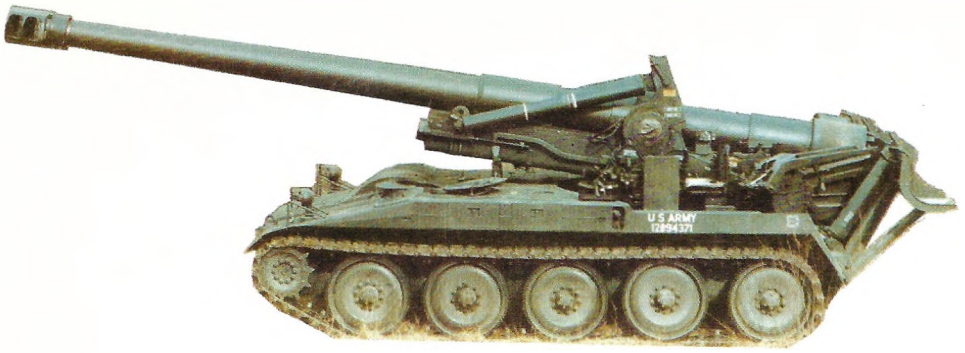

8 INCH M110A2 ARTILLERY WEAPON SYSTEM

REFERENCE DATA BOOK

JANUARY 1981

J. POTENZANO

Artillery Systems Office
Systems Development & Modeling Division
LARGE CALIBER WEAPON SYSTEMS LAB
US Army Armament Research & Development Command
Dover, New Jersey

8 INCH

M110A2 ARTILLERY WEAPON SYSTEM

REFERENCE DATA BOOK

PREPARED BY

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CHAPTER I

INTRODUCTION

1.1. PURPOSE

This Reference Data Book was prepared with the specific purpose of providing the reader a convenient and readily accessible source of information for identifying the various projectiles, propelling charges, fuzes and weapon which comprise the 8 Inch, M110A2 Self Propelled Weapon System. The report attempts to provide, under one cover, all or most of the technical information most often requested by persons engaged in artillery and armament related programs. Only classified material and material which was unavailable or inadvertently overlooked is omitted.

1.2. SCOPE

a. The material presented in this Data Book consists of illustrations, informational sheets and tables which describe the basic design, operation, performance and status of the major end items.

b. Numerical values such as weights, dimensions, pressure, velocity, range, etc., are nominal values except where maximum or minimum values are specified. Actual values may vary slightly from the information shown.

c. This Data Book is not intended to supersede or replace any technical manual or reference report associated with the 8 Inch, M110A2 Self Propelled Weapon System.

d. This report is prepared functionally similar to a loose leaf book to allow for additional page inserts based upon anticipated periodic updating. As an aid, all corrections, modifications or suggestions should be directed to the Artillery Systems Office, Systems Development and Modeling Division, Large Caliber Weapon System Laboratory, ARRADCOM, Dover, New Jersey. Autovon 880-3707/6404

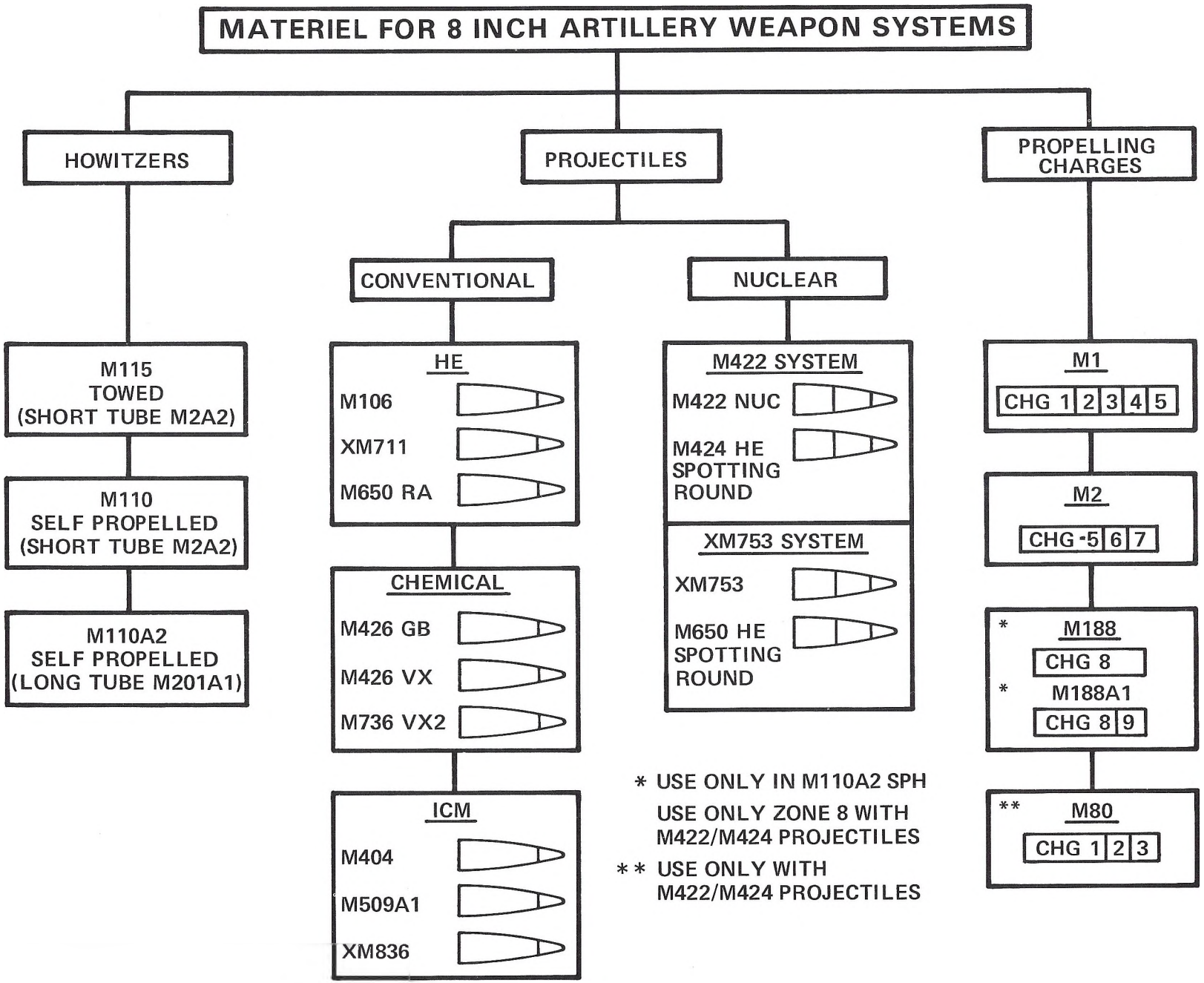
1.3. KEY TO ABBREVIATIONS AND SYMBOLS

A glossary of abbreviations and symbols is shown in Table 1.

GLOSSARY OF ABBREVIATIONS AND SYMBOLS

AA----------Anti Armor
AP----------Anti Personnel
CAL/TURN-------Caliber length per revolution
CHG----------Charge
DIA----------Diameter
EFC----------Effective Full Charge
ETSQ----------Electronic Time Super Quick
FPS----------Feet Per Second
G's----------Acceleration factor based on Earth's gravity
GB----------Non persistent agent
HE----------High Explosive
ICM----------Improved Conventional Munition
IN----------Inch
IN^3----------Cubic Inches
LBS----------Pounds
MAX----------Maximum
MIN----------Minimum
M----------Meters
MPG----------Miles Per Gallon
MPH----------Miles Per Hour
MT----------Mechanical Time
MTSQ----------Mechanical Time Super Quick
NA----------Not Applicable
NUC----------Nuclear
OZ----------Ounces
PD----------Point Detonating
PROP----------Propelling
PSI----------Pounds Per Square Inch
RAP----------Rocket Assisted Projectile
RAD----------Radians
RSI----------Rationalization, Standardization and Interoperability
SEC----------Seconds
S&A----------Safing and Arming
SPH----------Self Propelled Howitzer
VX----------Persistent Agent

TABLE 1


MATERIEL FOR 8 INCH ARTILLERY WEAPON SYSTEMS
HOWITZERS
PROJECTILES
PROPELLING CHARGES
M115 TOWED (SHORT TUBE M2A2)
M110 SELF PROPELLED (SHORT TUBE M2A2)
M110A2 SELF PROPELLED (LONG TUBE M201A1)
CONVENTIONAL
NUCLEAR
HE
M106
XM711
M650 RA
CHEMICAL
M426 GB
M426 VX
M736 VX2
ICM
M404
M509A1
XM836
M422 SYSTEM
M422 NUC
M424 HE SPOTTING ROUND
XM753 SYSTEM
XM753
M650 HE SPOTTING ROUND
M1
CHG 1 2 3 4 5
M2
CHG 5 6 7
* M188
CHG 8
* M188A1
CHG 8 9
** M80
CHG 1 2 3
* USE ONLY IN M110A2 SPH
USE ONLY ZONE 8 WITH M422/M424 PROJECTILES
** USE ONLY WITH M422/M424 PROJECTILES

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CHAPTER 2

8 INCH, M110A2
SELF PROPELLED HOWITZER

8 INCH SP HOWITZER, M110

8 INCH SP HOWITZER, M110A2

M110A2 SELF PROPELLED HOWITZER

OBJECT OF DEVELOPMENT: The M110A2 Self Propelled Howitzer was developed for the purpose of providing long range general support fires for the light and heavy divisions using nuclear and conventional munitions. The 8 Inch, M110A2 SP Howitzer is intended to provide massing capability for direct support artillery, and be capable of delivering counter battery fires to the maximum range of hostile artillery.

ITEM DESCRIPTION: The M110A2 is a product improved M110 self propelled, fully tracked vehicle incorporating a longer 8 Inch Cannon (M201A1) and the 8 Inch Muzzle Brake. Product improvements to the M110 SPH also include modifications of the M174 gun mount, lock out cylinders, parking brake, ammo spade stowage, drivers hatch, gunners seat, elevating and traversing slip clutch, hydraulic motor drain line, and the addition of above deck warning lights, remote air filter indicators and a hydraulic pump relief valve.

OPERATION: Operationally, the M110A2 SP Howitzer with the M201A1 cannon and the 8 Inch Muzzle Brake has effectively demonstrated increased range and fire power capability over the older M110 Self Propelled Howitzer. The versatility of the M110A2 is evident by the variety of 8 Inch munitions and propelling charges which can be fired in this weapon. As a result of the M201A1 cannon, larger and more energetic propelling charges, such as the M188A1/M188 can be used to propel the M650, M106, M426, M509, XM736, XM753 and other 8 Inch projectiles to ranges never before possible with the M110 SP and M115 towed howitzers. In addition, to its increased fire power capability, the M110A2 is designed to provide improved reliability, availability and maintainability and requires no additional training or skill to operate.

PROGRAM STATUS: The M110A2 SPH was type classified Standard A in July 1978 following type classification of the new muzzle brake. This action has led to the up grading of all US Army M110 and M110A1 SP Howitzers in Europe, and to the procurement of additional M110A2 SP Howitzers.

DESIGN PARAMETERS AND PERFORMANCE DATA OF THE M110A2 SELF PROPELLED (SP) HOWITZER

GENERAL

Combat Loaded	62 500 pounds
Overall Length (cannon in travel position)	35 feet 4 inches
Overall Width	10 feet 4 inches
Overall Height (cannon in travel position)	12 feet 6 inches
Ground Clearance	1 foot 5 inches

PERFORMANCE

Maximum Allowable Speed	34 MPH
Cruising Range (320 gallon fuel tank)	450 miles w/o fuel cell, Mod Kit 2
Cruising Range (260 gallon fuel tank)	325 miles
Fuel Consumption	1.3 MPG
Turning Radius (minimum)	12 feet
Traverse (right and left of centerline)	30 degrees (533 mil)
Cannon Elevation (maximum)	65 degrees (1156 mil)

PROPULSION

Engine Type	Diesel
Fuel Type	Diesel, 40 cetane

RATE OF FIRE

1 Round in 2 Minutes (sustained)
4 Rounds in first 3 Minutes (max.)

DESIGN PARAMETERS AND PERFORMANCE DATA
of the M110A2 SELF PROPELLED (SP) HOWITZER
and the M110 SELF PROPELLED HOWITZER

Howitzer	M110A2	M110/M115
Cannon	M201A1	M2A2/M2A1
Shot Travel (Inches)	273	168
Rifling Twist	1/20	1/25
Chamber Volume	1943 IN^3 (M106)	1545 IN^3 (M106)
Diametral Forcing Cone Taper	0.1000 IN/IN	0.1000 IN/IN
Chamber Contour	Tapered	Cylindrical
Chamber Length (Inches)	42.6 Reference	34.8 Reference
Spindle	Two 1 Inch Bumps for Charge Stand Off	Flat Surface
Spindle Spit Hole	On Center	On Center
Wall Thickness, Chamber (IN)	4.26-4.43	4.26
Temperature Indicator	None	None
*Upper Pressure Limit at $70^{o}F$ with M106	42100 psi with M188A1 Prop Charge	42100 psi with M2 Prop Charge
**PIMP with M106	48000 psi with M188A1 Prop Charge	48000 psi with M2 Prop Charge

*Upper pressure limit is specified as upper limit of average pressure at $70^{o}F$ developed by a particular propellant with a specified projectile.

