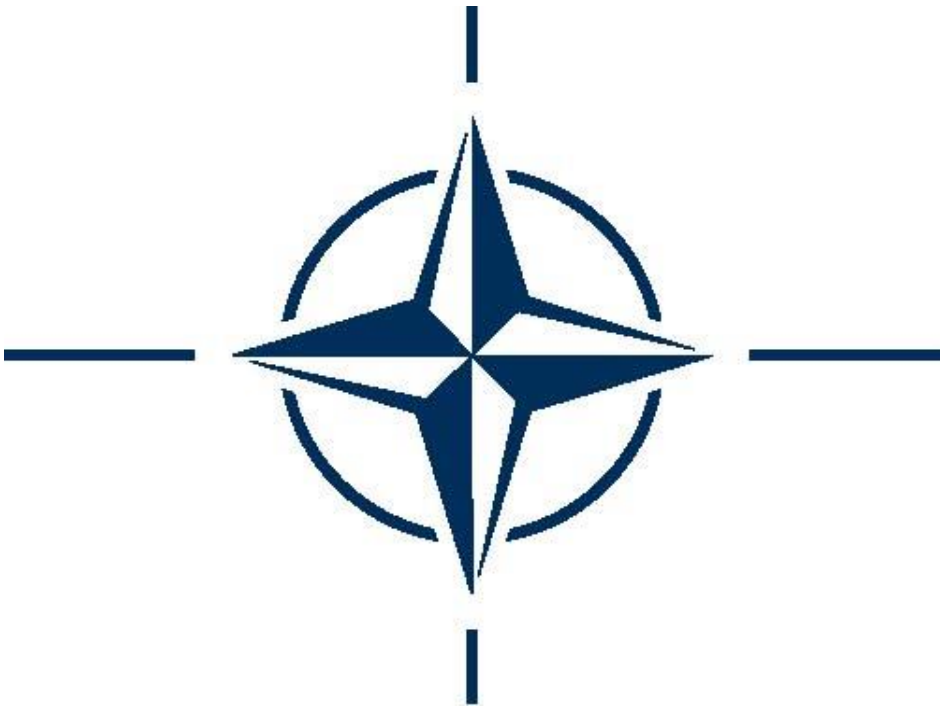
NATO STANDARD

AOP-68

NOSE FUZE CONTOURS AND MATCHING PROJECTILE CAVITIES FOR ARTILLERY AND MORTAR PROJECTILES

Edition A Version 1

AUGUST 2019



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NATO LETTER OF PROMULGATION

14 August 2019

1. The enclosed Allied Ordnance Publication AOP-68, Edition A, Version 1, NOSE FUZE CONTOURS AND MATCHING PROJECTILE CAVITIES FOR ARTILLERY AND MORTAR PROJECTILES, which has been approved by the nations in the CNAD AMMUNITION SAFETY GROUP (AC/326), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 2916.

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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CHAPTER 1 INTRODUCTION

1.1 GENERAL

1.1.1. The units used in Figures 1 through 14 (Annexes A, B, C, D) conform to the International System (SI) of metric units except those used for thread designations which are in English units (e.g. 2-12 UNS-1A).

1.1.2 Drawing practice and symbology are in accordance with the international methods covered in the "American National Standard Engineering Drawings and Related Documentation Practices", ANSI Y14.5M-1982.

1.1.3 Participating nations are to provide forecast dates when they will cease to use deep intrusion fuzes and/or deep intrusion fuze cavity details as per Figure 7 (Annex B). These forecast dates will be used during periodic review of this standard with a view to deleting these combinations when appropriate.

1.2 DETAILS OF THE AGREEMENT

1.2.1 In addition to physical interchangeability, the various types of nose fuzes (PD, prox, time) shall, when fired with a given projectile type, follow the same ballistic trajectory to the same burst point. Minor differences, which can be adjusted by specifying an appropriate firing table weight correction, are acceptable. Firings shall be used to confirm such performance.

1.2.2 Certain fuze/projectile combinations may require close control of fuze weight, center of gravity, and contour for ballistic consideration. As an example, for the 76mm Oto Melara, 3 inch 62 caliber, and 5 inch 54 caliber projectiles, a fuze weight of 952.56 ± 22.68 grams is preferred.

1.2.3 Preferred fuze contour and projectile cavity combinations must be in accordance with Figures 1 through 6 (Annex A). Currently available permissible fuze contour and projectile cavity combinations are shown in Figures 7 through 16 (Annex B). A currently permissible fuze adapter for artillery fuzes is shown in Figure 17 (Annex C).

1.2.4 Preferred automatic/hand setter slots for mechanical time, ring-set fuzes must be in accordance with Figures 18 and 19 (Annex D). Currently available permissible hand setter slots for ring-set fuzes are shown in Figures 20 and 21 (Annex E). The need for special setters for future hand set fuzes should be eliminated. New fuze setting techniques requiring special setter slots shall require NATO AC/326 approval prior to type classification.

1.2.5 The 1.5 and 2.0 inch mating threads (fuze and projectile) are standard threads. Other size mating threads are used, generally for safety reasons, to prevent interchangeability. Such examples are shown in Figures 9 and 10 (Annex B).

1.2.6 When mortar projectiles are pre-fuzed in manufacture without field re-fuzing intentions, intrusion dimensions are optional.

1.2.7 Deviations from the maximum material conditions shown for the fuze intrusion and projectile cavity shall take into account operational and safety considerations.

ANNEX A PREFERRED FUZE CONTOUR AND PROJECTILE CAVITY COMBINATIONS

A.1. INDEX OF FIGURES

Preferred fuze contour and projectile cavity combinations must be in accordance with Figures 1 through 6.

FUZE USE	CAVITY DIA/DEPTH	FIGURE
ARTY/MORTAR (HE/WP) SPIN OR FIN STABILISED	2 in./56 mm	1
ARTY/MORTAR (CARGO) SPIN STABILISED	2 in./42 mm	2
ARTY (CARGO) (ICM) SPIN OR FIN STABILISED	2 in./42 mm	3
MORTAR (CARGO) FIN STABILISED	2 in./16 mm	4
MORTAR (HE/CARGO) FIN STABILISED	1.5 in./28 mm	5
MORTAR (WP) FIN STABILISED	1.5 in./15 mm	6

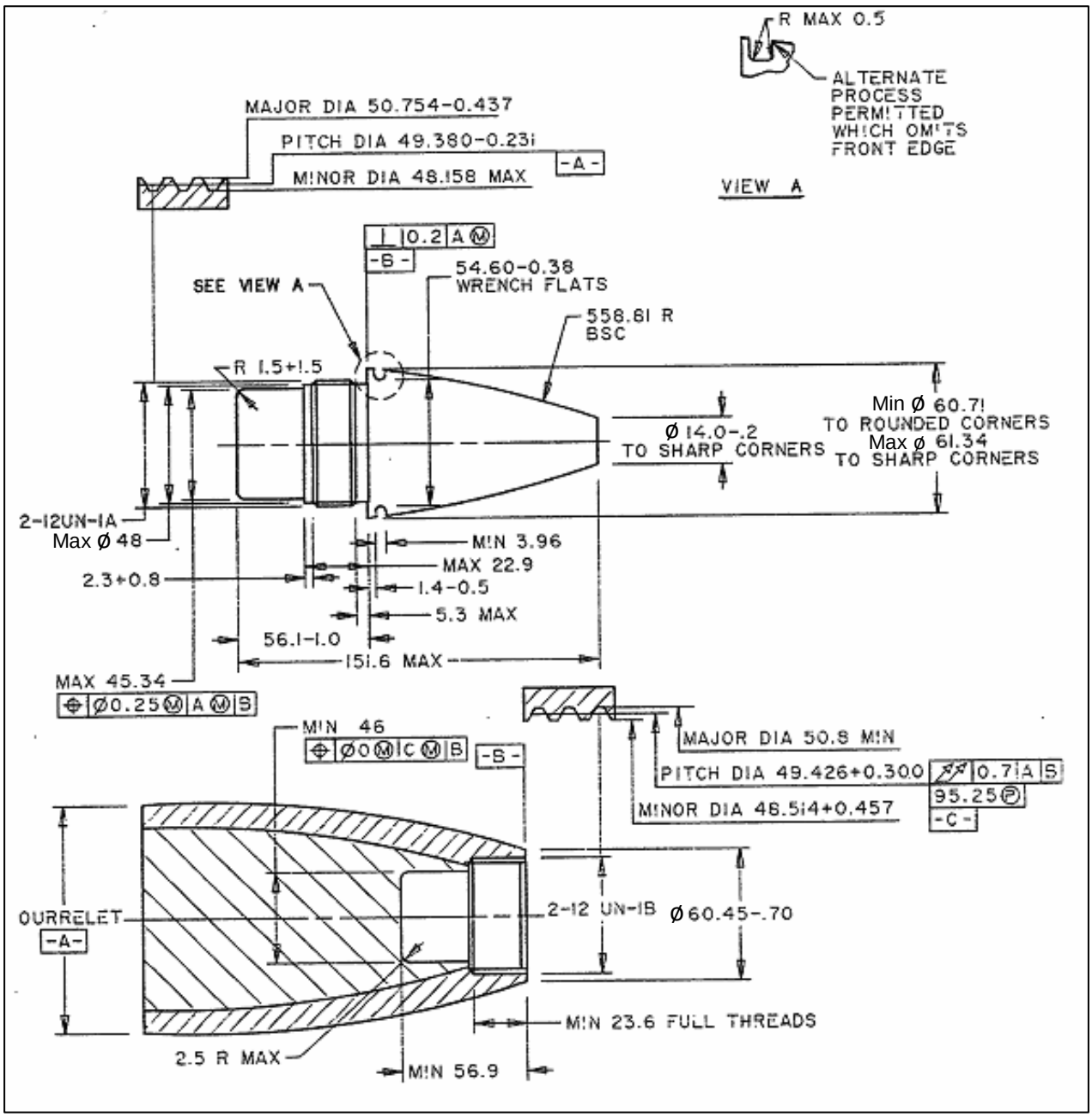

FIGURE 1: STANDARD CONTOUR FOR 2-INCH NOSE FUZES WITH BOOSTER AND MATCHING CAVITY FOR ARTILLERY AND MORTAR HE OR BURSTING TYPE PROJECTILES (SPIN OR FIN STABILISED).

