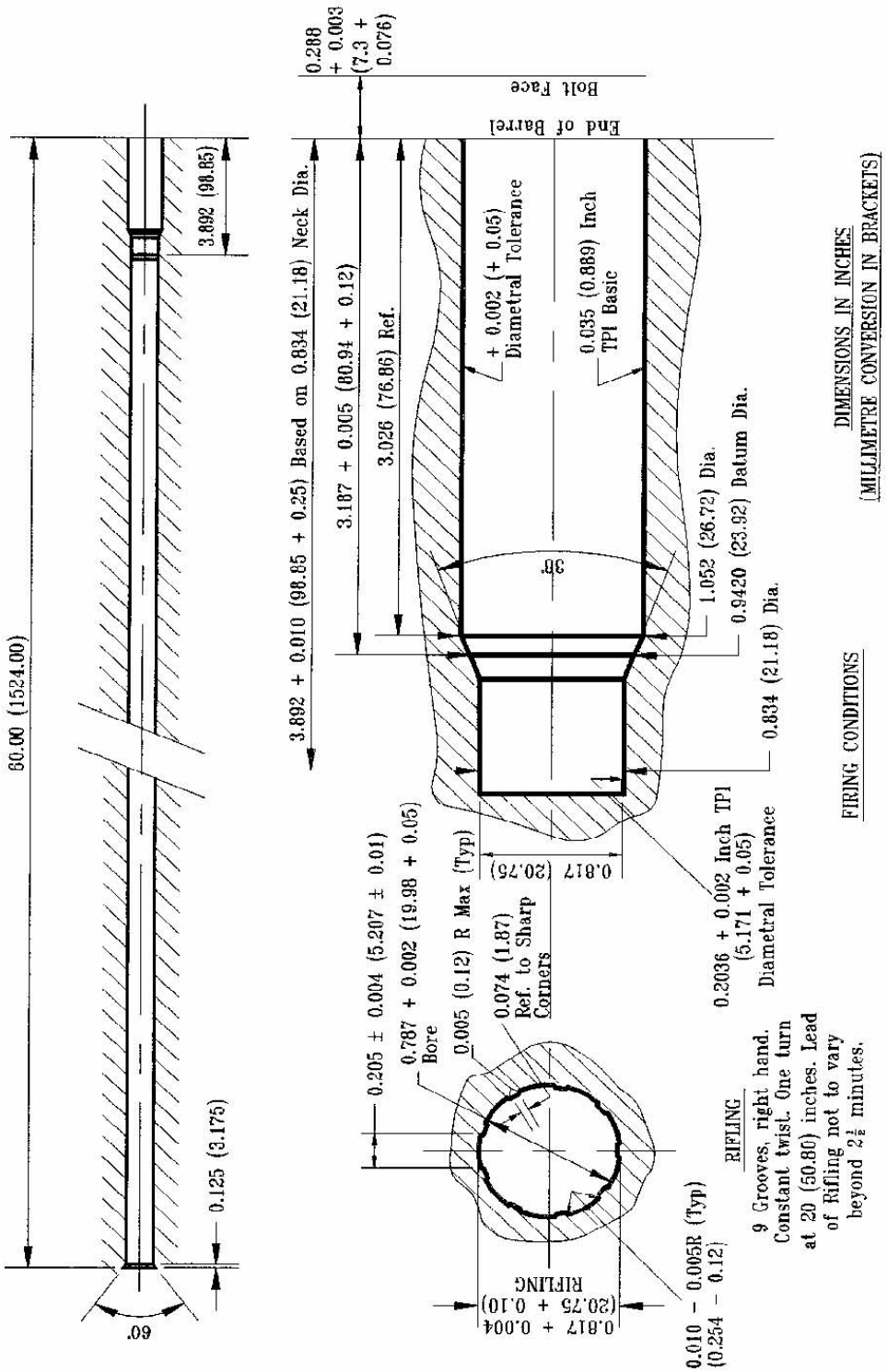
GUN AND CARTRIDGE INTERFACE

GUN AND CARTRIDGE INTERFACE (Contd.)