**Permissible Individual Maximum Pressure (PIMP) is pressure which should not be exceeded 13/10,000 times. It is based on max allowable ammunition temp, heaviest allowable projectile weight, propellant at upper pressure limit and cannon giving highest pressures (new or humped).

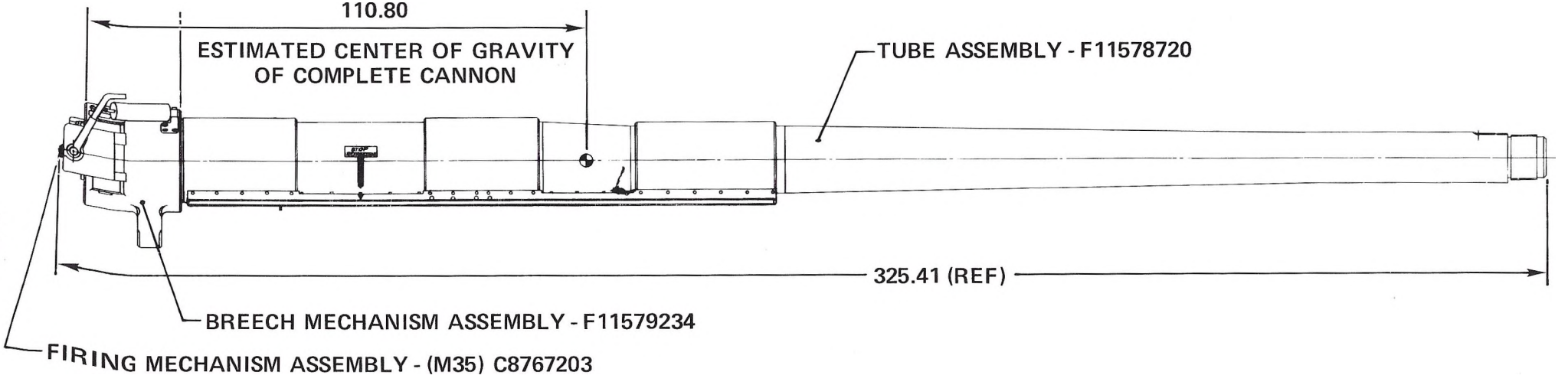
LIFE OF CANNON TUBE BASED ON EFC ROUND
COUNT ON THE 8 INCH SP HOWITZER CANNON, M201A1, M2A1, M2A2

CANNON MODEL	WEAPON	EFC ROUND LIFE OF TUBE	EFC FACTORS
M2A1	M115	7500	Zone 7 = 1.00 Zone 1-6 = 0.25
M2A2	M110	7500	Zone 7 = 1.00 Zone 1-6 = 0.25
M201/M201A1	M110A2	7500	Zone 9 = 1.0 Zone 7-8 = 0.7 Zone 1-6 = 0.25

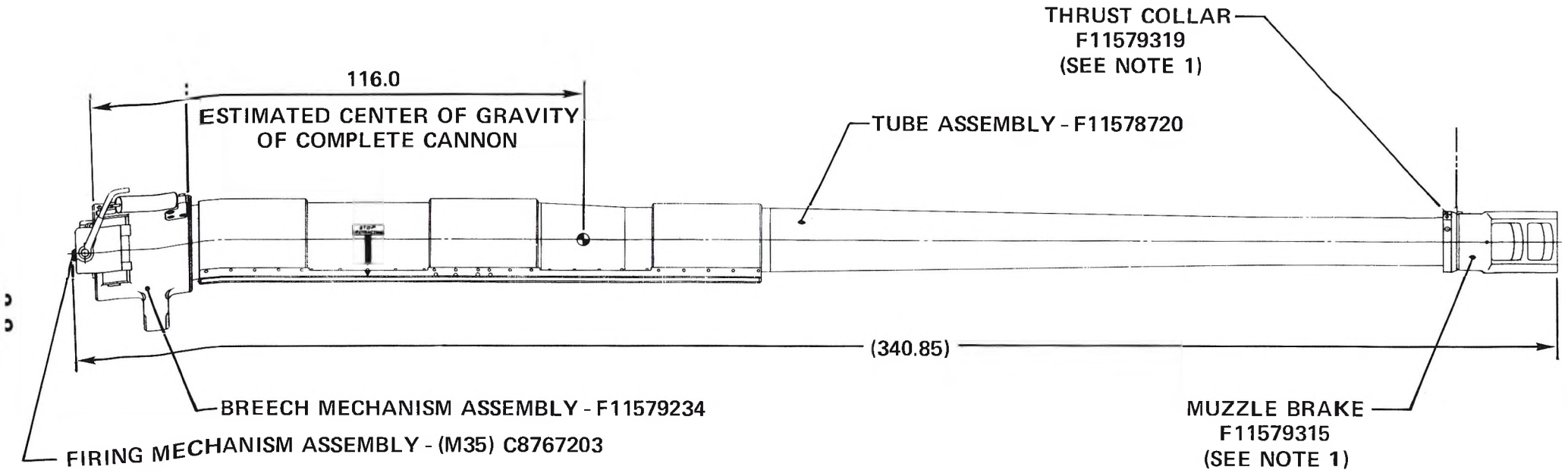
NOTE: Condemnation criteria for the M201/M201A1 tube is based on a pullover gage measurement of 8.135 inches measured 53 inches forward of rear face of breech ring or 46 inches forward of breech end of tube or 7,500 EFC rounds whichever occurs first.

QUARTER LIFE DIAMETERS OF
8 INCH M201/M201A1 CANNON TUBES

QUARTER	MINIMUM DIAMETER	MAXIMUM DIAMETER
1st	7.998	8.034"
2nd	8.034"	8.067"
3rd	8.067"	8.101"
4th	8.101	8.135



8 INCH CANNON, M201



8 INCH CANNON, M201A1

CANNON, 8 INCH HOWITZER: M201/M201A1

PHYSICAL CHARACTERISTICS:

Model	M201	M201A1
Length (in.)	325.41	340.85
Wts (lb)		
Tube Assy	12450	12450
Muzzlebrake		450
Breech Mechanism	1750	1750
Total	14200	14650
Rifling Twist (R.H.)	1/20	1/20
Projectile Travel (in.)	273.3	273.3
Chamber Volume (cu.in.) (w/M106 Projectile)	1950	1950
Tube Life	7500 EFC	7500 EFC
Breech Life	7500 EFC	7500 EFC
Cannon Assy Dwg	F11578719	F11579521

PURPOSE:

The M201 Cannon is used on the Howitzer, Heavy, Self-Propelled: 8 inch, M110A1.

The M201A1 Cannon is used on the Howitzer, Heavy, Self-Propelled: 8" M110A2.

STATUS:

M201: Transitioned - in production.

M201A1: Transitioned - in production.

DESCRIPTION:

The cannon consists of a tube assembly, a muzzle brake (M201A1 only), a breech mechanism assembly, and a firing mechanism. The tube assembly consists of a tube to which are attached three hoops which hold the rails that slide in the mount. At the rear end of the tube is a thread for the breech ring. At the muzzle end is a thread for attaching the muzzle brake. The interior of the tube is machined to form a chamber in which the propelling charge is placed and the rifling which imparts spin and stability to the projectile.

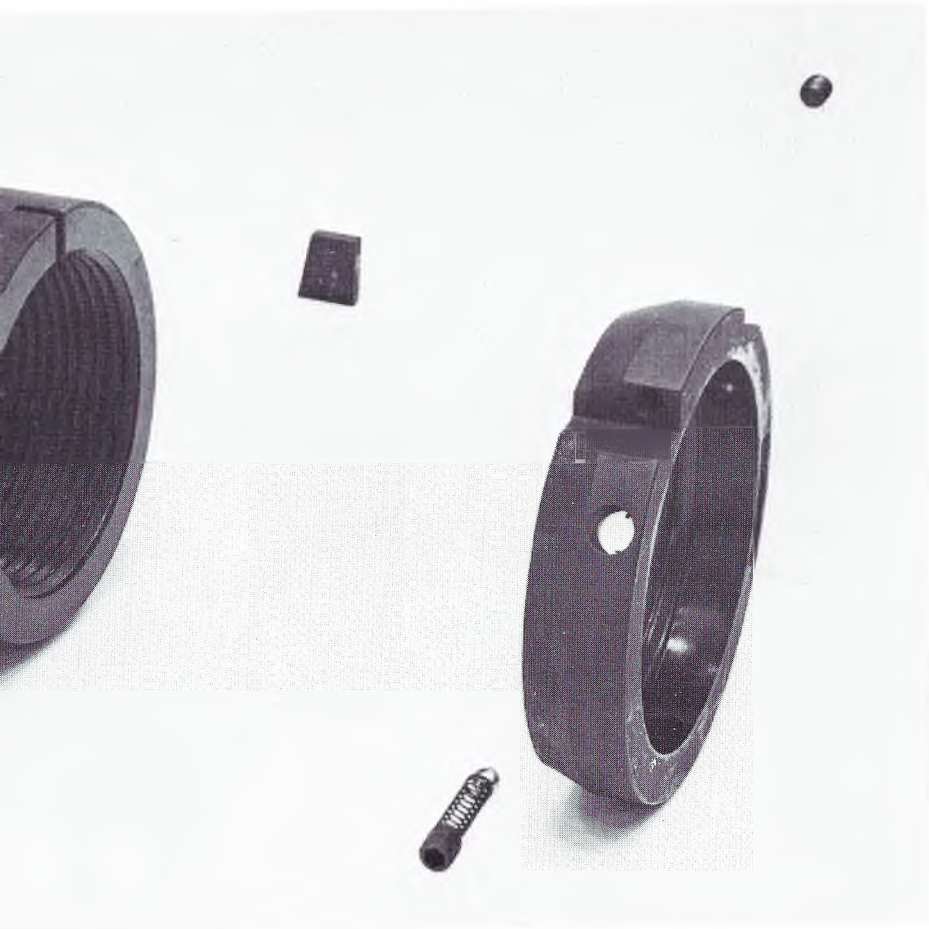
The muzzle brake turns back propellant gases to "brake" the tube recoil reducing the load on the recoil mechanism allowing the use of the higher impulse charge (Zone 9).

The breech mechanism is manually operated. It is opened by pulling on the operating lever. It includes the breech ring, which connects to the recoil mechanism, the breechblock, which screws into the rear end of the breech ring and holds the obturator system, which seals the chamber during firing, and the carrier, which holds the breechblock and swings it into (and out of) the breech ring. An interlock mechanism prevents the firing mechanism from closing unless the breechblock is fully closed and locked.

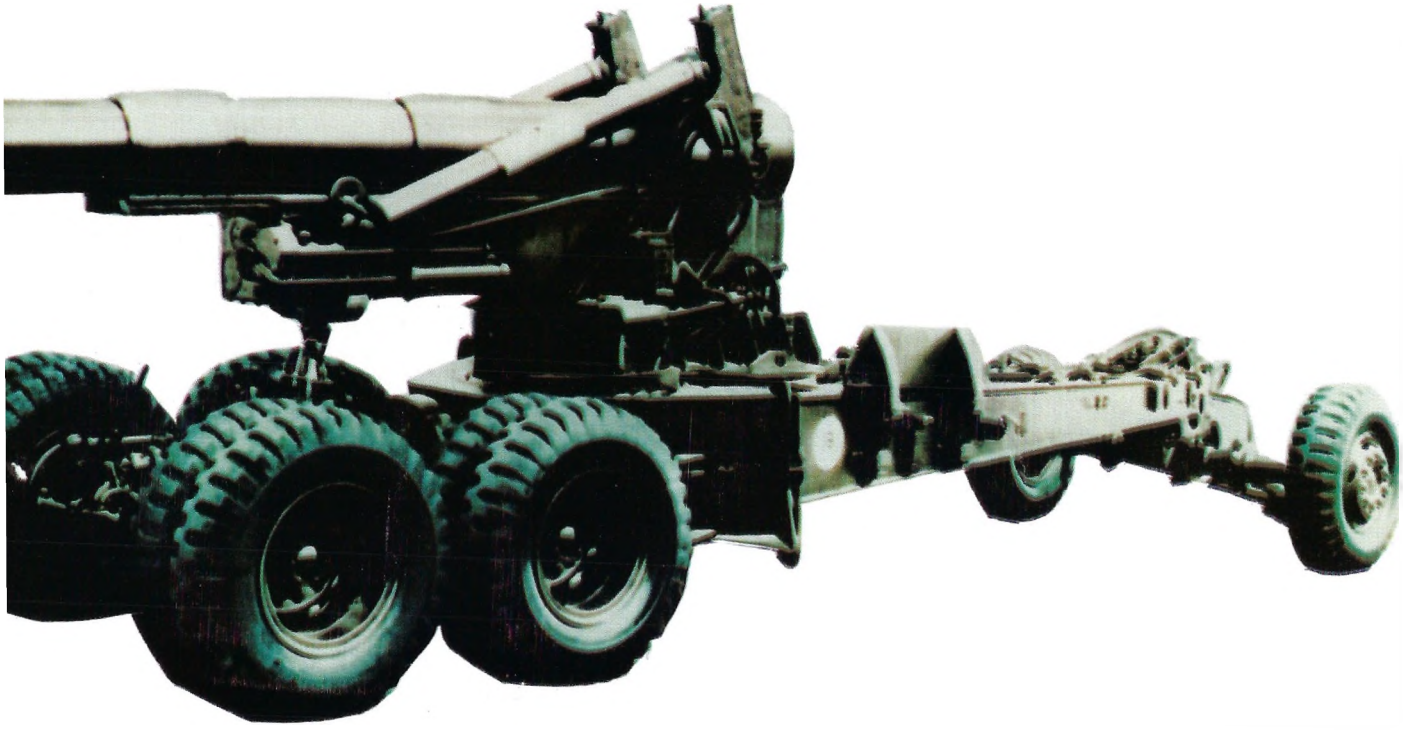
DIFFERENCES BETWEEN MODELS:

The cannon are identical except that a muzzle brake and thrust collar are added to the M201A1.