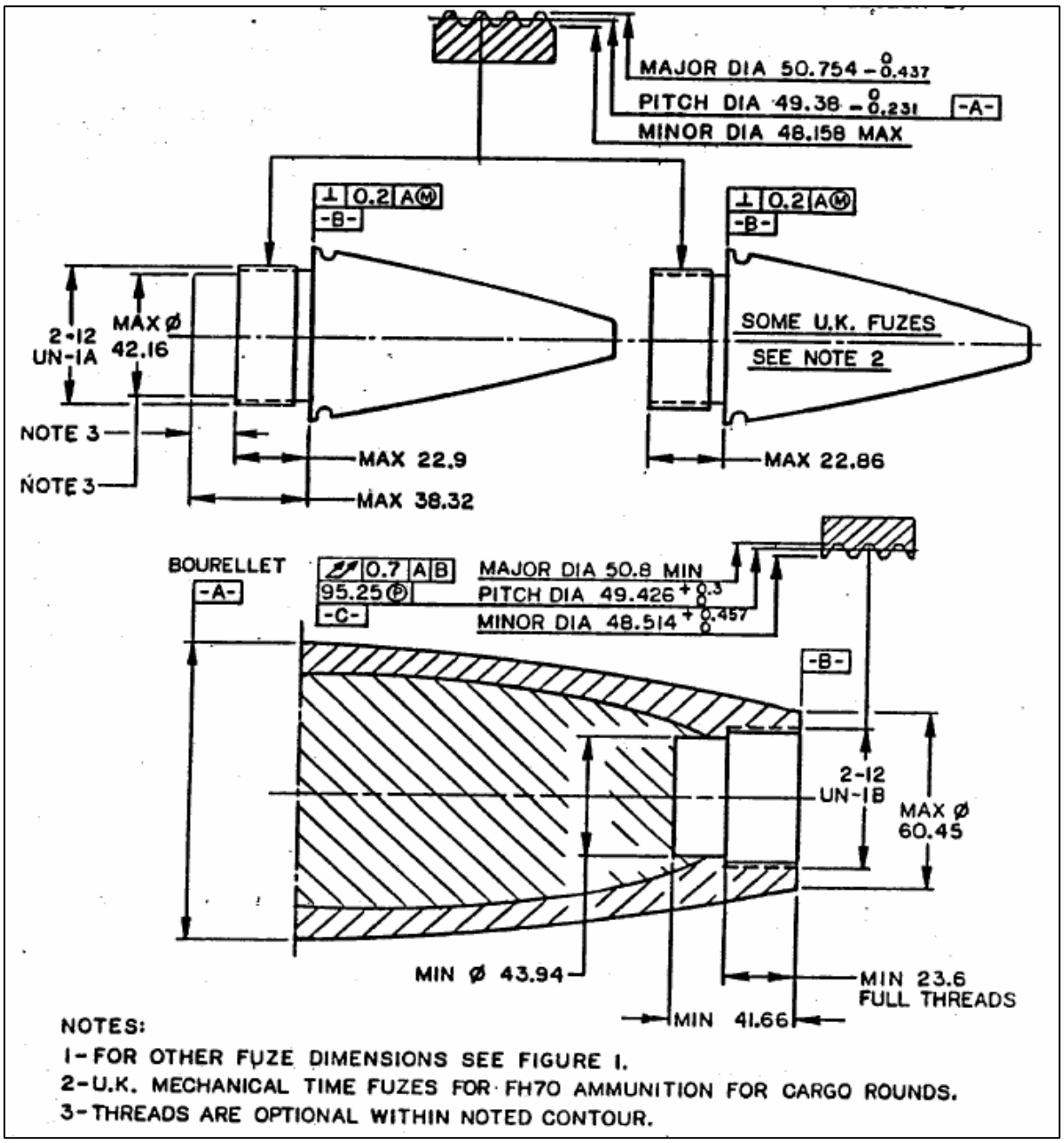

FIGURE 2: STANDARD CONTOUR FOR 2-INCH NOSE TIME FUZES AND MATCHING CAVITY FOR ARTILLERY AND MORTAR CARGO PROJECTILES (SPIN STABILISED)

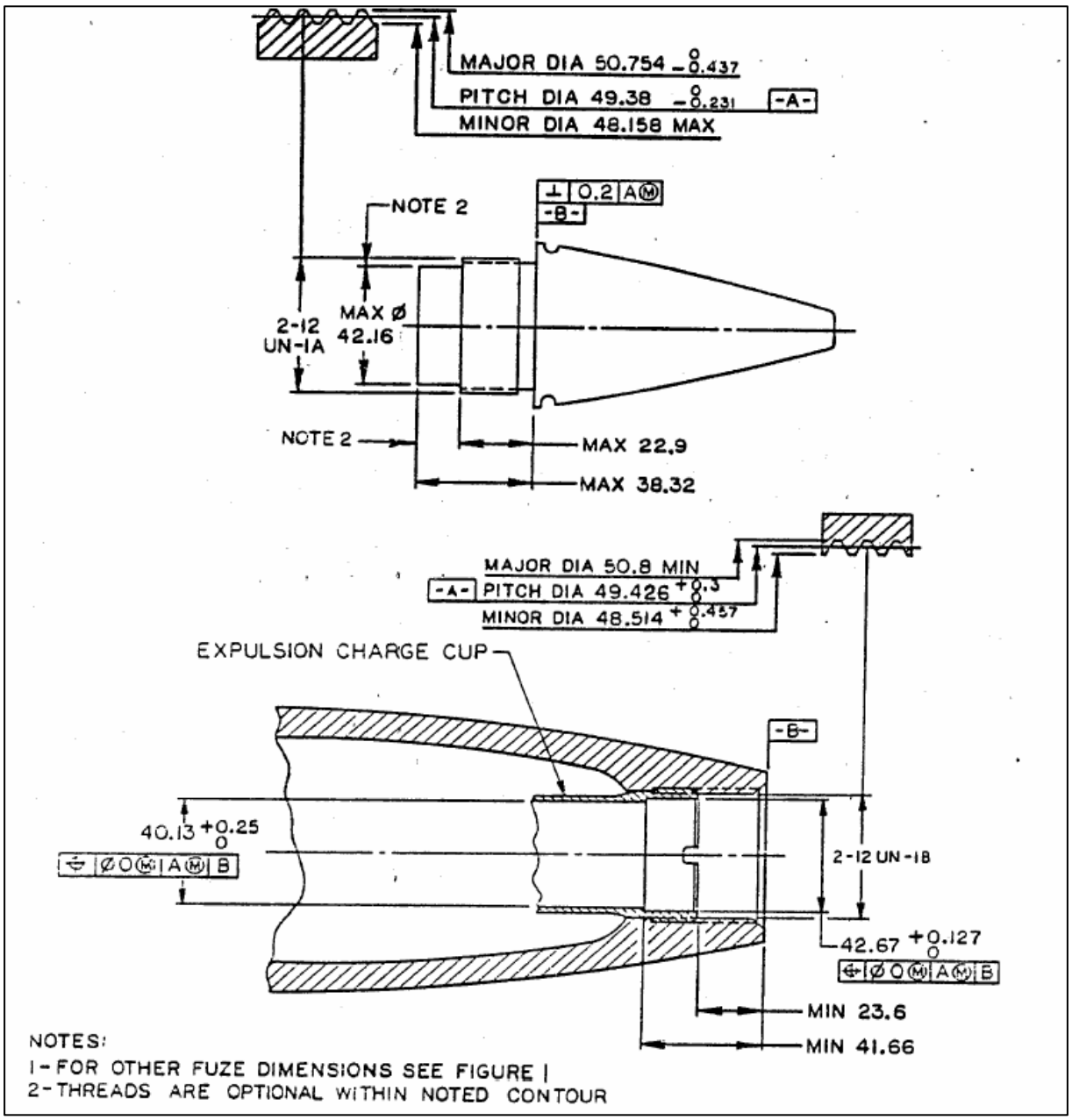

FIGURE 3: STANDARD CONTOUR FOR 2-INCH NOSE TIME FUZES AND MATCHING CAVITY FOR ARTILLERY AND MORTAR CARGO PROJECTILES (ICM) (SPIN OR FIN STABILISED)

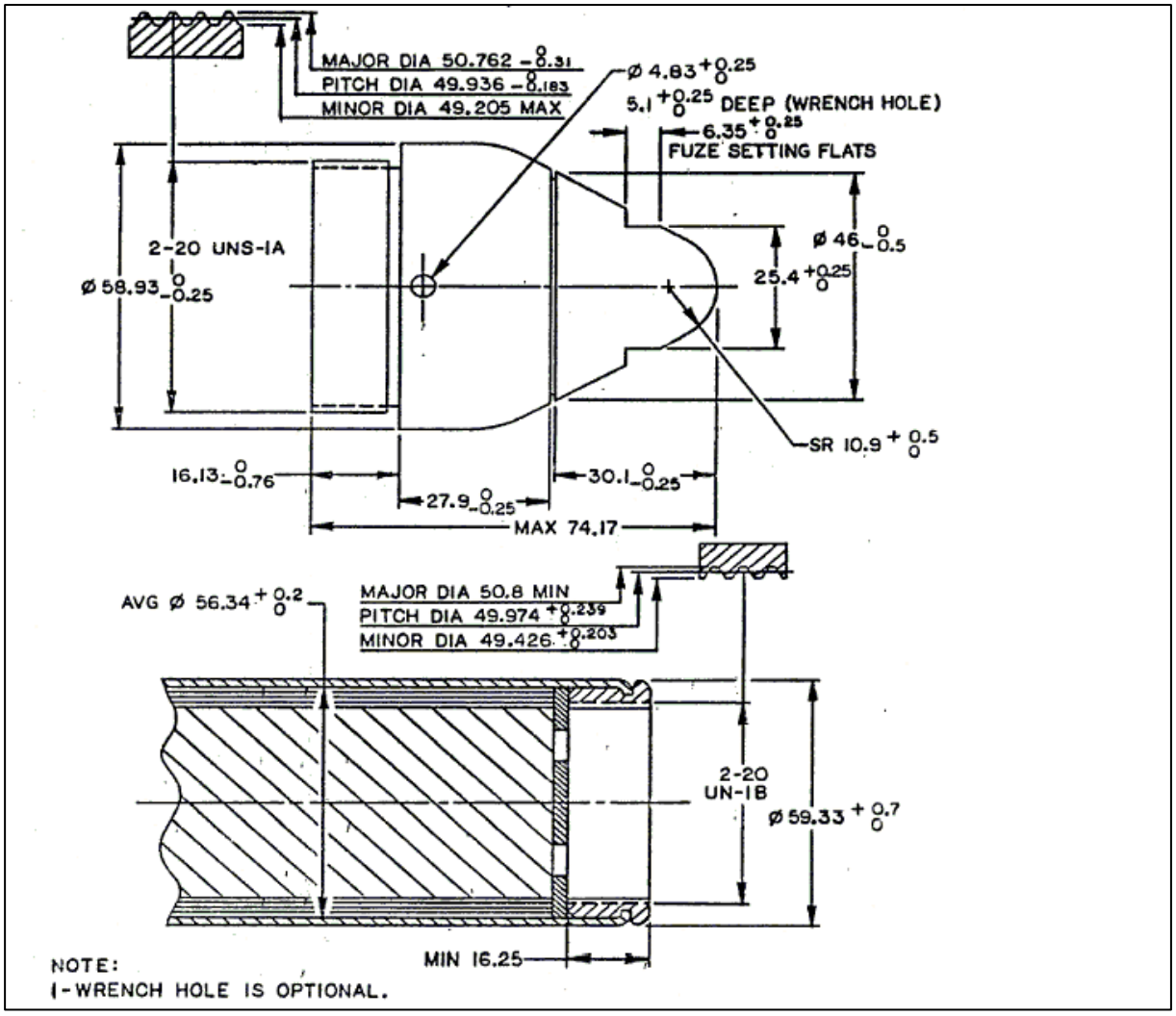

FIGURE 4: STANDARD CONTOUR FOR 60 MM MORTAR NOSE FUZES AND MATCHING CAVITY FOR 60 MM MORTAR CARGO PROJECTILE (FIN STABLISED)