STATION	HORIZONTAL POSITION	GENERATION	
	(INCHES-DATUM)	DEGREES	INCHES
A	0.0000	0° 00′	.0000
B	0.5000	0° 17′	.0020
C	1.0000	0° 54′	.0062
D	1.5000	1° 46′	.0121
E	2.0000	2° 48′	.0192
F	4.0000	8° 39′	.0594
G	6.0000	16° 42′	.1147
H	8.0000	26° 39′	.1831
K	10.0000	38° 17′	.2631
L	12.0000	51° 30′	.3539
M	14.0000	66° 10′	.4546
N	16.0000	82° 12′	.5648
P	18.0000	99° 32′	.6839
R	20.0000	118° 07′	.8116
S	22.0000	137° 54′	.9476
T	24.0000	158° 51′	1.0915
U	26.0000	180° 55′	1.2431
W	28.0000	204° 04′	1.4022
X	30.0000	228° 17′	1.5686
Z	32.0000	253° 31′	1.7420
AA	34.0000	279° 46′	1.9224
BB	36.0000	307° 00′	2.1095
CC	38.0000	335° 11′	2.3032
DD	40.0000	364° 19′	2.5034
EE	42.0000	394° 23′	2.7100
FF	44.0000	425° 22′	2.9228
GG	46.0000	457° 13′	3.1417
HH	48.0000	489° 58′	3.3667
KK	50.0000	523° 34′	3.5976
LL	52.0000	558° 01′	3.8343
MM	54.0000	593° 18′	4.0768
NN	54.7500	606° 46′	4.1693

PERMISSIBLE VARIATION OF ANGULAR DEFLECTION NOT TO EXCEED ± 0° 10′



TEST BARREL RIFLING AND CHAMBER FORM

ANNEX B to
STANAG 3585
(Edition 6)