8 INCH MU



UZZLE BREAK



8 INCH HOWITZER, M115

M115 TOWED HOWITZER

BACKGROUND:

On 18 May 61, the 8 Inch, M55 Towed Howitzer was redesignated the 8 Inch, M115 Towed Howitzer. Since then the M115 has undergone no further modification. With increasing emphasis being given to artillery mobility and survivability, the M115 Towed Howitzer today is considered an obsolecent weapon. The role of 8 Inch artillery has been given over to the 8 Inch, M110A2 Self Propelled Howitzer. Currently, the few remaining M115's in the Army inventory are being utilized by the US Army Reserve for training purposes only.

8 INCH

CANNON, M2A1

CANNON, 8 INCH HOWITZER: M2A1/M2A2 (M2A1E1)

PHYSICAL CHARACTERISTICS:

Model	M2A1	M2A2
Length (in.)	217.10	215.05
Wts (lb)		
Tube Assy	8490	8490
Breech Mechanism	1750	1750
Total	10240	10240
Rifling Twist (R.H.)	1/25	1/25
Projectile Travel (in.)	167.8	167.8
Chamber Volume (cu.in.) (w/M106 Projectile)	1545	1545
Tube Life	7500 EFC	7500 EFC
Breech Life	7500 EFC	7500 EFC
Cannon Assy Dwg	D7309249	F8767225

PURPOSE:

The M2A1 Cannon is used on the Howitzer, Heavy, Towed: 8 inch, M115.

The M2A2 Cannon is used on the Howitzer, Heavy, Self-Propelled: 8" M110.

STATUS:

M2A1: Transitioned - in production.

M2A2: Transitioned - out of production.

DESCRIPTION:

The cannon consists of a tube assembly, a breech mechanism assembly, and a firing mechanism. The tube assembly consists of a tube to which are attached three hoops which hold the rails that slide in the mount. At the rear end of the tube is a thread for the breech ring. The interior of the tube is machined to form a chamber in which the propelling charge is placed and the rifling which imparts spin and stability to the projectile.

The breech mechanism is manually operated. It is opened by pulling on the operating lever. It includes the breech ring, which connects to the recoil mechanism, the breechblock, which screws into the rear end of the breech ring and holds the obturator system, which seals the chamber during firing, and the carrier, which holds the breechblock and swings it into (and out of) the breech ring. An interlock mechanism prevents the firing mechanism from closing unless the breechblock is fully closed and locked.

DIFFERENCES BETWEEN MODELS:

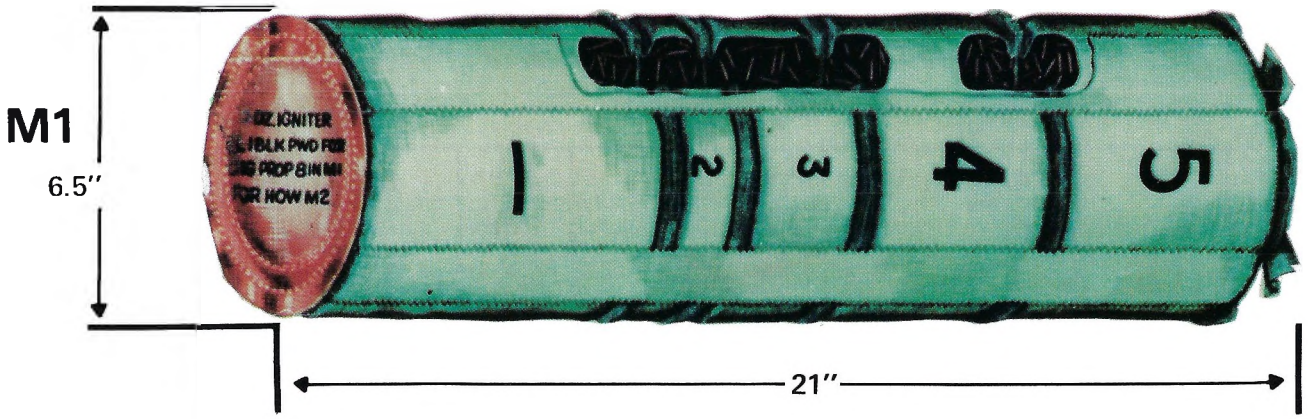
The M2A1 uses the M1 Firing Mechanism while the M2A2 uses the M35 Firing Mechanism. This requires that different interfacing components (spindle, breechblock and carrier) be used for each.

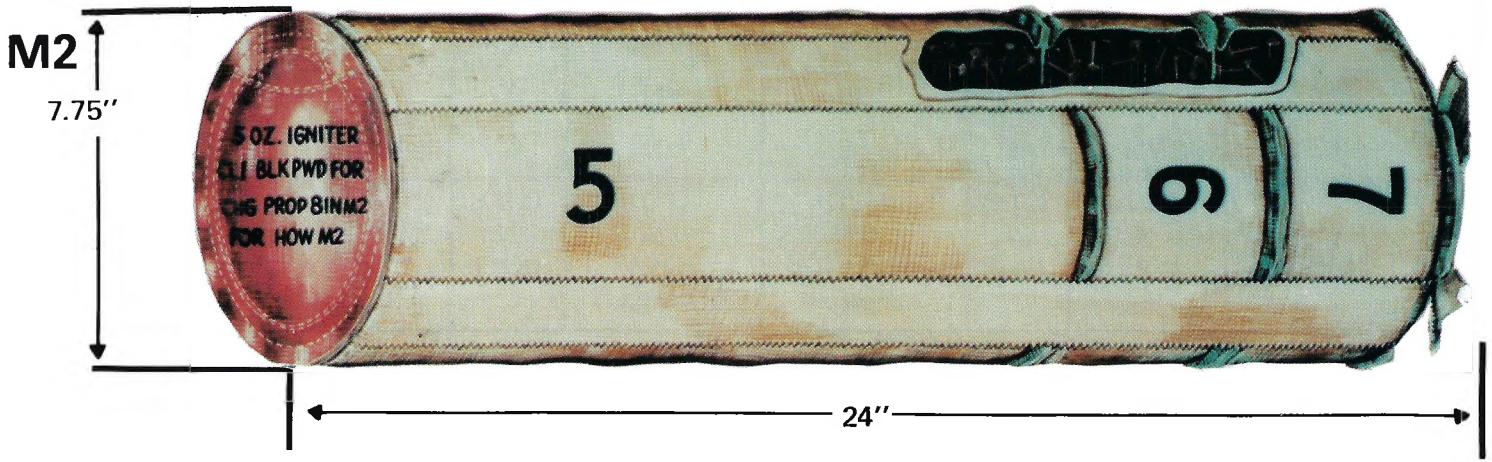
CHAPTER 3

PROPELLING CHARGES, 8 INCH

PHYSICAL CONFIGURATIONS OF 8 INCH PROPELLING CHARGES

CHARGE	ZONE	PROPELLANT TYPE	PROP WT (LBS)	TITANIUM WAX WT (OZ)	BLACK POWDER WT (OZ)	LEAD WT (OZ)	FLASH REDUCER (OZ)	STACKED LENGTH (IN)	MAX DIAMETER (IN)
M1	1	M1	5.9	NA	5	NA	NA	8.25	6.5
M1	2	M1	7.0	NA	5	NA	NA	9.50	6.5
M1	3	M1	8.3	NA	5	NA	NA	11.50	6.5
M1	4	M1	10.3	NA	5	NA	NA	14.5	6.5
M1	5	M1	13.6	NA	5	NA	NA	21 (MAX)	6.5
M2	5	M1	15.6	NA	5	NA	NA	14	7.75
M2	6	M1	20.6	NA	5	NA	NA	18	7.75
M2	7	M1	26.5	NA	5	NA	NA	24 (MAX)	7.75
M188	8	M30A2	38.0	19.7	6	6	12	29	8.0
M188A1	8	M31A1	41.0	0	6	10	0		8.0
M188A1	9	M31A1	48.0	4.3	6	12	0	32	8.0





PROPELLING CHARGES, 8 INCH, M1 AND M2

PROPELLING CHARGES, 8 INCH, M1 and M2

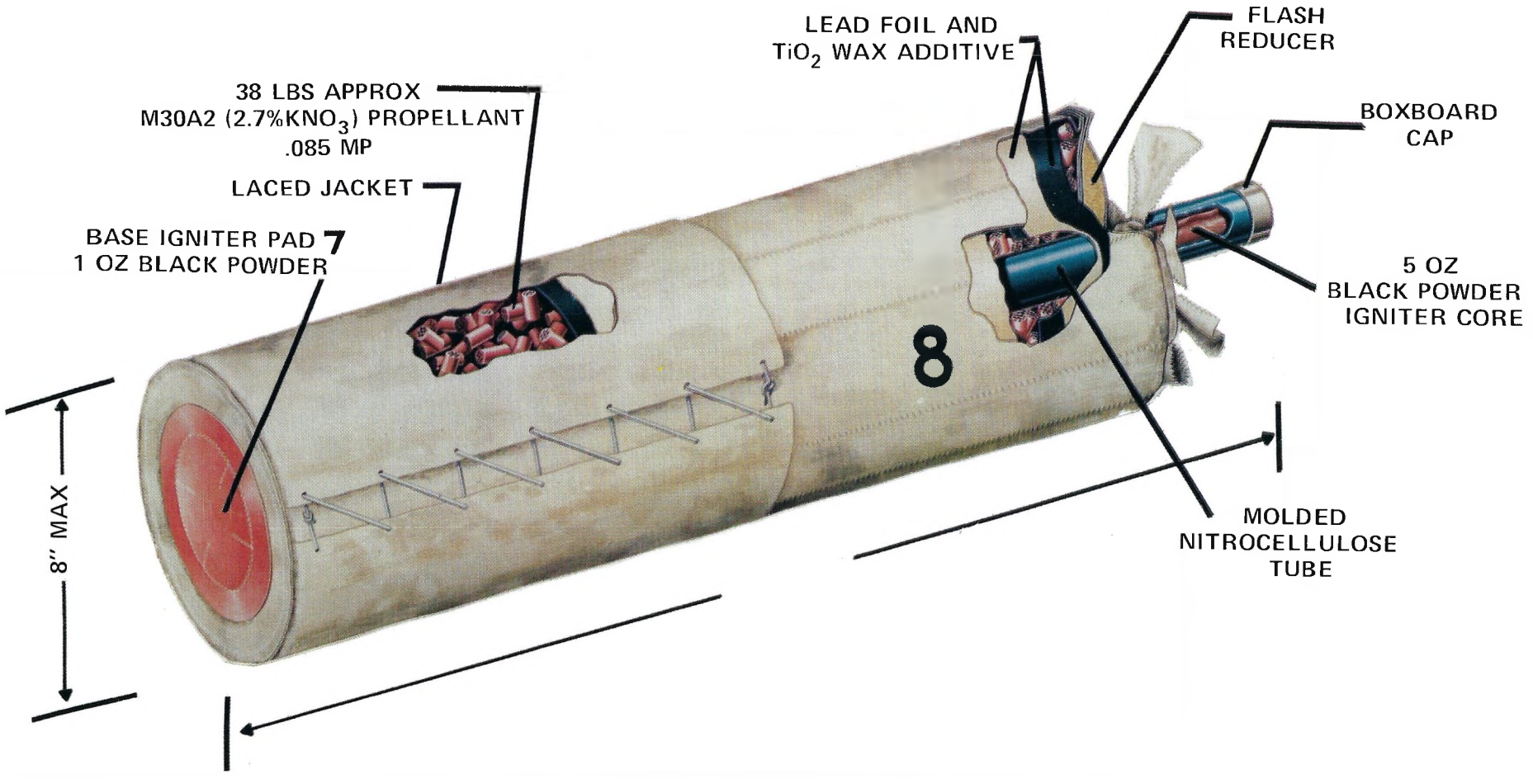
OBJECT OF DEVELOPMENT: The M1 and M2 Propelling Charges were initially developed for the 8 Inch, M115 Towed Howitzer. Today, the M1 and M2 Propelling Charges are used primarily in the M110 and M110A2 Self Propelled Howitzers.