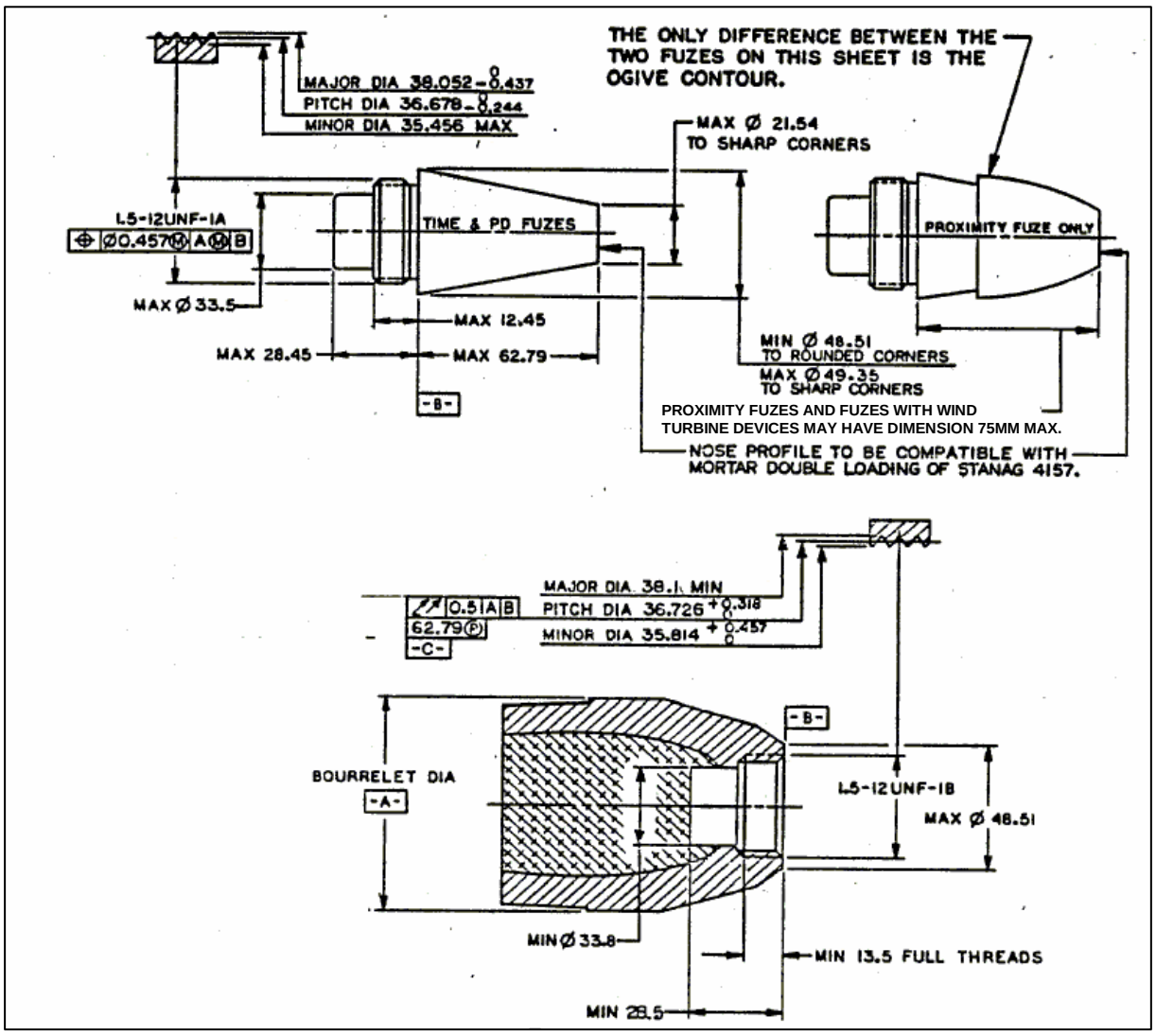

FIGURE 5: STANDARD CONTOUR FOR 1.5-INCH PROXIMITY, TIME AND POINT DETONATING FUZES WITH BOOSTER AND MATCHING CAVITY FOR 60 MM AND 81 MM MORTAR HE PROJECTILES (FIN STABILISED)

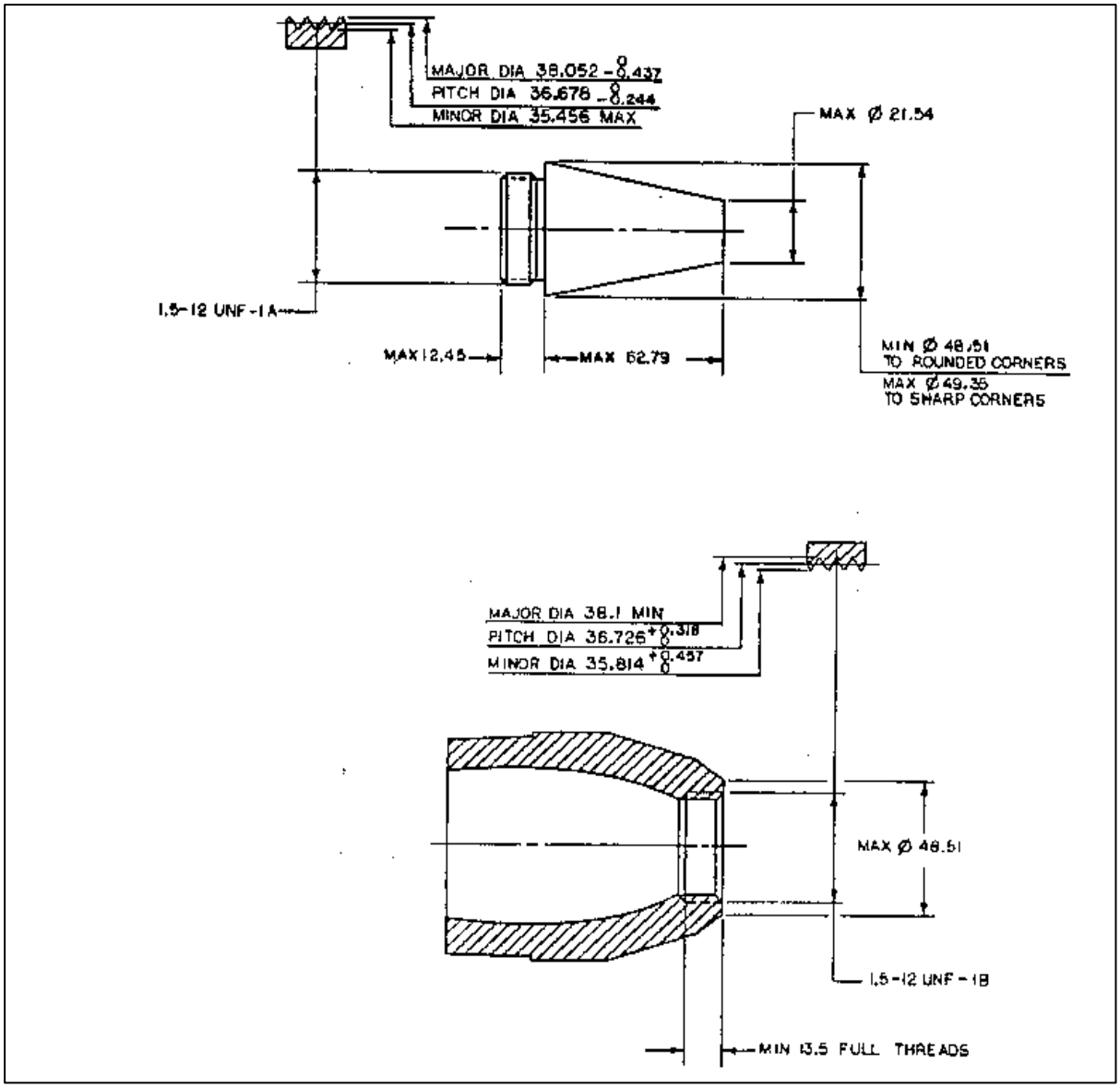

FIGURE 6: STANDARD CONTOUR FOR 1.5-INCH TIME AND POINT DETONATING FUZES AND MATCHING CAVITY FOR 60 MM AND 120 MM MORTAR CARGO PROJECTILES (FIN STABILISED)

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ANNEX B PERMISSIBLE FUZE CONTOUR AND PROJECTILE CAVITY COMBINATIONS

Index of Figures

Currently available permissible fuze contour and projectile cavity combinations are shown in Figures 7 through 16.

FUZE USE	CAVITY DIA / DEPTH	FIGURE
ARTY/MORTAR (HE) SPIN STABILISED	2 in./125 mm	7
ARTY (HE) (5 in./54 CALIBERS) SPIN STABILISED	2 in./57 mm	8
ARTY (CARGO) (APERS) SPIN STABILISED	1.9 IN./38 mm	9
MORTAR (ILLUM/SMOKE) FIN STABILISED	2.4 in./16 mm	10
ARTY (HE) (100, 122 and 152 mm) SPIN STABILISED; ARTY (HE) (125 mm) FIN OR SPIN STABILISED; MORTAR (120 mm) FIN STABILISED	1.5 in./36 mm	11
ARTY (TRAINING) 125 mm FIN STABILISED	1.5 in./36 mm	12
MORTAR (HE) (81 and 98 mm) FIN STABILISED	1.5 in./36 mm	13
MORTAR (HE) 120 mm FIN STABILISED	1.5 in./36 mm	14
ROCKET (HE) 122 mm FIN STABILISED	45 mm	15
ARTY (NAVAL) (HE) 76 mm SPIN STABILISED	2.3 in./58 mm	16

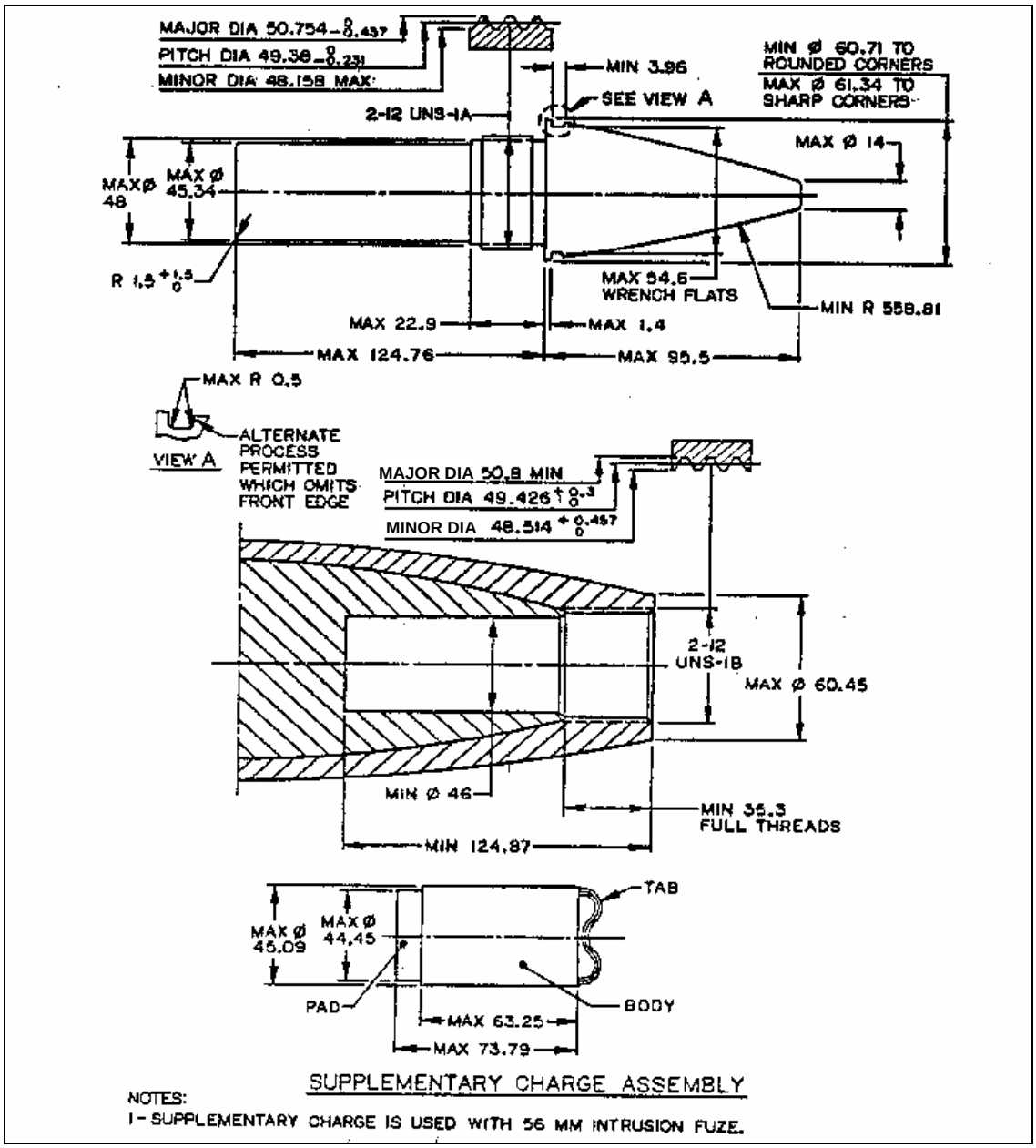


FIGURE 7: STANDARD CONTOUR FOR 125 MM INTRUSION 2-INCH PROXIMITY NOSE FUZES WITH BOOSTER AND MATCHING CAVITY FOR ARTILLERY AND MORTAR PROJECTILES (SPIN STABILISED)