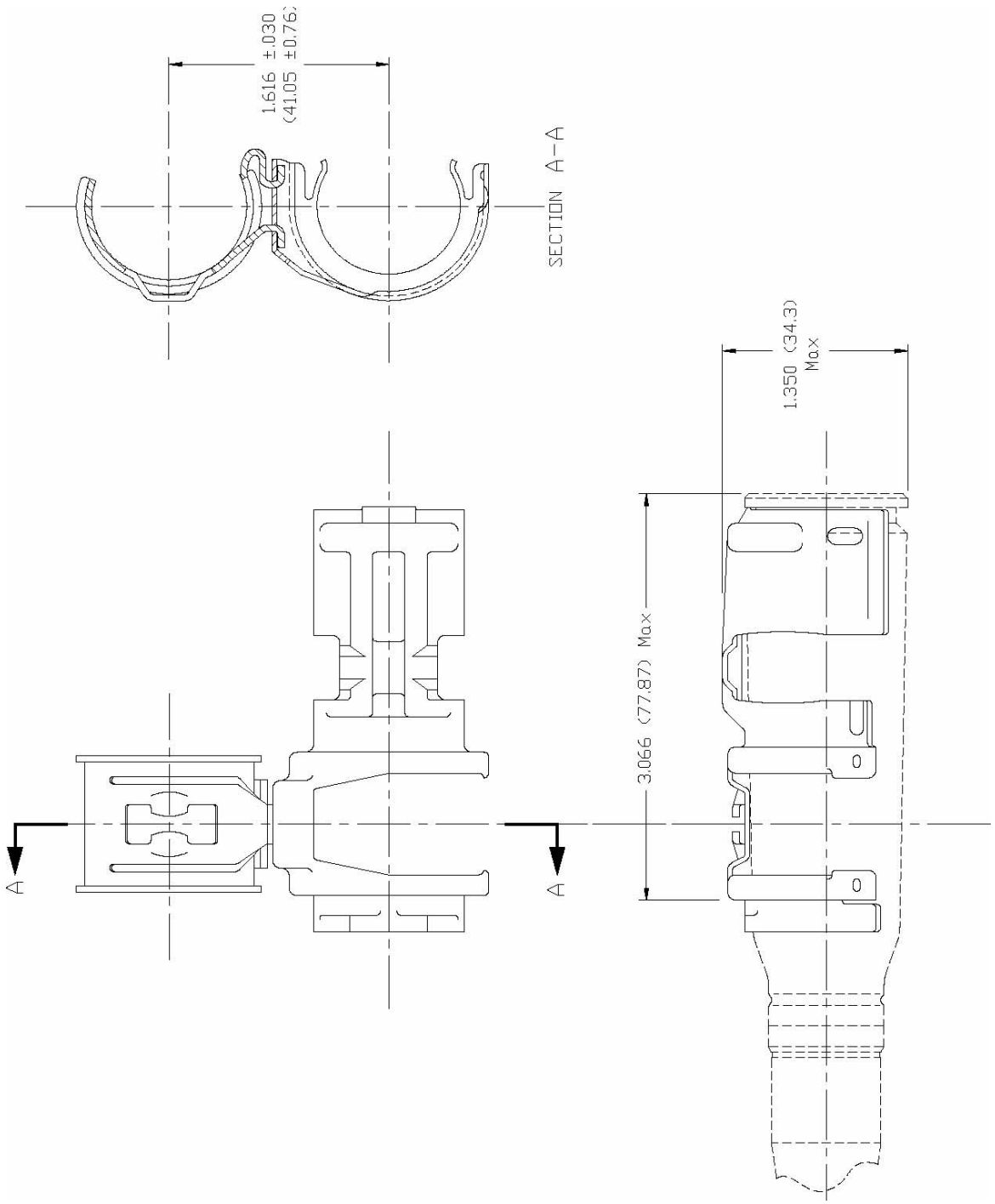
LINK AND BELT CHARACTERISTICS

LINK CHARACTERISTICS

1. Dimensions. See page B-2.

BELT CHARACTERISTICS

2.	Belt Pitch.	41.0 mm ± 0.76 mm
3.	Belt 180° Twist	16 rounds maximum
4.	Link Stripping Force	
	a. Forward Stripping.	Not applicable
	b. Sideward Stripping.	622 N minimum 845 N maximum
5.	Tensile Strength.	1.9 kN
6.	Belt Base Fan Radius.	103 mm maximum
7.	Belt Nose Fan Radius.	38 mm maximum
8.	Mass Per Link	51g average



EXERNAL DIMENSIONS 20 MM LINK

ANNEX C to
STANAG 3585
(Edition 6)

INSPECTION FOR RE-USE AND STORAGE OF 20 MM AMMUNITION

1. General - Due to the explosive nature of a hang-fire in external powered gun systems, special emphasis should be placed on inspection of ammunition to be re-used in those guns. The cartridge should be free of loose projectiles (any movement of the projectile in the cartridge case rejects cartridge), and free of any rounds with moisture, which is normally indicated by watermarks or a bluish-green corrosive ring area between the mouth of the cartridge case and rotating band. This condition is found to be caused by excessive exposure to and/or accumulation of water around that area.

Inspections will be performed to assure the serviceability of 20 mm ammunition downloaded from aircraft, gun pods, and ammunition loaders prior to re-use or storage. Inspection procedures are defined in NAVAIR 11-1-119 Section VIII, MIL-STD-651 and T.O. 11A13-4-7.

2. Inspection Definitions

Defect - A defect is a condition indicative of damage or deterioration. Defects are classified as critical, major or minor.

Stain - A stain is visible discoloration or contamination of metal surface or coating as a result of exposure to acid, salt, alkali products, or moisture and oxygen. Discernible etching in a stained area will be classified as corrosion.

Foreign Matter - Foreign matter is a discernible contamination of surface condition; oil, grease, dirt, chips, scale, flakes, brass shaving, or other substances alien to the finished item.

Long Round - A long round is a cartridge improperly positioned in the link which causes it to protrude ahead of other cartridges in the belt. This causes a bad hand-off (cartridge placed ahead of bolt) in the transfer of the cartridge from the link, resulting in a double feed and damaging the gun system. This term does not mean the cartridge (complete round) is too long.

Correctable Defect - Ammunition components having defects will be segregated, marked defective, and scheduled for maintenance.

Non-Correctable Defects - Cartridges with non-correctable defects will be rejected, segregated, marked defective and reported for disposition in accordance with Explosive Ordnance Disposal (EOD) procedures.

3. Defect Classification

Critical - A critical characteristic is one that analysis indicates is likely, if defective, to create or increase a hazard to human safety, or result in failure of a weapon system or major system to perform a required mission.

Major - A major characteristic is one that analysis indicates is not critical but likely, if defective, to result in failure of an end item to perform a required mission.

Minor - A minor characteristic is one that analysis indicates is significant to a product quality but is not likely, if defective, to impair the mission performance of the item.