ITEM DESCRIPTION: The M1 charge consists of a base section (charge 1) and four unequal increments (2 through 5) of M1 SP propellant in green bags. The increments are held in place by four tying straps sewn to the base of increment one and tied over the top of increment five. A red igniter pad containing five ounces of black powder is sewn to the base of increment one. Each increment of the charge and igniter pad is identified by black stencil markings.

The M2 charge consists of a base section (charge 5) and two unequal increments (charges 6 and 7) of M1 MP Propellant in white bags. The increments are held in place by four typing straps sewn to the base of increment five and tied over the top of increment seven. A red cloth igniter pad containing five ounces of black powder is sewn to the base of increment five. Each increment of the charge and igniter pad is identified by black stencil markings. When required, an M3 Flash Reducer is inserted under the tie straps at the forward end of charge seven. It consists of a square pad of red cloth containing a one pound mixture of potassium sulfate and black powder.

OPERATION: The M1 and M2 propelling charges are used in the M110 and the M110A2 SP Howitzers to provide short to intermediate range capability (zones 1 thru 7). In preparation for firing, the M1 and M2 propelling charges are adjusted to the appropriate zone, manually and separately loaded into the gun chamber and initiated by the M82 Percussion Primer. Nominal chamber pressures produced by the M1 and M2 charges in the M110A2 weapon are typically lower than those generated in the short tube M110 and M115 howitzers. Muzzle velocities, however, are slightly higher in the long tube M110A2 weapon.

PROGRAM STATUS: The M1 and M2 propelling charges represent a significant part of the US Army's 8 Inch munition inventory. Extensive use of these charges in the development and testing of new 8 Inch end items plus the need to maintain a sufficient stockpile for wartime mobilization insures the prospects for their continued production.



CHARGE, PROPELLING, 8 INCH, M188

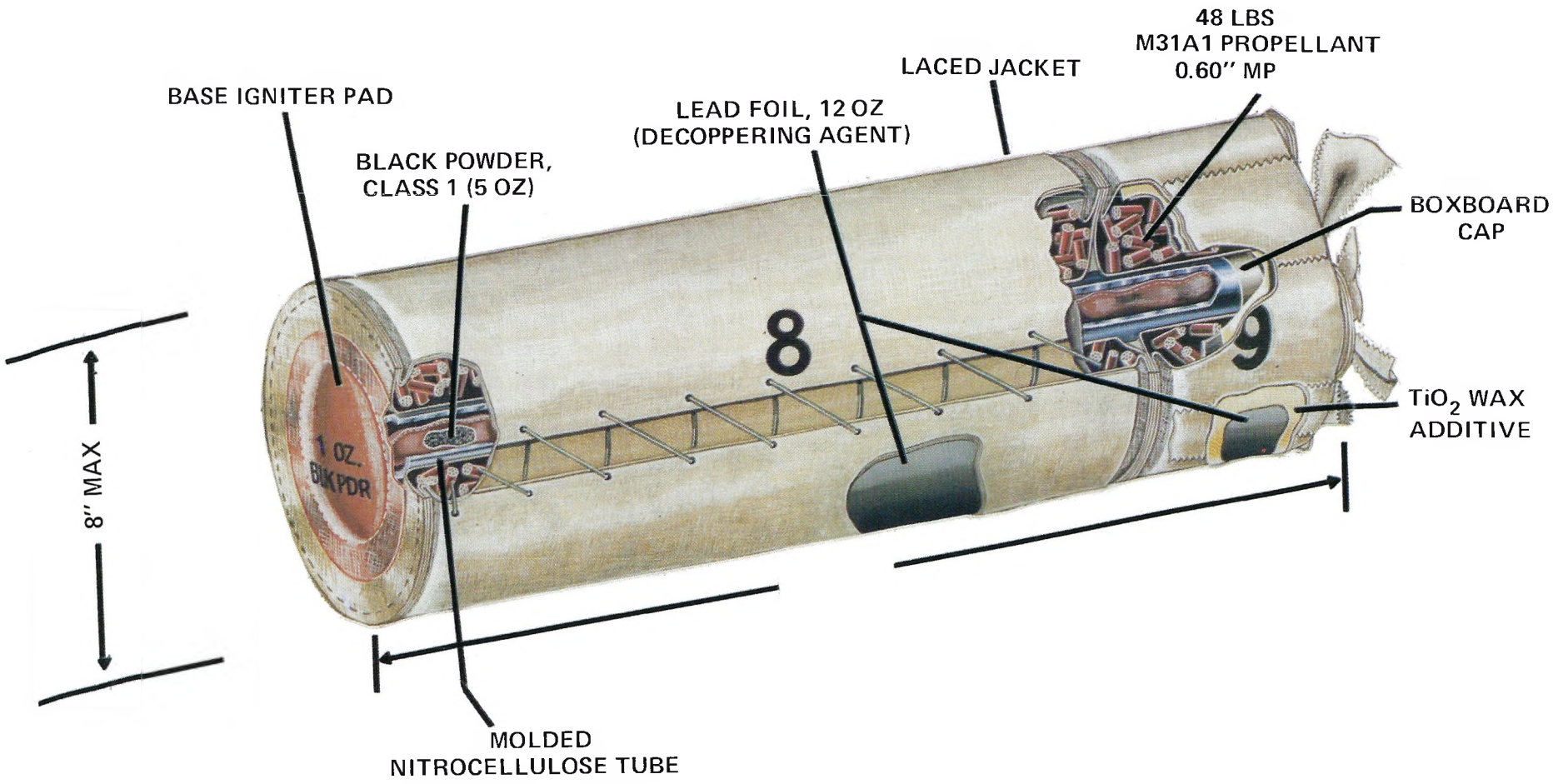
CHARGE PROPELLING 8 INCH M188

OBJECT OF DEVELOPMENT: The M188 Propelling Charge was developed specifically for the M110A2 SP Howitzer for the purpose of providing extended range capability.

ITEM DESCRIPTION: The M188 Propelling Charge is a single increment (Zone 8), white bag charge containing approximately 38 pounds of M30A2 propellant, and a central core ignition system. This ignition system consists of a base pad filled with one ounce of black powder and a central core igniter tube (Nitrocellulose) containing five ounces of black powder. A liner consisting of a sheet of rayon cloth coated with titanium dioxide and paraffin wax on one side and a sheet of lead foil on the other side lines the forward end of the charge. Four tie straps sewed to the base of the charge run the length of the charge and are tied at the forward end of the charge. A flash reducer is inserted under the tie straps at the forward end of the charge. A cylindrical jacket is placed part way over the charge length and tightly laced. End to end, the M188 charge measures 29 inches in length and weighs approximately 40 pounds.

OPERATION: The M188 Propelling Charge is designed for use in the 8 Inch, M110A2 Self Propelled Howitzer. Although it was intended to be a two zone (8 and 9) charge, the problems of excessive muzzle flash and gun tube residue have limited the use of this charge to zone 8 only. Operationally, the M188 charge is manually and separately loaded into the gun chamber in a normal manner and initiated by the action of a M82 Percussion Primer. Under standard operating conditions the M188 charge will generate a nominal chamber pressure of 31000 psi and propel the M106 projectile to a muzzle velocity of 2330 fps.

PROGRAM STATUS: The M188 Propelling Charge was type classified in 1976. During the initial production phase only a limited number of these charges were produced. As a result of excessive muzzle flash and gun residue, no additional M188 Propelling Charges are expected to be manufactured.



CHARGE, PROPELLING: 8 INCH, M188A1

CHARGE, PROPELLING 8 INCH M188A1

OBJECT OF DEVELOPMENT: The M188A1 Propelling Charge was developed specifically to replace the M188 Propelling Charge in the M110A2 SP Howitzer. Due to its cooler burning properties, the M188A1 charge produces significantly lower muzzle flash and longer tube life than the M188 charge.

ITEM DESCRIPTION: The M188A1 is a two increment (8 and 9) white bag propelling charge containing approximately 48 pounds of M31A1 propellant and a central core ignition system. The ignition system consists of a base pad filled with one ounce of black powder and a central core nitrocellulose tube containing five ounces of black powder. A wear reducing composition consisting of a cloth side impregnated with 4.3 ounces of titanium dioxide and paraffin wax lines the zone 9 increment. A decoppering agent consisting of lead foil lines the zone 9 increment and the adjacent end of the zone 8 increment. The charge is held in place by four tying straps attached to increment eight and tied over the top of increment nine. Fully assembled, the M188A1 charge weighs 50 pounds and is 32 inches long.

OPERATION: The M188A1 Propelling Charge was designed exclusively for the 8 Inch M110A2 Self Propelled Howitzer to provide a two-zone (8 and 9) extended range capability. Operationally, the M188A1 charge is manually and separately loaded into the gun chamber in the conventional manner and is initiated by the action of a M82 Percussion Primer. Under standard operating conditions, the M188A1 zone 9 charge will generate a nominal chamber pressure of 39000 psi and propel the M106 projectile to a muzzle velocity of approximately 2530 fps at charge 9, and 2330 fps at charge 8.

PROGRAM STATUS: The M188A1 Propelling Charge was type classified in August 1979. Initial production of the charge was initiated in December 1979.

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CHAPTER 4

PROJECTILES, 8 INCH

8 INCH PROJECTILE/FUZE PHYSICAL PROPERTIES

FUZE PROJECTILE	M557 M106	M577 M509	M739 M650	M735 XM753	M577 XM736	M565 M404	M542 M422	M591 M424A1	M728 M426
POLAR MOMENT OF INERTIA ($Lb\text{-}In^2$)	1822	1938	1921			1745	1734	1840	NA
TRANVERSE MOMENT OF INERTIA ($Lb\text{-}In^2$)	14590	15945	15317			13309	12100	12500	NA
CENTER OF GRAVITY FROM BASE END (INCHES)	12.32	15.15	14.61			12.40	11.70	11.80	NA
WEIGHT (LBS)	200	208	200			200	244	244	200

PROJECTILE,

8 INCH, M845

PROJECTILE, 8 INCH M845

OBJECT OF DEVELOPMENT:

The M845 Projectile was developed for the purpose of providing the User a training round which will be used to train gun crews in the proper loading and ramming procedures for 8 Inch self propelled howitzers.

ITEM DESCRIPTION:

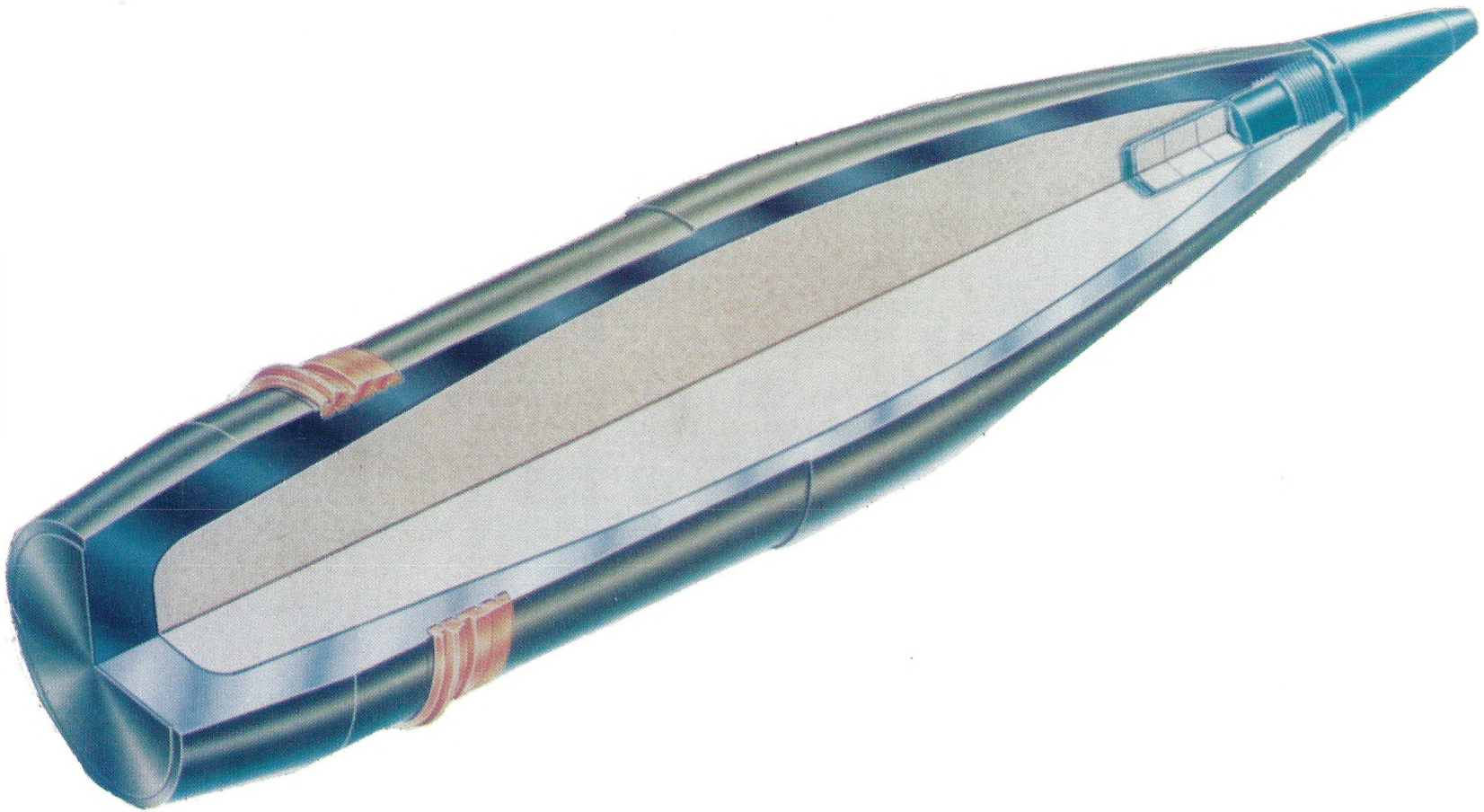
The M845 Projectile consists of a hollow steel ogive and body section threaded to a hollow steel base and boat tail section. To provide the required projectile weight the forward body/ogive section is filled with approximately 35 pounds of inert material. The ogive also includes a threaded fuze cavity in the nose end which contains a simulated supplementary charge and a lifting plug. The hollow base section is designed with a replaceable plastic rotating band at the forward end, and a threaded cut out in the back end to facilitate projectile extraction from the gun breech. With the M51 inert fuze threaded into the nose of the projectile, the M845 training round measures 35.76 inches in length and weighs approximately 200 pounds.