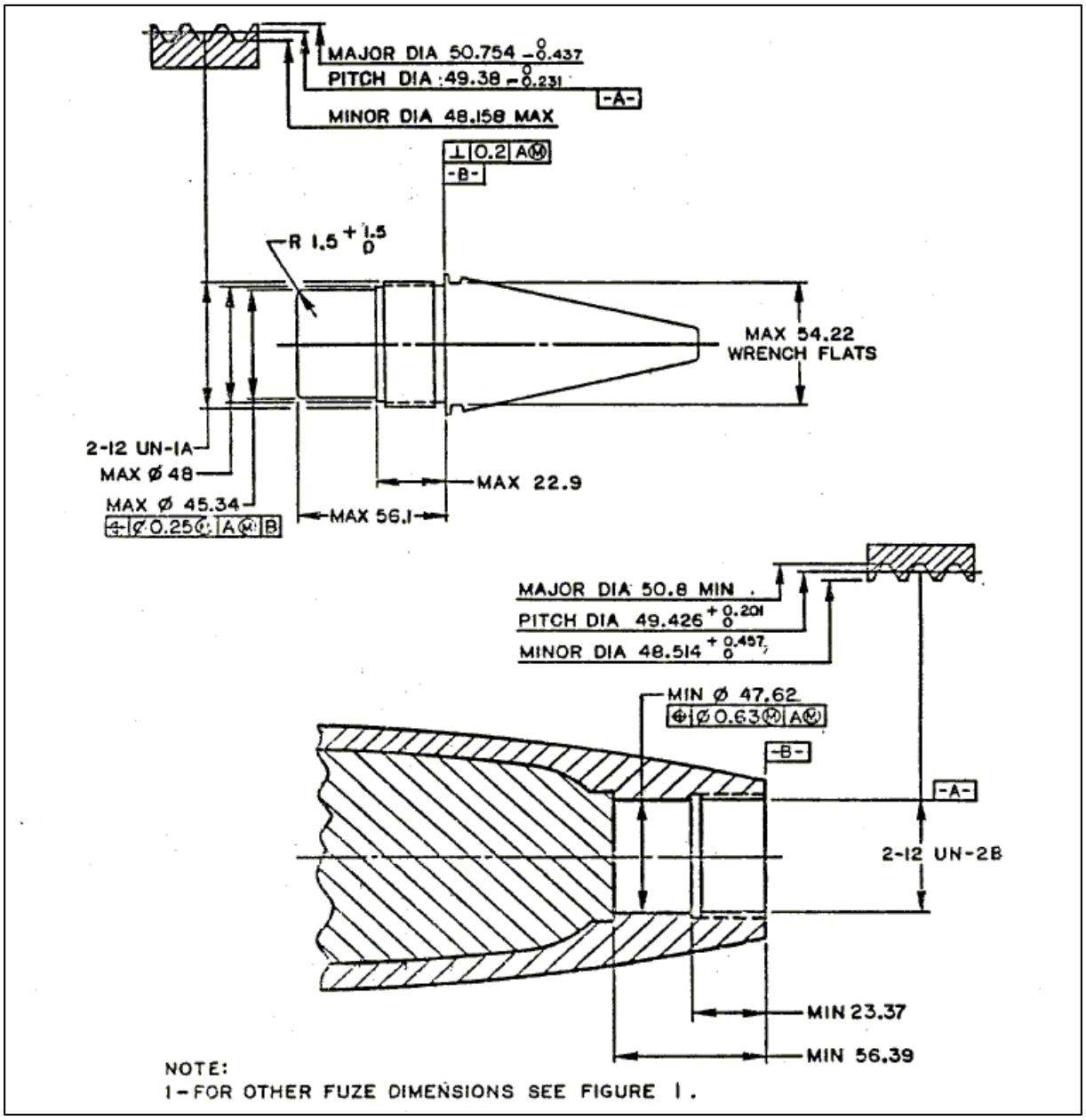


FIGURE 8: STANDARD CONTOUR FOR 2-INCH NOSE FUZES WITH BOOSTER AND MATCHING CAVITY FOR ARTILLERY HE EXPLOSIVE LOADING 5"/54 PROJECTILE (NAVY) (SPIN STABILISED)

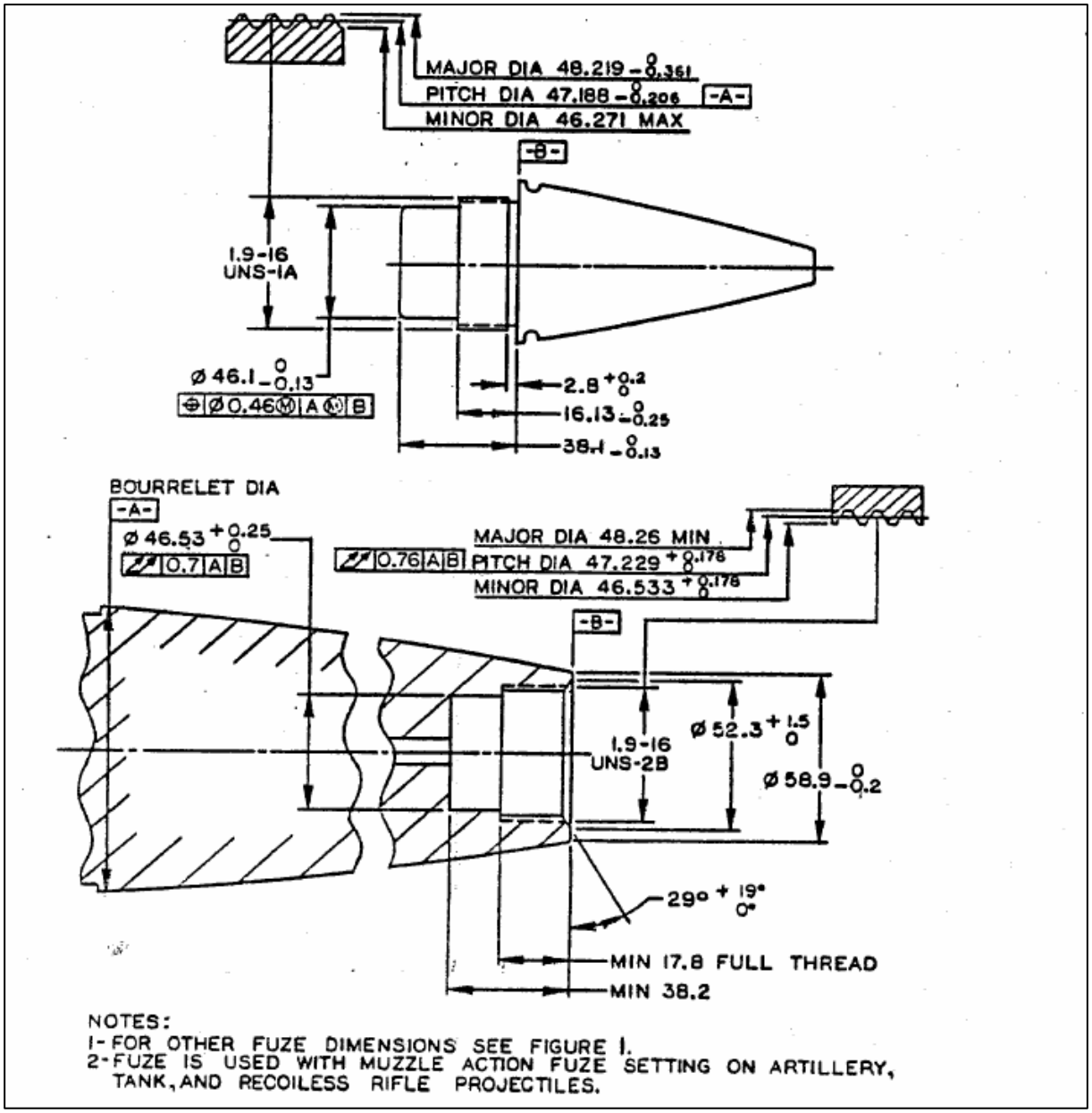


FIGURE 9: STANDARD CONTOUR FOR APERS NOSE FUZES AND MATCHING CAVITY FOR ARTILLERY, TANK AND RECOILLESS RIFLE PROJECTILES (SPIN STABILISED)

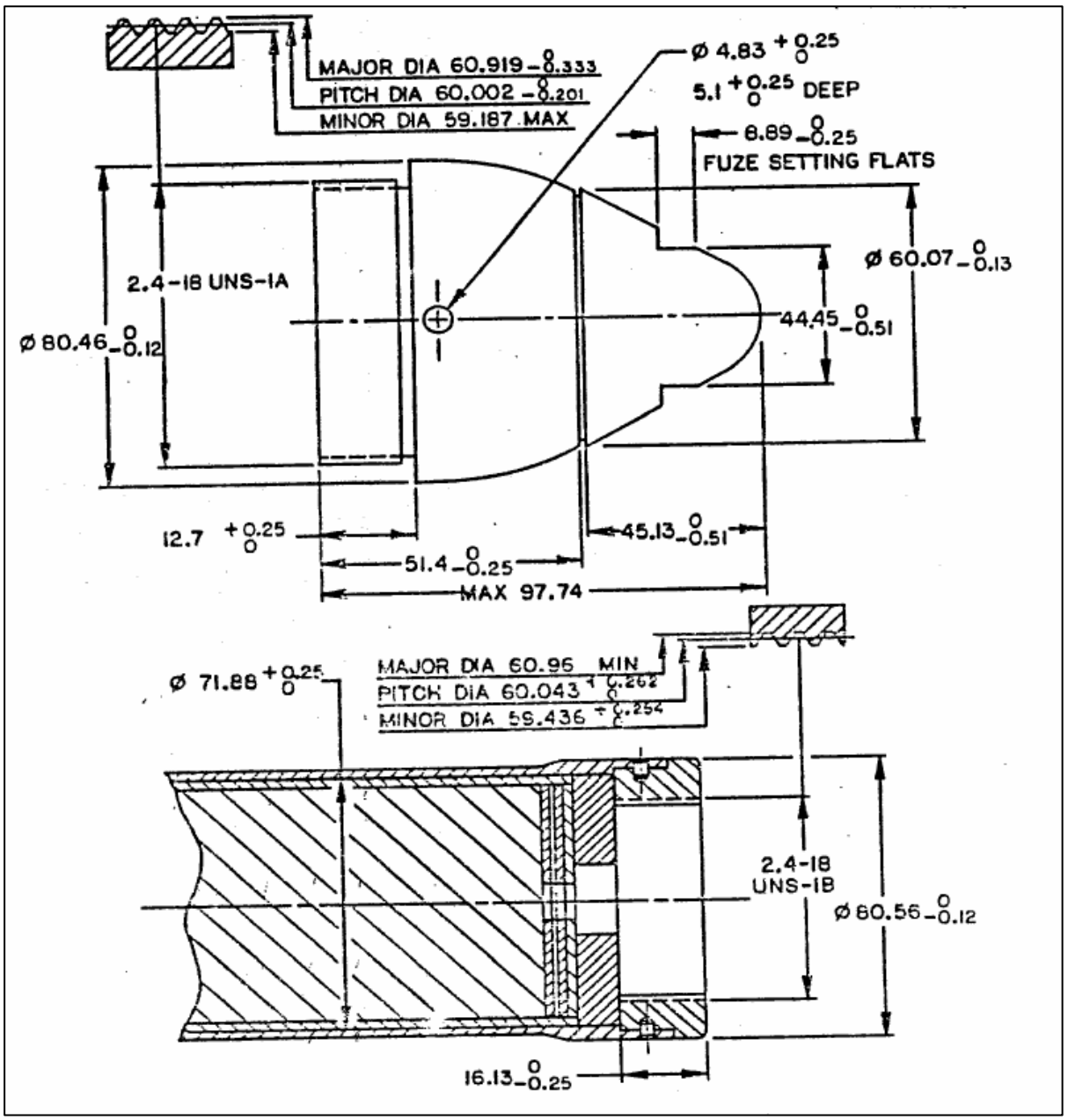


FIGURE 10: STANDARD CONTOUR FOR 2.4-INCH NOSE FUZES AND MATCHING CAVITY FOR 81 MM MORTAR ILLUM/SMOKE PROJECTILES (FIN STABILISED)