OPERATION:

The M845 Projectile is a practice round which is designed solely for training gun crews in the proper procedures for loading and ramming 8 Inch howitzers. During a training exercise, the M845 is first loaded and rammed into an 8 Inch cannon in the conventional manner. An H4277 Extraction Tool is then inserted into the gun chamber until it enters and engages the threaded cut out at the base of the rammed projectile. Using the H4277 extraction procedures, the rammed projectile is then dislodged and removed from the cannon. In the event an H4277 Extractor is not available, an appropriate bell rammer will suffice. This operation can be repeated numerous times before the replaceable plastic rotating band on the M845 Projectile must be replaced.

STATUS:

The M845 Projectile was type classified in May 1980. Limited production of the M845 Projectile was initiated at the Savanna Army Ammunition Plant in June 1980.



PROJECTILE, 8 INCH, M106

PROJECTILE, 8 INCH M106

OBJECT OF DEVELOPMENT: Since its development in the early 1930's, the M106 has been the US Army's standard projectile for all 8 Inch towed and self propelled artillery weapons. By design, the M106 today provides the basis by which all other 8 inch conventional munitions are compared and evaluated.

ITEM DESCRIPTION: The M106 is a high explosive projectile consisting of a one piece, forged steel body containing 36 pounds of TNT filler and a M557 nose fuze. Fully assembled, the projectile measures approximately 35 inches in length and weighs 200 pounds.

OPERATION: The M106 projectile is designed to be fired in the M110A2 SP Howitzer with the M1, M2, M188 and M188A1 propelling charges. Chambering and firing of the M106 projectile is conducted in a conventional manner and requires no special training or skill. At a designated time in its trajectory, the projectile may be set off to produce either an airburst or ground burst depending on the type of fuze and setting used.

PROGRAM STATUS: The M106 Projectile is a stockpiled item representing a large part of the US Army's 8 inch munition inventory. Because of its relatively low cost, the M106 has been used extensively to train 8 inch artillery gun crews and to generate a variety of propelling charge and gun firing data. Although the US Army has had no need to produce additional M106 Projectiles for many years, the Free Republic of Germany, under RSI direction, has been licensed to manufacture this projectile.

INTERIOR BALLISTIC PARAMETERS OF M106 PROJECTILE FIRED IN M110A2 SP HOWITZER

(70 DEGREES F)

CHG/ZONE	NOMINAL CHAMBER PRESSURE (PSI)	AVERAGE MUZZLE VELOCITY (FPS)	PROJECTILE SET BACK (G'S)	MAX ANGULAR VELOCITY (RAD/SEC)	MAX ANGULAR ACCELERATION (RAD/SEC^2)
M1/1	8100	838	2035	395	30837
M1/2	9700	920	2437	433	36928
M1/3	12000	1016	3014	479	45684
M1/4	15600	1161	3919	547	59389
M1/5	24000	1390	6029	655	91368
M2/5	14300	1463	3592	689	54440
M2/6	20000	1705	5024	803	76140
M2/7	31400	1991	7888	938	119540
M188A1/8	31000	2330	7787	1097	118017
M188A1/9	39600	2530	9947	1192	150757

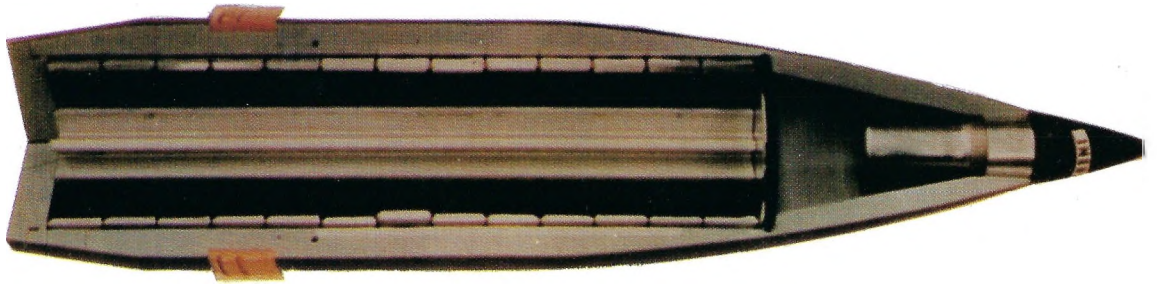
GUN TUBE TWIST: 20 CAL/TURN

CHAMBER VOLUME W/M106: 1943 IN^3

PROJECTILE TRAVEL: 273 INCHES

RANGE ZONING AND RANGE OVERLAP AT 70°F
M106 HE PROJECTILES WITH M1, M2 AND M188A1
CHARGES IN M201 CANNON FOR M110A2 SP HOWITZER

CHARGE (MODEL)	ZONE	MUZZLE VELOCITY (F/S)	RANGE		RANGE OVERLAP	
			MAX @45° QE (METERS)	MIN @65° QE (METERS)	METERS	PERCENT (%)
M1 (GREEN BAG)	1	838	5800	4400		
	2	920	6800	5200	600	11.5
	3	1016	8200	6200	600	9.7
	4	1161	98000	7500	700	9.3
	5	1390	11800	9150	650	7.1
M2 (GREEN BAG)	5	1463	12500	9700	2100	21.6
	6	1705	14500	11500	1000	8.7
	7	1991	17000	13500	1000	7.4
M188A1	8	2330	20600	16400	600	3.7
	9	2530	22900	18500	2100	11.4



PROJECTILE, 8 INCH, M404

PROJECTILE, 8 INCH M404

OBJECT OF DEVELOPMENT: The M404 Projectile is a first generation ICM round developed to provide increased firepower and lethal effectiveness against personnel targets.

ITEM DESCRIPTION: The M404 is a cargo carrying projectile containing 104, M43 grenades. Each grenade is a fragmenting steel sphere containing 21 grams of RDX and a time delay device. The carrier consists of a steel body, steel boattail, steel base plug and the M565 nose fuze. Fully assembled the projectile measures approximately 35 inches and weighs 200 pounds.

OPERATION: The M404 Projectile is designed to be fired in the M110A2 SP Howitzer with the M1 and M2 Propelling charges only. Chambering and firing of the projectile is conducted in a conventional manner and requires no special training or skill. At a predetermined point in the trajectory, the cargo is base ejected by the action of the M565 nose fuze. Upon ejection from the carrier, the grenades are dispersed by the projectile spin. On impact with the ground the spheres are released. A functioning time delay within the sphere initiates the high explosive charge producing a detonation five feet above the ground.

PROGRAM STATUS: The 404 Projectile was Type Classified Standard for the M110 SPH in the 1960's. In 1978, the M404 Projectile was modified to assure compatibility with the M2 charge in the M110A2 SPH. Modifications to existing stocks will include torquing of the projectile base to 1000 ft. pounds and pinning of the aft body joint. The M404 projectile is no longer in production.

INTERIOR BALLISTIC PARAMETERS
OF M404 PROJECTILE FIRED IN M110A2 SP HOWITZER

(70 DEGREES F)

CHG/ZONE	NOMINAL CHAMBER PRESSURE (PSI)	AVERAGE MUZZLE VELOCITY (FPS)	PROJECTILE SET BACK (G'S)	MAX ANGULAR VELOCITY (RAD/SEC)	MAX ANGULAR ACCELERATION (RAD/SEC^2)
M1/1	8100	838	2035	395	30837
M1/2	9700	920	2437	433	36928
M1/3	12000	1016	3014	479	45684
M1/4	15600	1161	3919	547	59389
M1/5	24000	1390	6029	655	91368
M2/5	14300	1463	3592	689	54440
M2/6	20000	1705	5024	803	76140
M2/7	31400	1991	7888	938	119540

GUN TUBE TWIST: 20 CAL/TURN

CHAMBER VOLUME W/M404: 2031 IN^3

PROJECTILE TRAVEL: 273 INCHES

RANGE ZONING AND RANGE OVERLAP AT 70° F
M404 HE PROJECTILES WITH M1, AND M188A1
CHARGES IN M201 CANNON FOR M110A2 SP HOWITZER

CHARGE (MODEL)	ZONE	MUZZLE VELOCITY (F/S)	RANGE		RANGE OVERLAP	
			MAX @ 45° QE (METERS)	MIN @ 65° QE (METERS)	METERS	PERCENT (%)
M1 (GREEN BAG)	1	838	5800	4400		
	2	920	6800	5200	600	11.5
	3	1016	8200	6200	600	9.7
	4	1161	9800	7500	700	9.3
	5	1390	11800	9150	650	7.1
M2 (WHITE BAG)	5	1463	12500	9700	2100	21.6
	6	1705	14500	11500	1000	8.7
	7	1991	17000	13500	1000	7.4

PROJECTILE, 8 INCH, M426

PROJECTILE 8 INCH, M426

OBJECT OF DEVELOPMENT: The M426 Projectile is a chemical round designed with the capability of delivering and dispensing casualty producing agents. When filled with VX agent, the projectile is also used to contaminate habitable areas to deny such areas to the enemy.

ITEM DESCRIPTION: The M426 Projectile is a hollow steel forging ballistically similar to the standard HE M106 Projectile. A tubular burster casing of thin metal, containing a Composition B4 burster occupies the center of the shell and seals in the agent. The remainder of the interior space is filled with 14.5 pounds of liquefied GB non-persistent, or VX persistent gas. A threaded steel adapter provides a receptacle for a point-detonating or proximity fuze. A rotating band of gilding metal encircles the casing near the back end of the projectile.

OPERATION: Designed initially for the M110 Weapon System, the M426 Projectile is also capable of being fired from the M110A2 SP Howitzer with the M1, M2, M188 and M188A1 propelling charges. Chambering and firing the M426 Projectile is conducted in a conventional manner and requires no special preparation or skill. The projectile can be fired with either a point-detonating or proximity fuze. When a PD fuze is used, impact causes the fuze to detonate the supplementary charge which in turn detonates the burster tube. Subsequently the burster ruptures the shell case releasing the agent. When a proximity fuze is employed, action on the burster tube is initiated directly from the booster element of the fuze causing rupturing of the projectile over the target area.

PROGRAM STATUS: In 1961, the M426 Projectile was Type Classified Standard in the M110 SPH. Following limited initial production no M426 Projectiles have been produced.

In 1978, the M426 Projectile was Safety Certified with the M188E1 (Zone 9) Propelling Charge in the M110A2 SPH. Type classification however is still pending.

INTERIOR BALLISTIC PARAMETERS
OF M426 PROJECTILE FIRED IN M110A2 SP HOWITZER
(70 DEGREES F)

CHG ZONE	NOMINAL CHAMBER PRESSURE (PSI)	AVERAGE MUZZLE VELOCITY (FPS)	PROJECTILE SET BACK (G'S)	MAX ANGULAR VELOCITY (RAD/SEC)	MAX ANGULAR ACCELERATION (RAD/SEC^2)
M1/1	8100	838	2035	395	30837
M1/2	9700	920	2437	433	36928
M1/3	12000	1016	3014	479	45684
M1/4	15600	1161	3919	547	59389
M1/5	24000	1390	6029	655	91368
M2/5	14300	1463	3592	689	54440
M2/6	20000	1705	5024	803	76140
M2/7	31400	1991	7888	938	119540
M188A1/8	31000	2330	7787	1097	118017
M188A1/9	39600	2530	9947	1192	150757

GUN TUBE TWIST: 20 CAL/TURN

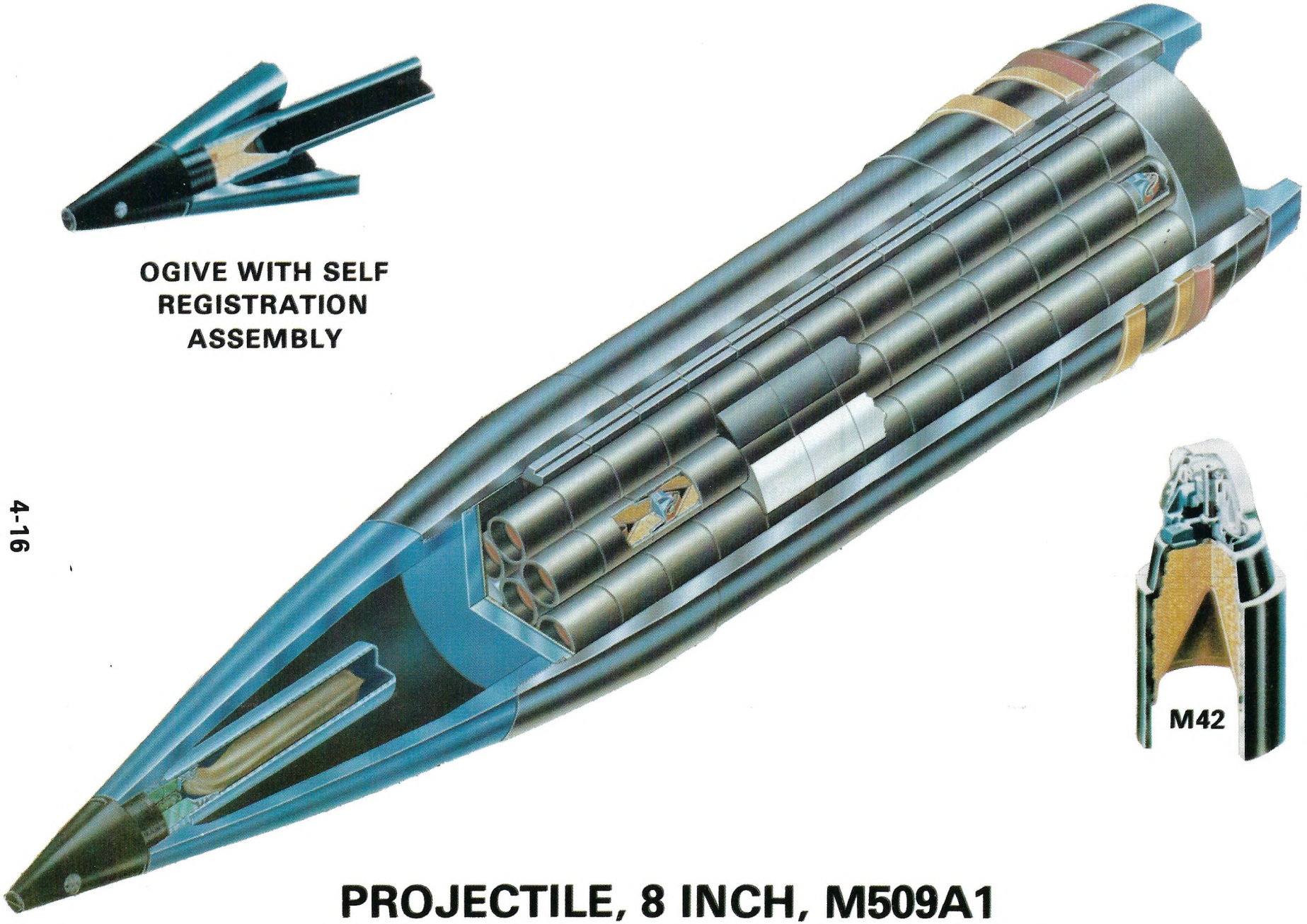
CHAMBER VOLUME W/M426: 1943 IN^2

PROJECTILE TRAVEL: 273 INCHES

RANGE ZONING AND RANGE OVERLAP AT 70° F
M426 PROJECTILES WITH M1, AND M188A1
CHARGES IN M201 CANNON FOR M110A2 SP HOWITZER

CHARGE (MODEL)	ZONE	MUZZLE VELOCITY (F/S)	RANGE		RANGE OVERLAP	
			MAX @ 45° QE (METERS)	MIN @ 65° QE (METERS)	METERS	PERCENT (%)
M1 (GREEN BAG)	1	838	5800	4400		
	2	920	6800	5200	600	11.5
	3	1016	8200	6200	600	9.7
	4	1161	9800	7500	700	9.3
	5	1390	11800	9150	650	7.1
M2 (WHITE BAG)	5	1463	12500	9700	2100	21.6
	6	1705	14500	11500	1000	8.7
	7	1991	17000	13500	1000	7.4
M188A1	8	2330	20600	16400	600	3.7
	9	2530	22900	18500	2100	11.4

OGIVE WITH SELF REGISTRATION ASSEMBLY



PROJECTILE, 8 INCH, M509A1

PROJECTILE 8 INCH, M509A1

OBJECT OF DEVELOPMENT:

The M509A1 Projectile is a second generation ICM round which was developed to replace the older, single purpose M404 ICM Projectile. Providing a dual purpose capability, the M509A1 Projectile is designed to engage light armor and personnel targets at longer range.

ITEM DESCRIPTION:

The M509A1 is a cargo carrying projectile containing 180, M42 grenades. Each grenade is a fragmenting shape charge consisting of an HE loaded embossed steel body with a copper liner (cone), a M223 fuze and a ribbon stabilizer. The carrier consists of a 7075 aluminum ogive, 4140 steel shell body with welded copper rotating band, 7075 aluminum base plug and the M577 fuze. Fully assembled, the M509A1 Projectile weighs approximately 208 pounds and measures 43.9 inches in length.

OPERATION:

The M509A1 Projectile is designed to be fired in the M110A2 SP Howitzer with the M1, M2, M188 and M188A1 Propelling charges. Chambering and firing of the M509A1 Projectile is conducted in a conventional manner and requires no special training or skill. At a predetermined point in the trajectory, the cargo is base ejected by the action of the M577 nose fuze. Upon ejection from the carrier, the grenades are dispersed by the projectile spin and are oriented and armed by a stabilizing ribbon device. On impact the grenade fuze initiates the high explosive charge producing an armor penetrating jet and numerous high velocity metal fragments.

PROGRAM STATUS:

The M509 Projectile was type classified standard in the M110 SPH in November 1973. The M509A1 Projectile was type classified standard in the M110A2 SPH in September 1980. Initial production is expected to start in the latter part of FY81.

INTERIOR BALLISTIC PARAMETERS OF M509A1 PROJECTILE FIRED IN M110A2 SP HOWITZER

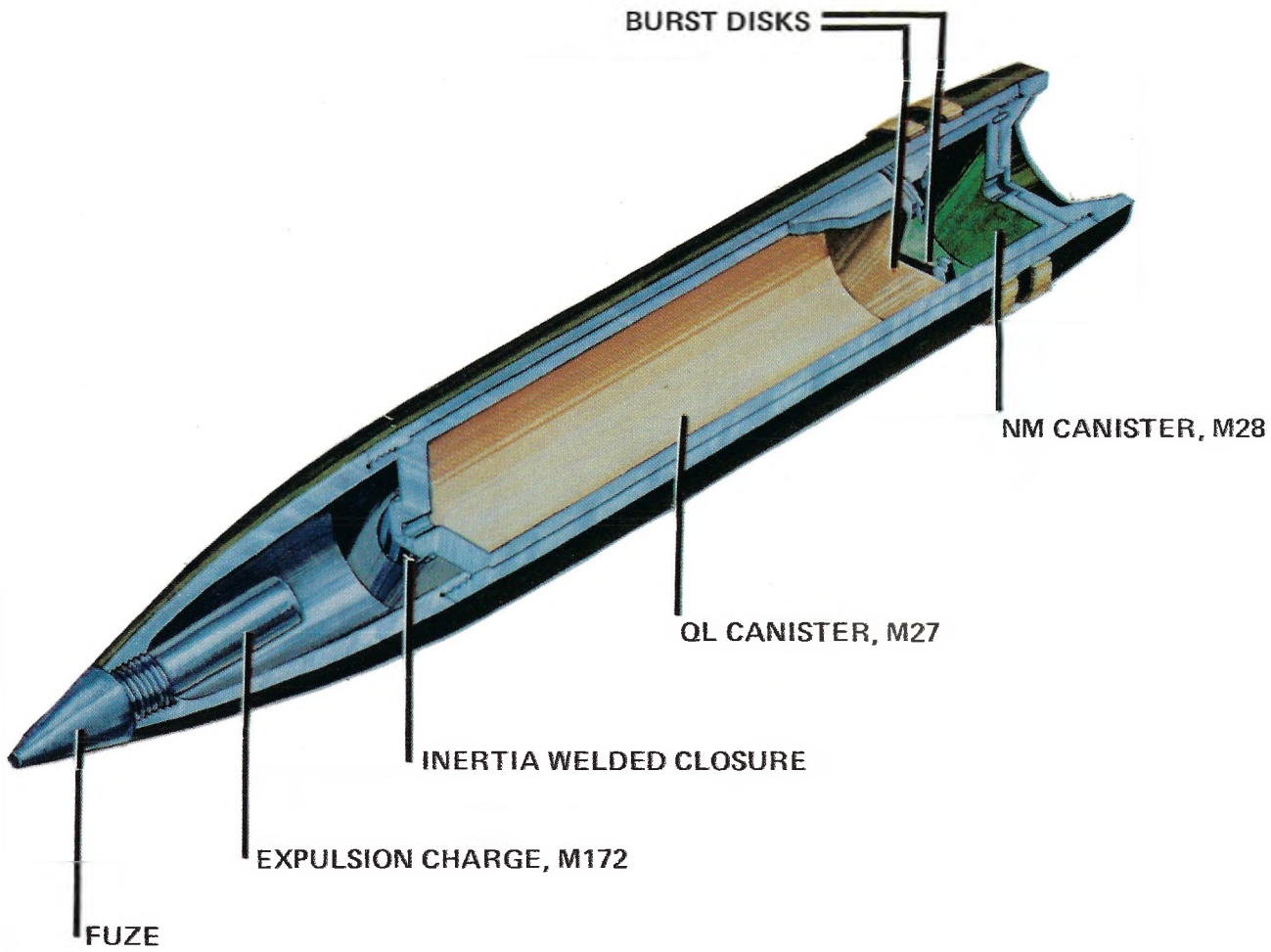
(70 DEGREES F)

CHG/ZONE	NOMINAL CHAMBER PRESSURE (PSI)	AVERAGE MUZZLE VELOCITY (FPS)	PROJECTILE SET BACK (G'S)	MAX ANGULAR VELOCITY (RAD/SEC)	MAX ANGULAR ACCELERATION (RAD/SEC^2)
M1/1	8,080	805.8	1,919	385	29,490
M1/2	9,480	878.8	2,251	419	34,599
M1/3	11,720	984.1	2,784	470	42,774
M1/4	16,010	1133.2	3,803	541	58,432
M1/5	23,490	1358.0	5,579	648	85,731
M2/5	14,500	1431.5	3,444	683	52,920
M2/6	21,180	1674.5	5,030	799	77,300
M2/7	31,030	1950.1	7,370	931	113,250
M188A1/8	31,210	2316.2	7,413	1,105	113,907
M188A1/9	39,040	2509.7	9,272	1,198	142,484

GUN TUBE TWIST – 20 CAL/TURN
CHAMBER VOLUME W/M509A1 = 2045 IN^3
PROJECTILE TRAVEL – 273 INCHES

RANGE ZONING AND RANGE OVERLAP AT 70°F
M509A1 PROJECTILES WITH M1, M2 AND M188A1
CHARGES IN M201 CANNON FOR M110A2 SP HOWITZER

CHARGE (MODEL)	ZONE	MUZZLE VELOCITY (F/S)	RANGE		RANGE OVERLAP	
			MAX @ 45° QE (METERS)	MIN @ 65° QE (METERS)	METERS	PERCENT (%)
M1 (GREEN BAG)	1	805.8	5,451	4098	–	–
	2	878.8	6,335	4830	621	11.4
	3	984.1	7,793	5794	541	8.5
	4	1133.2	9,661	7369	424	5.4
M2 (WHITE BAG)	5	1431.5	12,347	9668	–	–
	6	1674.5	14,551	11852	495	4.0
	7	1950.1	17,410	14578	–	–
M188A1	8	2316.2	21,304	17387	23	0.1
	9	2509.7	23,431	19597	1707	8.0



PROJECTILE, 8 INCH, XM736

PROJECTILE, 8 INCH, XM736

Due to security restrictions, information on the XM736 Projectile is being withheld pending type classification.