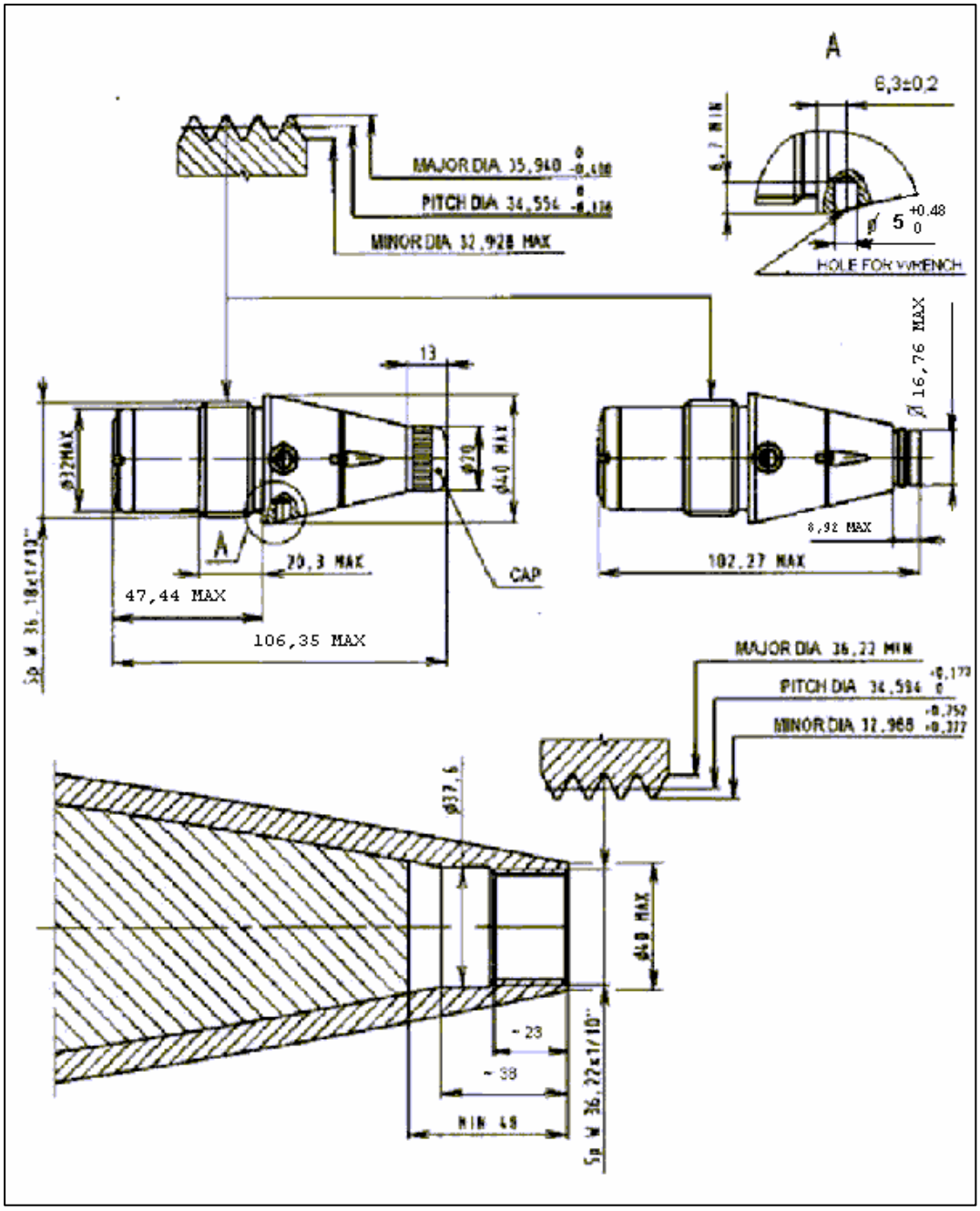


FIGURE 11: STANDARD CONTOUR FOR 1.5-INCH (36 MM) NOSE IMPACT FUZES WITH BOOSTER AND MATCHING CAVITY FOR 100 MM, 122 MM, 152MM ARTILLERY HE PROJECTILES (SPIN STABILISED), 125 MM ARTILLERY HE PROJECTILES (FIN OR SPIN STABILISED) AND 120 MM MORTAR HE PROJECTILES (FIN STABILISED)

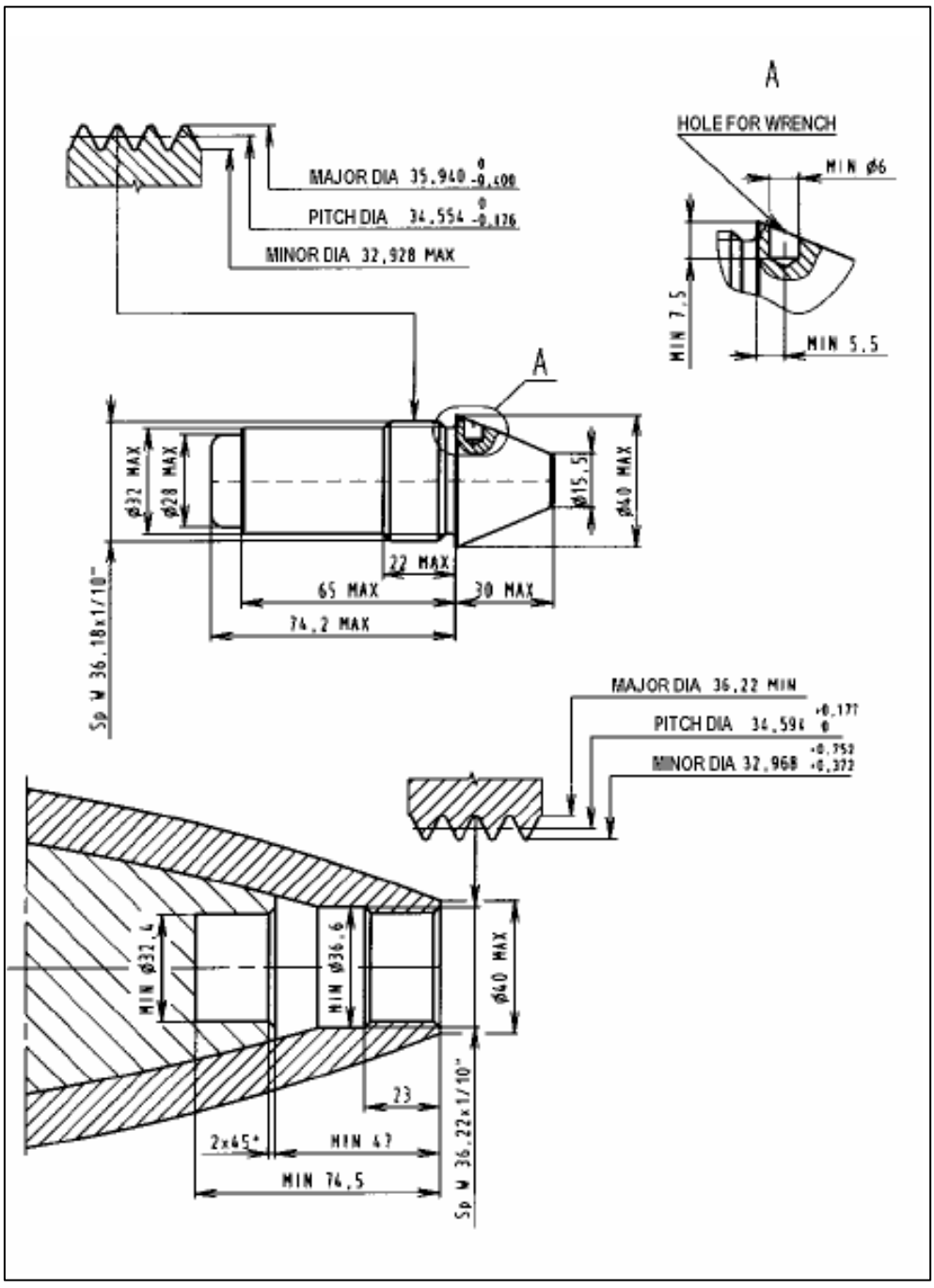


FIGURE 12: STANDARD CONTOUR FOR 1.5-INCH (36 MM) ARTILLERY NOSE FUZE WITH BOOSTER AND MATCHING CAVITY FOR 125 MM ARTILLERY TRAINING PROJECTILE (FIN STABILISED)

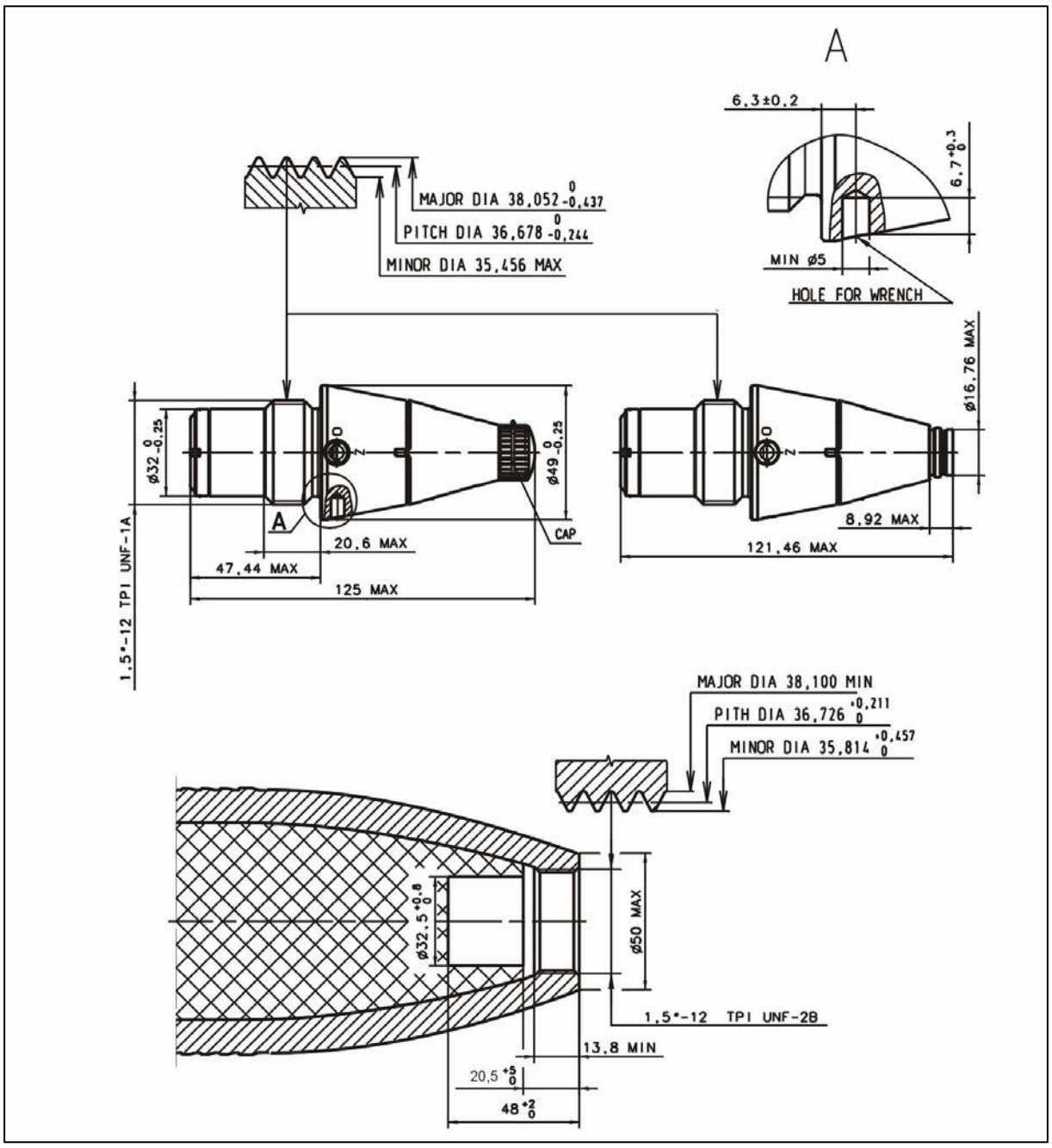


FIGURE 13: STANDARD CONTOUR FOR 1.5-INCH POINT DETONATING FUZES WITH BOOSTER AND MATCHING CAVITY FOR 81 MM AND 98 MM MORTAR HE PROJECTILES (FIN STABILISED)