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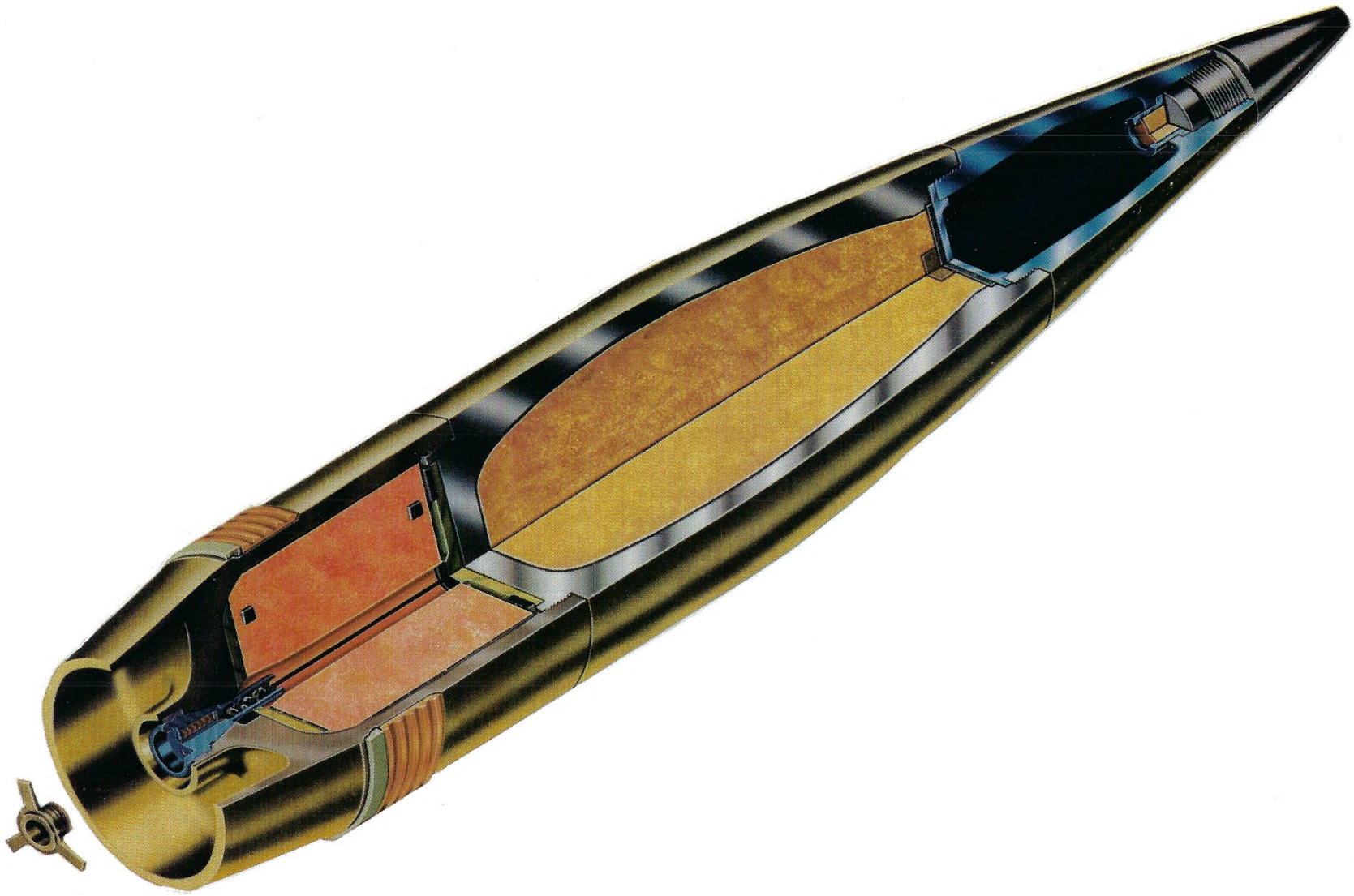


PROJECTILE, 8 INCH, M650

PROJECTILE, 8 INCH, ROCKET ASSIST (RA), M650

OBJECT OF DEVELOPMENT: The M650 Projectile is a high explosive rocket assisted round designed to reach a maximum range of 30 kilometers when fired from the M110A2 SP Howitzer. More powerful and lethal than the standard M106 Projectile, the M650 is intended for use against personnel and materiel targets and as a registration round for the XM753 Nuclear Projectile.

ITEM DESCRIPTION: By design, the M650 Projectile consists of four major components which include a fuze, forward warhead section, aft warhead section and a rocket motor. Threaded together these components form an aerodynamically streamlined projectile. For effect, the forward warhead section, fabricated from forged 7075 aluminum, is designed to accept short intrusion Point Detonating (PD), Mechanical Time Super Quick (MTSQ) and proximity fuzes, and a fuze spit back device for initiation of the high explosive warhead. Connected to the forward warhead is the HF-1 steel, high fragmentation, aft warhead filled with 26 pounds of TNT explosive. A composition A5 booster pellet embedded in the top surface of the TNT filler serves to assure high yield explosive detonation. Threaded to the aft warhead is a 4340 alloy steel rocket motor body containing a tri-split solid propellant grain and a ignition delay assembly with rocket-off cap. A welded copper overlay rotating band backed by a nylon obturator completes the rocket motor configuration. The M650 Projectile weighs 200 pounds and measures approximately 43.9 inches long.

OPERATION: The M650 Projectile is designed to be fired in the M110A2 SP Howitzer with the M1, M2, M188A1 and M188 Propelling Charges. Chambering and firing of the M650 Projectile is conducted in a conventional manner and requires no special training or skill. When fired in the rocket assist mode, however, it is necessary to unscrew the rocket-off cap from the ignition delay assembly prior to chambering of the round. This procedure is mandatory when firing for extended range. During a rocket-on firing the exposed pyrotechnic columns in the delay housing are ignited by the propelling charge gun gasses, and approximately seven seconds into the flight rocket ignition takes place. Upon ignition, the rocket motor provides an added thrust to the projectile increasing its velocity. The increased velocity imparted to the projectile produces the additional range.

PROGRAM STATUS: The M650 Projectile was type classified in October 1978. Initial production was started in September 1980.

INTERIOR BALLISTIC PARAMETERS
OF M650 PROJECTILE FIRED IN M110A2 SP HOWITZER
(70 DEGREES F)

CHG/ZONE	NOMINAL CHAMBER PRESSURE (PSI)	AVERAGE MUZZLE VELOCITY (FPS)	PROJECTILE SET BACK (G'S)	MAX ANGULAR VELOCITY (RAD/SEC)	MAX ANGULAR ACCELERATION (RAD/SEC^2)
M1/1	7700	842	1933	397	29314
M1/2	9200	920	2309	433	35024
M1/3	11400	1017	2861	479	43400
M1/4	15200	1154	3815	545	57866
M1/5	22200	1377	5572	649	84514
M2/5	13600	1453	3414	684	51775
M2/6	19940	1691	5004	796	75912
M2/7	29980	1980	7525	933	114134
M188A1/8	31600	2323	7937	1094	120377
M188A1/9	39600	2520	9819	1187	148930

GUN TUBE TWIST: 20 CAL/TURN

CHAMBER VOLUME W/M650: 2090 IN^3

PROJECTILE TRAVEL: 273 INCHES

RANGE ZONING AND RANGE OVERLAP AT 70° F
M650 PROJECTILES WITH M1, M2 AND M188A1
CHARGES IN M201 CANNON FOR M110A2 SP HOWITZER

CHARGE (MODEL)	ZONE	MUZZLE VELOCITY (F/S)	RANGE		RANGE OVERLAP	
			MAX @ 45° QE (METERS)	MIN @ 65° QE (METERS)	METERS	PERCENT (%)
M1 (GREEN BAG)	1	842	5800	4400		
	2	920	6800	5150	650	12.6
	3	1017	8100	6100	700	11.4
	4	1154	9600	7300	800	10.9
M2 (WHITE BAG)	5	1377	11700	9000	600	7.7
	5	1453	12500	9600	2100	23.6
	6	1691	14900	11500	1000	8.7
	7	1980	17900	14000	900	6.4
M188A1	8	2323	22000	17600	300	1.7
	9	2520	24300	19650	2350	12.0
	8R	2323	* 26800	23300	1000	4.3
	9R	2520	* 30000	26400	400	1.5

R = ROCKET ON

* = MAX @ 53° QE (METERS)

XM753 PROJECTILE SYSTEM

22 SEP 80

WR

- XM753 PROJECTILE
  - M735 FUZE
  - W79 WARHEAD
  - ROCKET MOTOR
- M613 CONTAINER
  - MC3138 CONTROL PANEL (KIT)
  - MC3395 DISABLE MODULE (KIT)
  - H4278 SPANNER WRENCH
- M38 FUZE SETTER
- H4272 EXTRACTOR TOOL
- XM21 SHOP EQUIPMENT

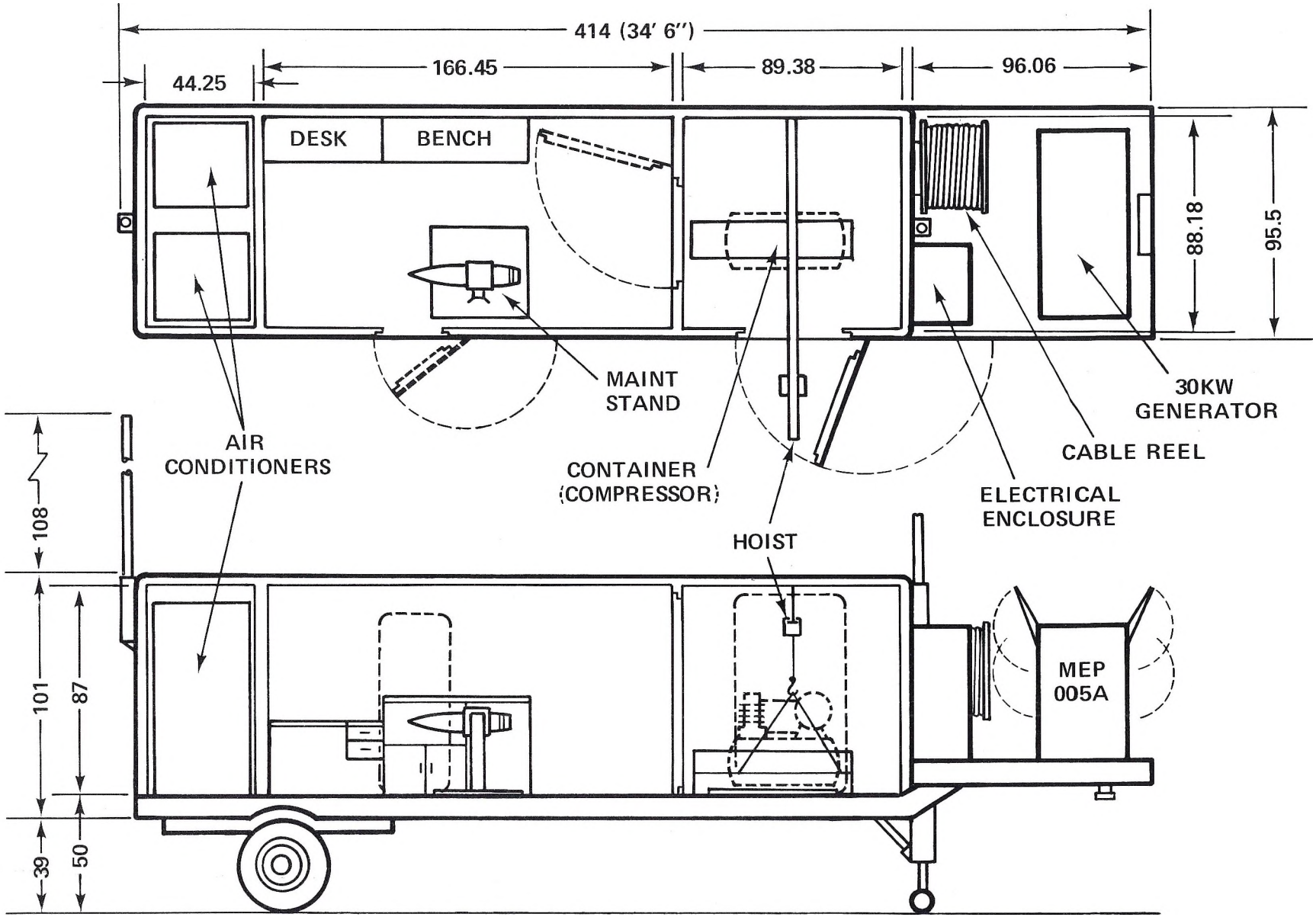
  SEMI-TRAILER MOUNTED
  - XM990 LLC ASSEMBLY VAN
  - XH4280 WHD LLC ASSY STAND
  - XH4283 MOTOR LLC ASSY STAND
  - DOE LLC EQUIPMENT
- G76 HANDCRANKED GENERATOR
- PAL ASSOCIATED EQUIPMENT