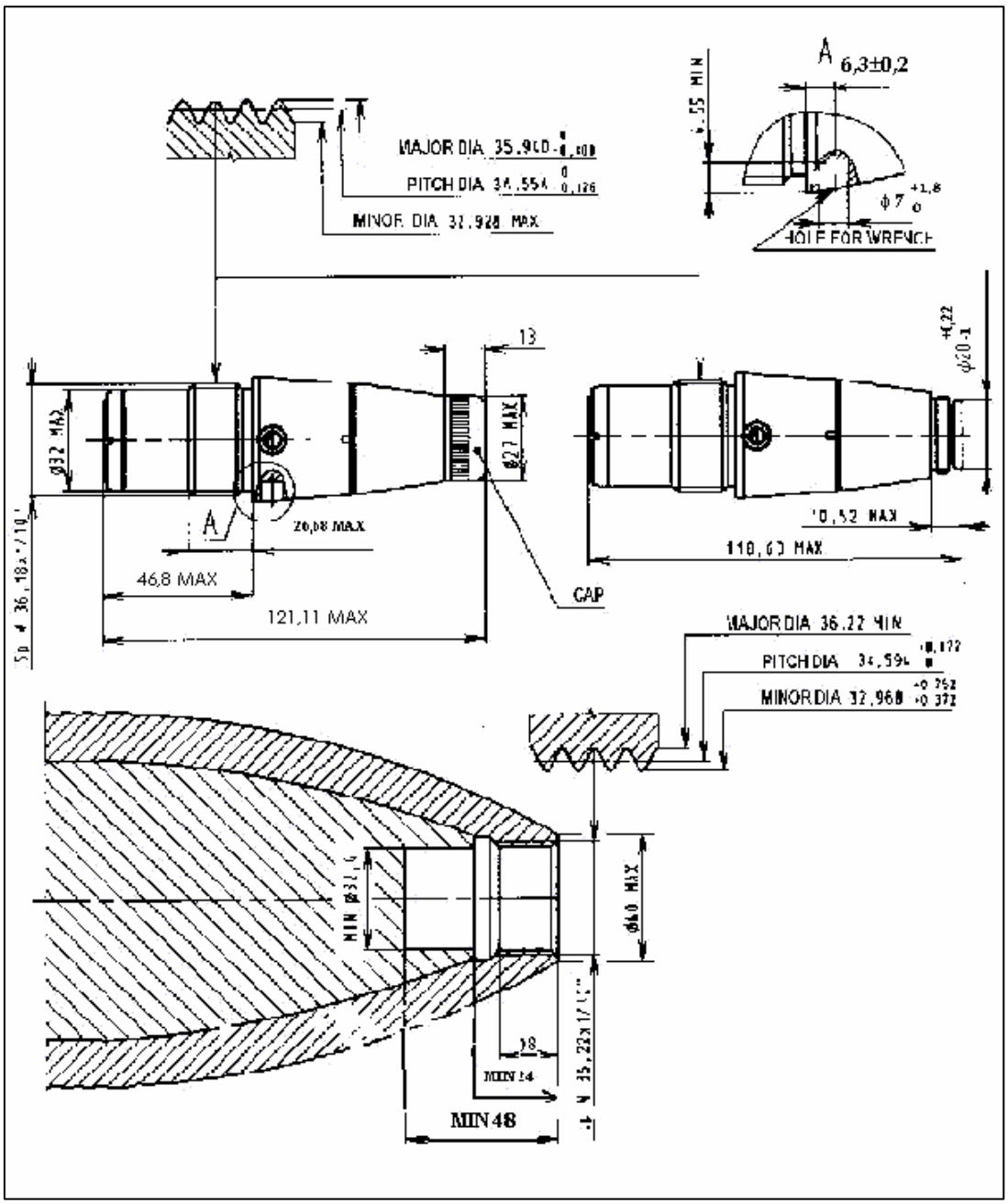


FIGURE 14: STANDARD CONTOUR FOR 120 MM MORTARS NOSE IMPACT FUZES WITH BOOSTER AND MATCHING CAVITY FOR 120 MM MORTARS HE PROJECTILES (FIN STABILISED)

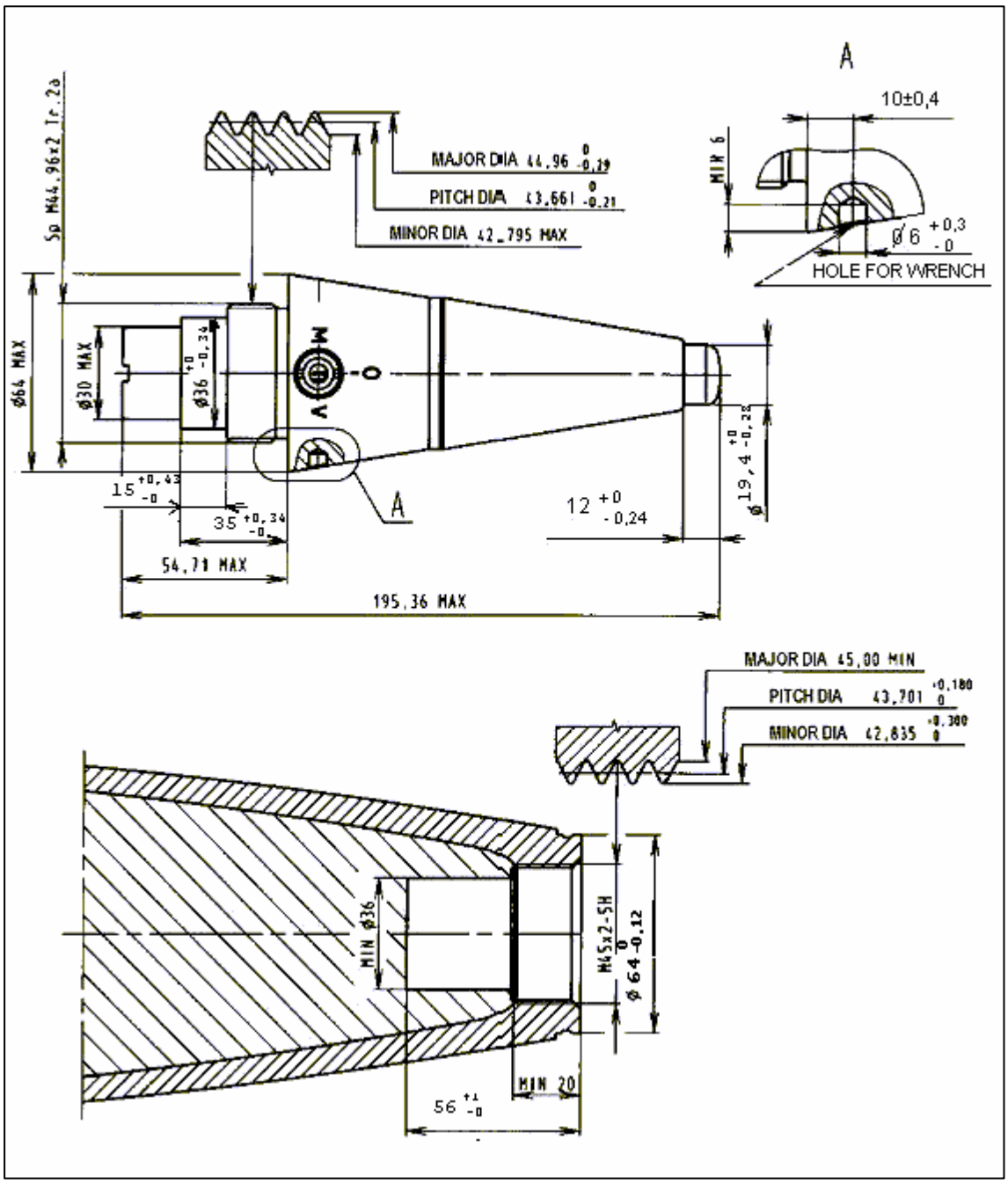
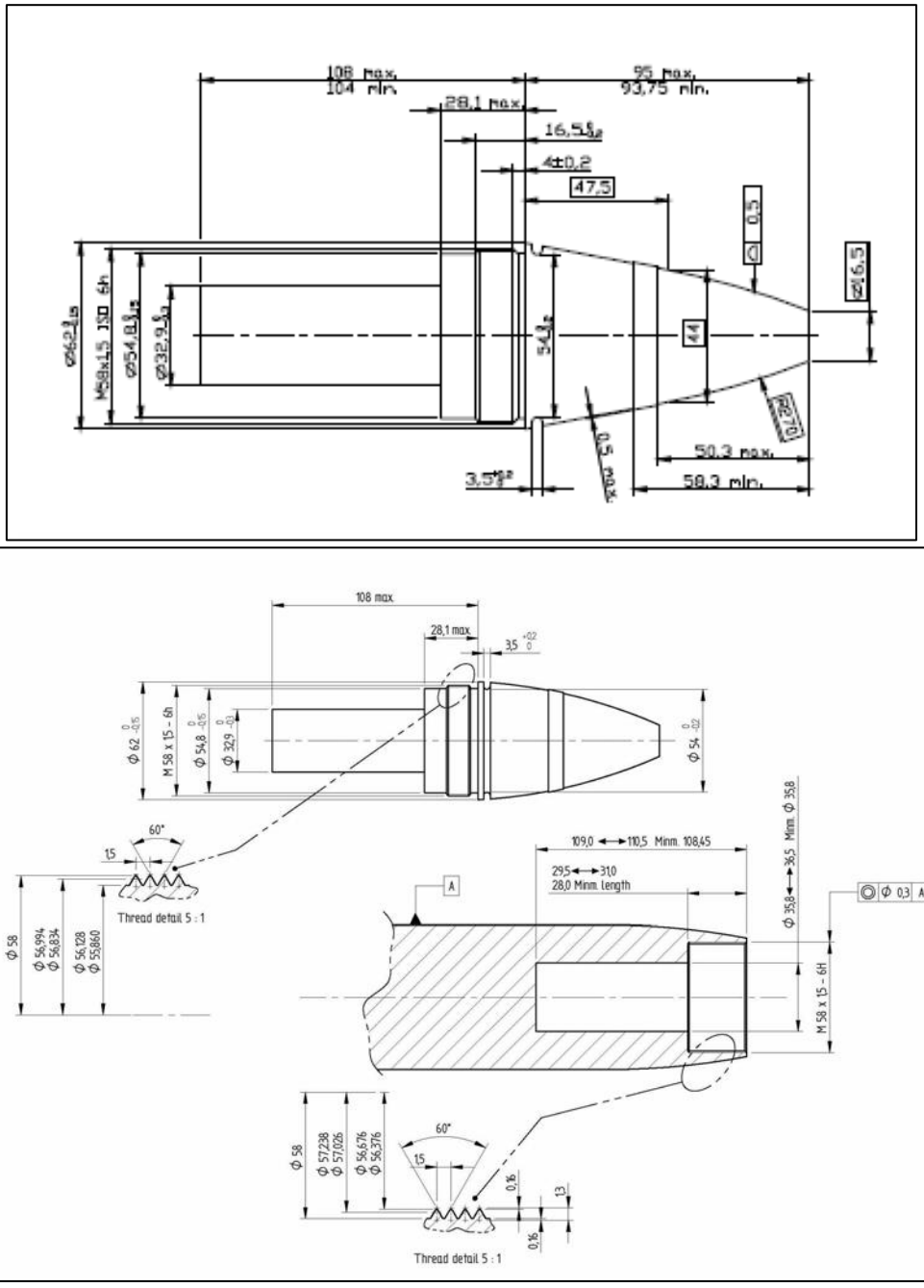


FIGURE 15: STANDARD CONTOUR FOR 44 MM ROCKET NOSE IMPACT FUZE WITH BOOSTER AND MATCHING CAVITY FOR 122 MM HE ROCKET (FIN STABILISED)



Notes:
1. The full charged shell mass shall be 5,370 ± 0.080 kg.
2. The bowl bottom shall be in contact with the explosive
3. Before the bowl is inserted, all particles of unpressed explosive the cavity and on the fuze thread shall be removed. It shall be ascertained that the fuze thread is free of rust, grease, paint or foreign matters.
4. Density of the burster charge to be between 1.58-1.61g/cm^3.
5. After filling apply lanoline grease on threads only to prevent rust. No grease on shell front end.

FIGURE 16: STANDARD CONTOUR FOR 2.3-INCH (58 MM) NAVAL FUZES WITH BOOSTER AND MATCHING CAVITY FOR 76 MM/62 HE PROJECTILES (SPIN STABILISED)

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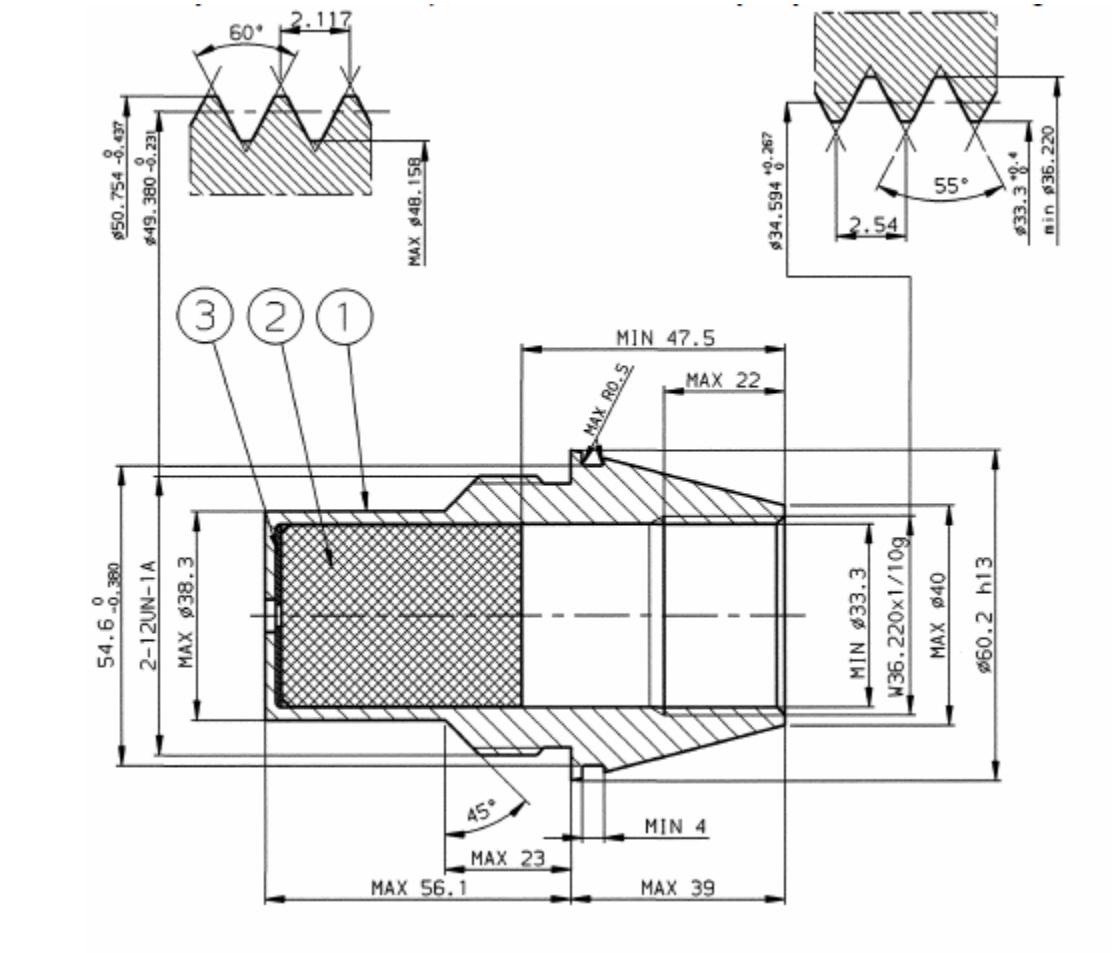
ANNEX C PERMISSIBLE FUZE ADAPTERS

Index of Figures

A currently available Fuze Adapter for 105-155 mm Artillery Projectiles is shown in Figure 17.



3		CARDBOARD PLATE 33X1		
	1	ACIDFREE KÖHLER-HALL MAX 10		
2		BOOSTER 33X43.4		
	1	HEXOTOL 50/50-60/40		
1		ADAPTER BODY		
	1			

FIGURE 17: FUZE ADAPTER FOR 105-155 MM ARTILLERY PROJECTILES

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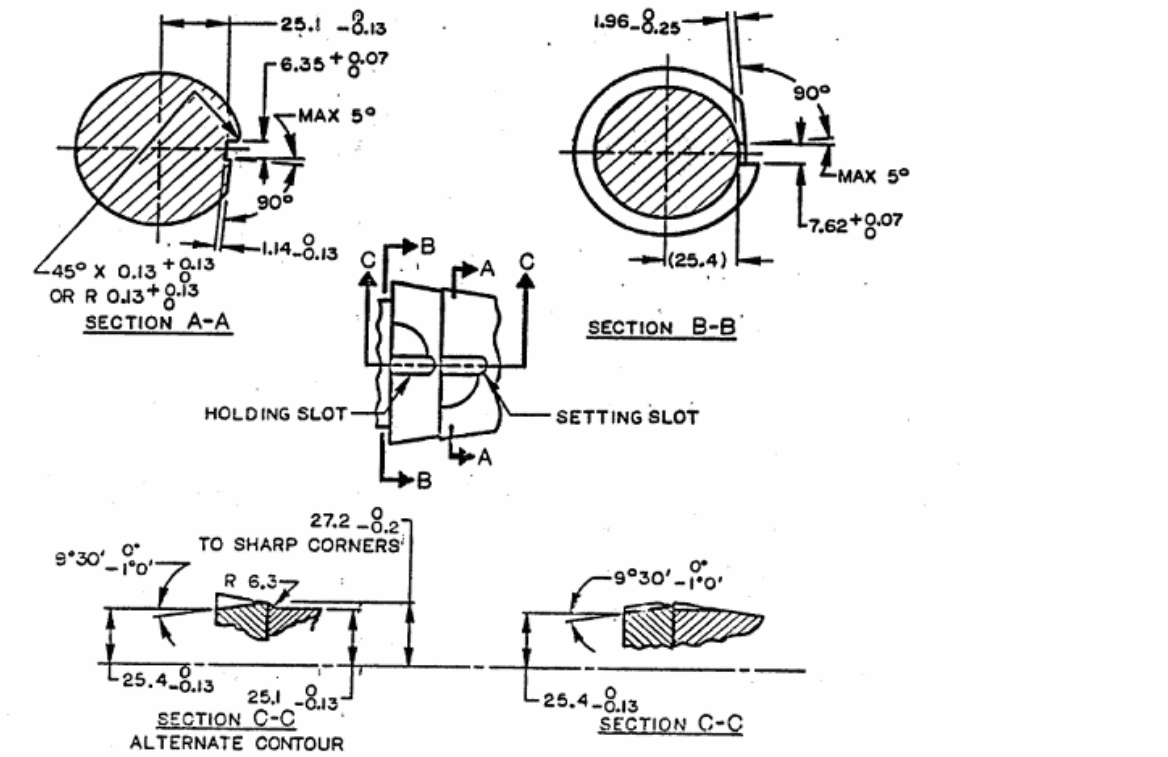
ANNEX D PREFERRED AUTOMATIC/HAND SETTER SLOTS FOR MECHANICAL TIME RING-SET FUZES

Index of Figures

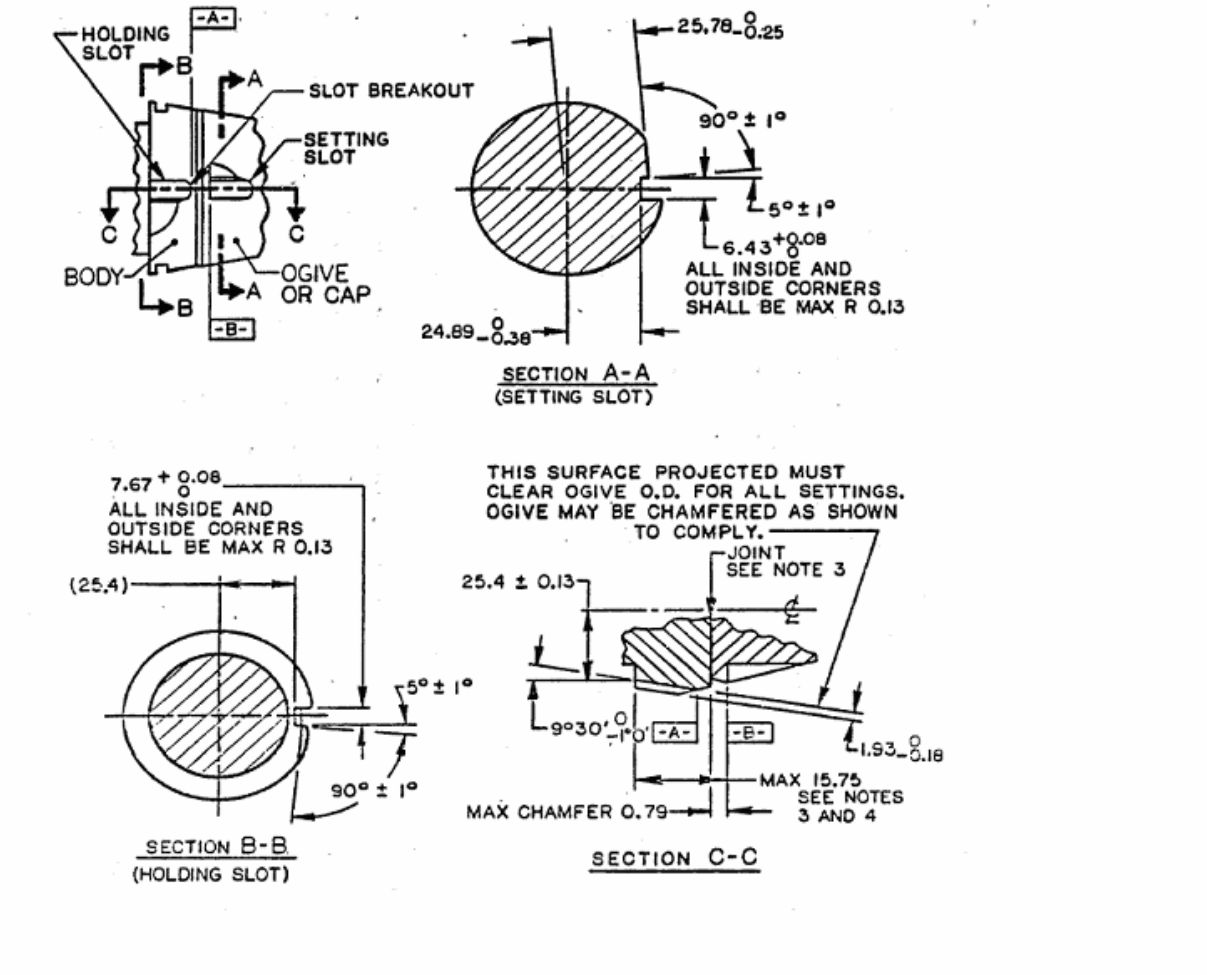
Preferred automatic/hand setter slots for mechanical time ring-set fuzes must be in accordance with Figures 18 and 19.



Notes:

1. Dimensions shown are for dual-purpose slots for mechanical setters (automatic and hand) for artillery and mortar (81 mm and spin stabilised) mechanical time and proximity fuzes.
2. Orientation of holding slot to setting slot is shown out of position for clarity.
3. Various details of sections omitted for clarity.
4. For other fuze dimensions, see Figure 1.

FIGURE 18: FUZE TIME-SETTING SLOTS TO INTERFACE WITH AUTOMATIC AND HAND MECHANICAL ARMY SETTERS



Notes:

1. Dimensions shown are for slots for mechanical setters (automatic and hand) for mechanical time fuzes for use on Navy projectiles.
2. Alignment of holding slot with setting slot is an arbitrary orientation. Shown for clarity.
3. Joint may vary between the top of Datum A and Datum B, inclusive.
4. At 15.75 max, min width of slot is 6.43. The setting slot may break out into joint.
5. For other fuze dimensions, see Figure 1. The ogival contour encompassing the setting and holding slots shall not deviate from the maximum material condition, defined in Figure 1 by more than 0.25 mm.

FIGURE 19: FUZE TIME-SETTING SLOTS TO INTERFACE WITH AUTOMATIC AND HAND NAVY MECHANICAL SETTERS

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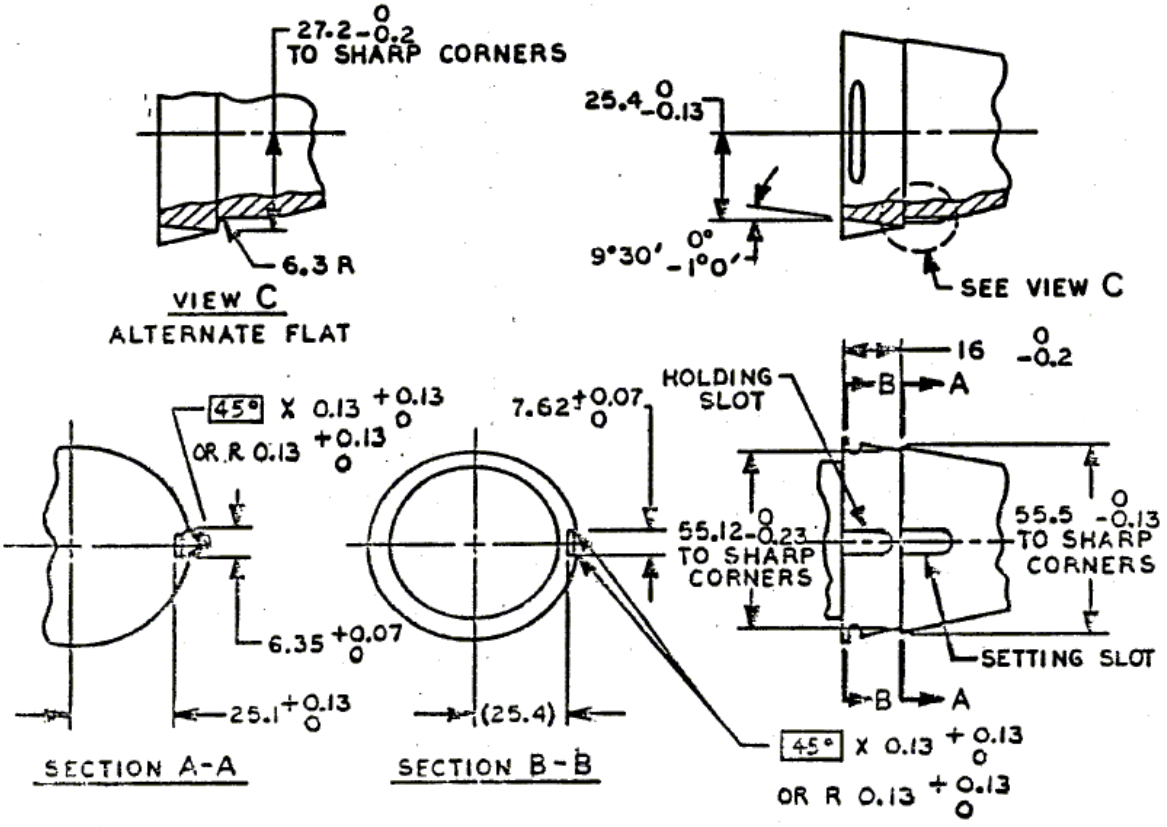
ANNEX E PERMISSIBLE HAND SETTER SLOTS FOR RING-SET FUZES

Index of Figures

Currently available permissible hand setter slots for ring-set fuzes are shown in Figures 20 and 21.

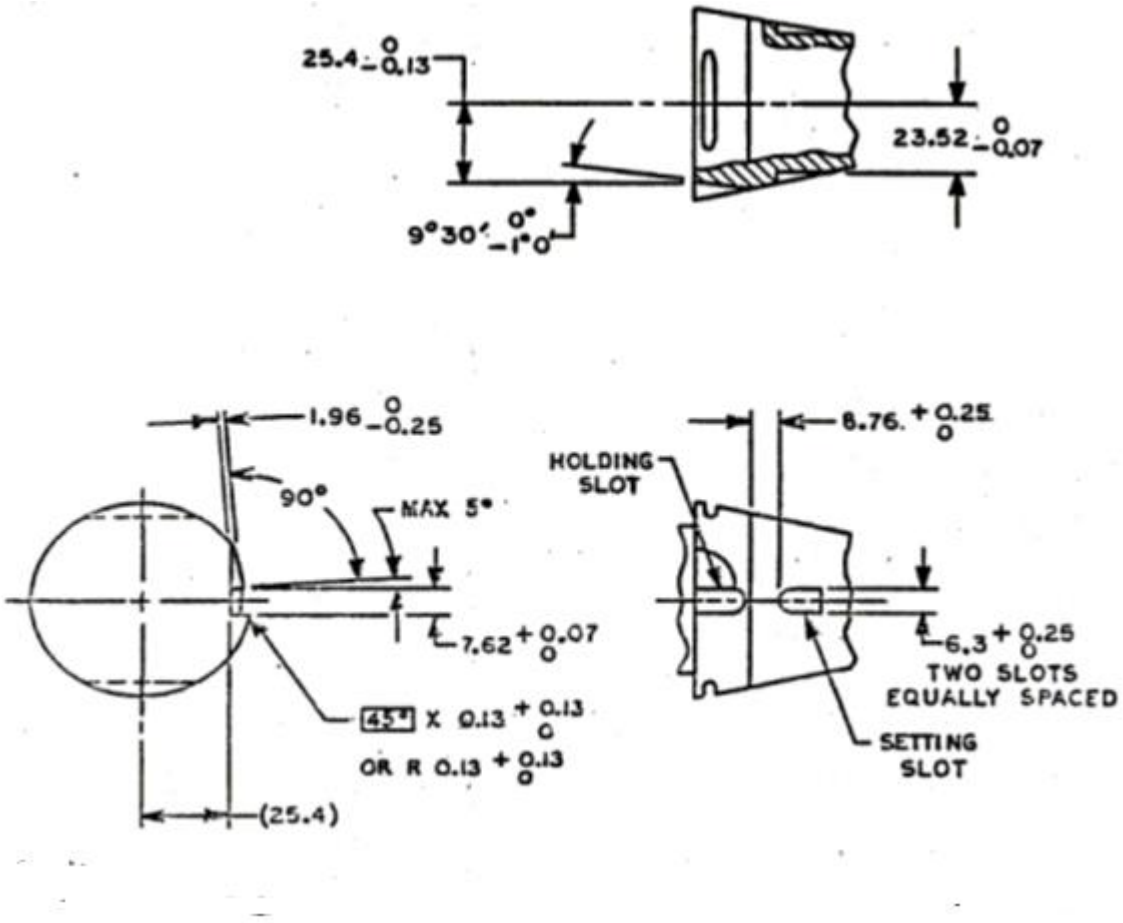
OTHER FEATURES	FIGURE
TIME SETTING SLOTS (HAND MECHANICAL SETTERS	20
TIME SETTING SLOTS (HAND MECHANICAL SETTERS)	21



Notes:

1. Dimensions shown above are for slots for a mechanical hand setter for artillery and mortar (81 mm and spin stabilised) mechanical time and deep intrusion proximity fuzes.
2. Orientation of holding slot to setting slot is shown out of position for clarity.
3. Various details of sections and views omitted for clarity.

FIGURE 20: FUZE TIME SETTING SLOTS TO INTERFACE WITH HAND SETTERS FOR ARTILLERY AND MORTAR TIME FUZES



Notes:

1. Dimensions shown above are for slots for a mechanical hand setter for artillery and mortar (81 mm and spin stabilized) time fuzes.
2. Orientation of holding slot to setting slot is shown out of position for clarity.
3. This note pertains to the fuze when viewed from the front. When the fuze is set in the shipping position, the setting slot closest to the holding slot is positioned clockwise to the holding slot and time set in the clockwise direction.

FIGURE 21: FUZE TIME SETTING SLOTS TO INTERFACE WITH HAND SETTERS FOR ARTILLERY AND MORTAR TIME FUZES

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ANNEX F DEFINITIONS AND ABBREVIATIONS

DEFINITIONS :

1. Cargo - A payload expelled or separated from the carrier, e.g. illuminating candle.

2. Cavity - The portion of the projectile that accepts the fuze.

3. Family of nose fuzes - Fuzes that are interchangeable with the same projectile, e.g. PD, MT, prox. (See abbreviations below).

4. Fin stabilised - Fixed or adjustable vanes or airfoils affixed along the longitudinal projectile contour to ensure stability in flight.

6. Fuze setter - A device for setting a unique and required function of the fuze. For the purpose of this standard, the following are not considered to be fuze setters: (a) commonly available aids used in setting such as screwdrivers, and (b) devices to aid in setting which are shipped with each box of fuzes.

7. Intrusion - The portion of the fuze that extends into the cavity of the projectile.

8. Ring-set fuze - A time fuze where the ogive or part connected to the timing release mechanism rotates about the stationary body.

9. Setter slots (holder, setting) - Those features of a fuze which interact with a setter, either automatic or hand, to enable the setting of the required mode of function.

10. Spin stabilised - Rotation is imparted about the longitudinal projectile axis to insure stability in flight.

11. Wrench slots - Those features of a fuze, which in the assembly of the fuze to the projectile, permit tightening of the fuze onto the projectile.

ABBREVIATIONS

APERS	Anti-personnel
ARTY	Artillery
HE	High Explosive
ICM	Improved Conventional Munition
MT	Mechanical Time Fuze
PD	Point Detonating Fuze
PROX	Proximity Fuze
WP	White Phosphorus

AOP-68(A)(1)