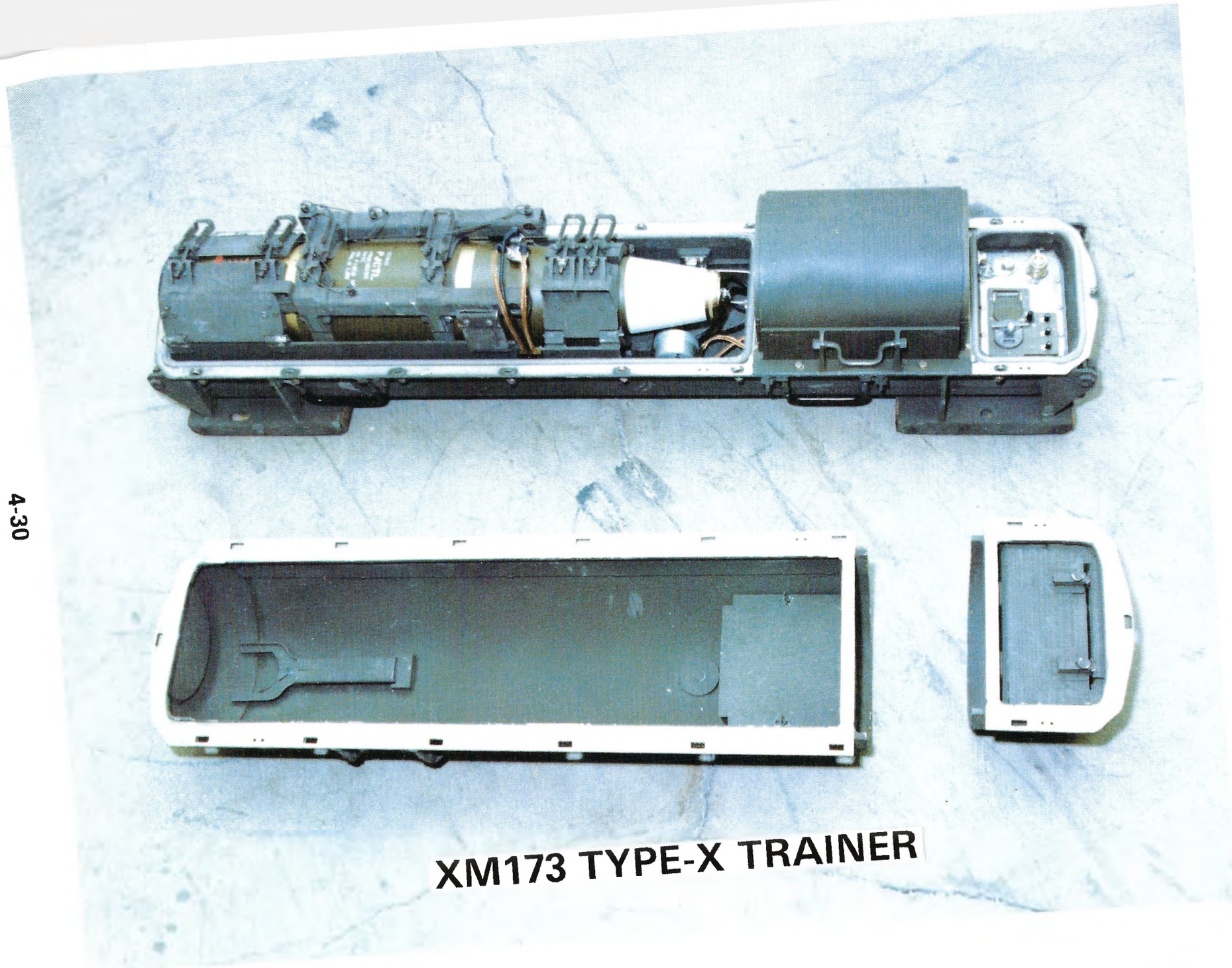
TRAINING

- XM173 TYPE X TRAINER
  - M754 TYPE X PROJECTILE
  - M613 CONTAINER
  - MC3138 TRA CONTROL PANEL (KIT)
  - MC3395 TRA DISABLE MODULE (KIT)
  - H4278 SPANNER WRENCH
- XM174 TYPE W TRAINER
  - XM786 TYPE W PROJECTILE
  - M613 CONTAINER
  - MC3138 TRA CONTROL PANEL (KIT)
  - MC3395 TRA DISABLE MODULE (KIT)
  - H4278 SPANNER WRENCH
- XM64 EOD TRAINING AID
  - W79 TYPE 3D PROJECTILE
  - MC3395 TRD DISABLE MODULE
- **XM622 DSS CONTAINER**

XM21 SHOP EQUIPMENT, NUCLEAR PROJECTILE, SEMI-TRAILER MOUNTED

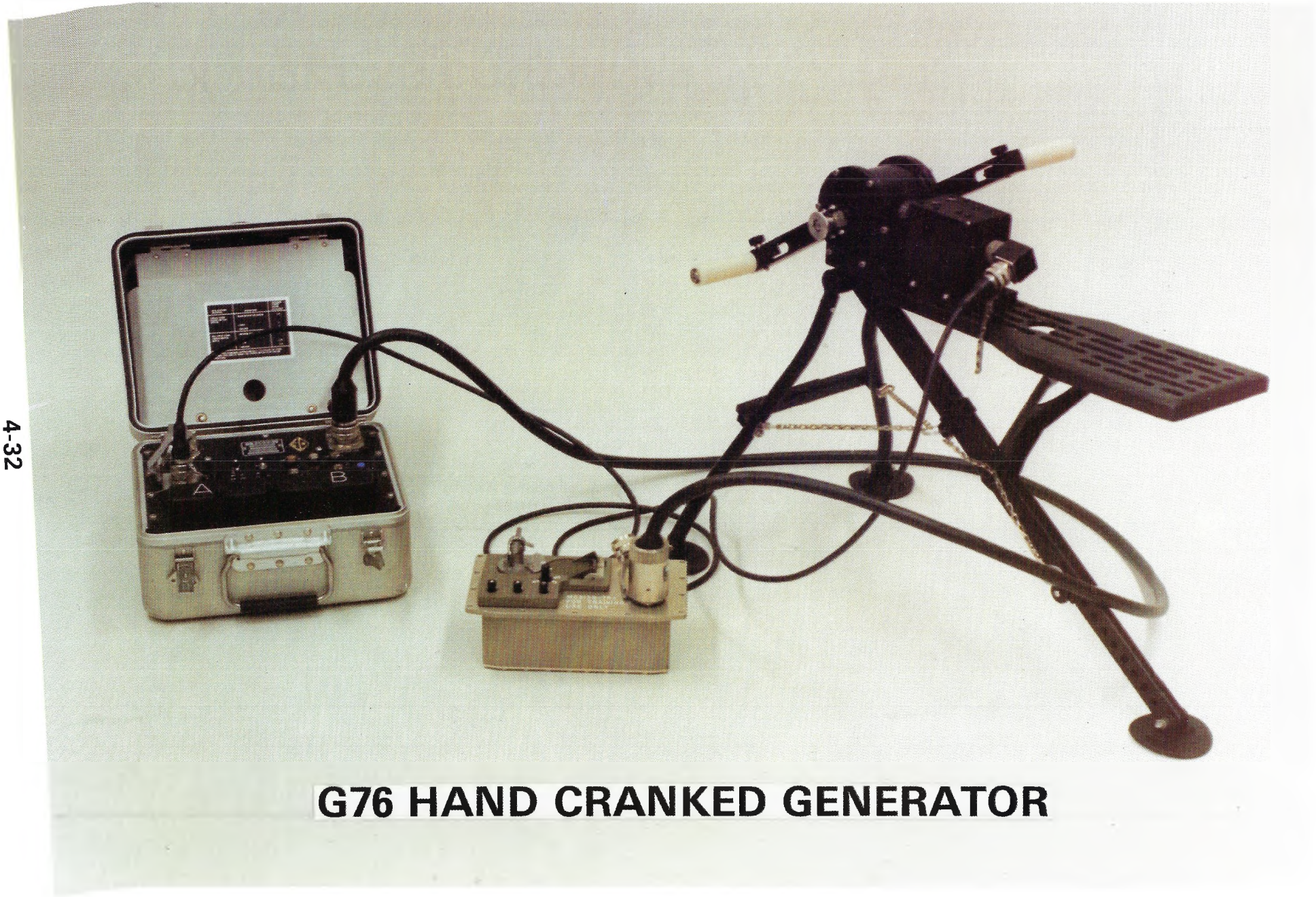
25 JUL 80





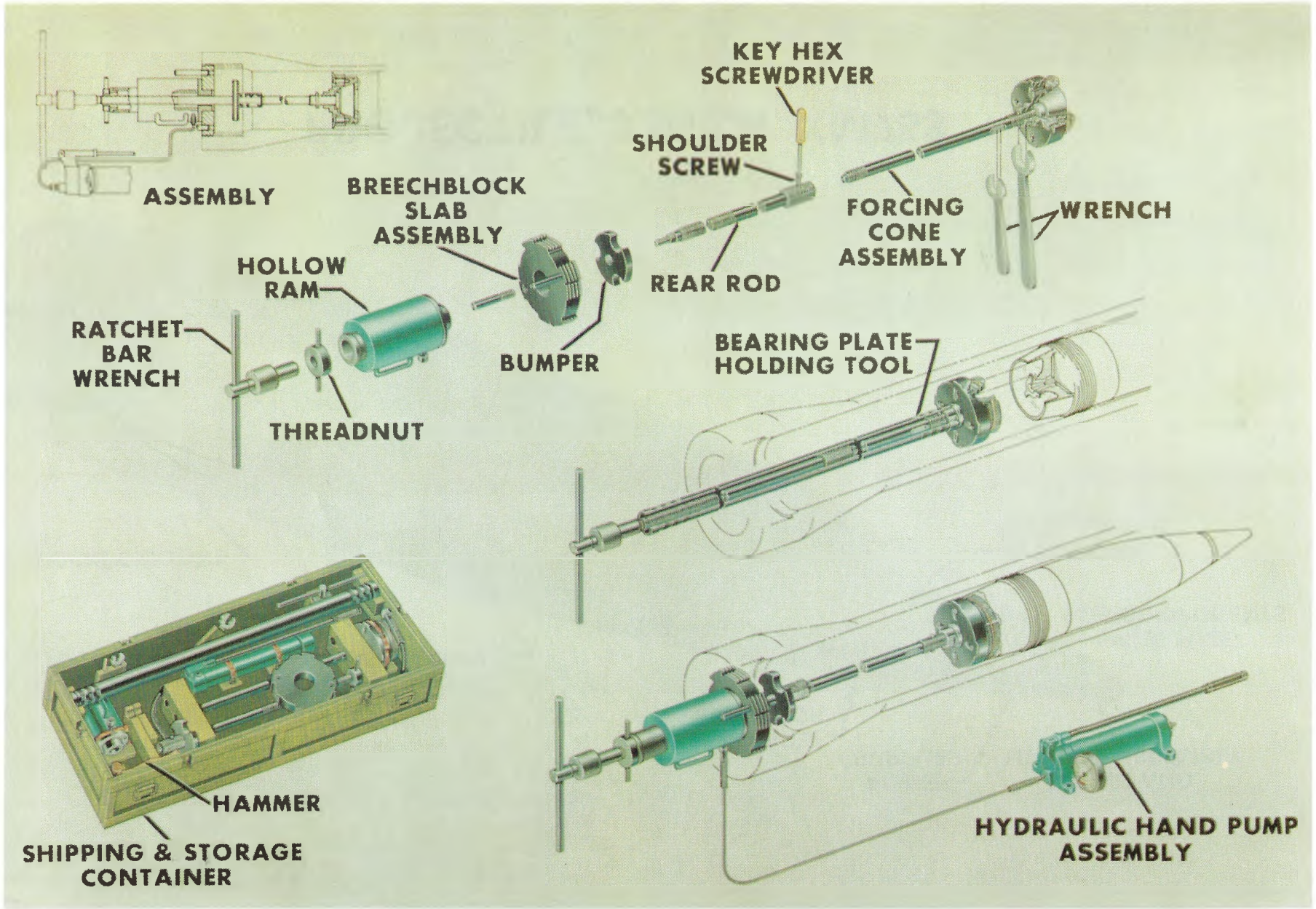
XM173 TYPE-X TRAINER

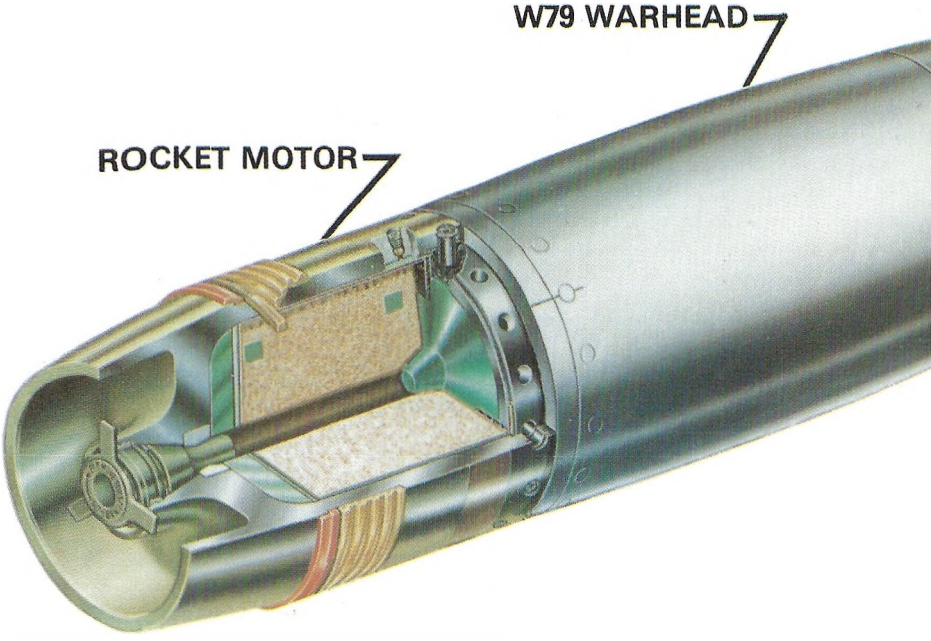
XM622 DSS CONTAINER



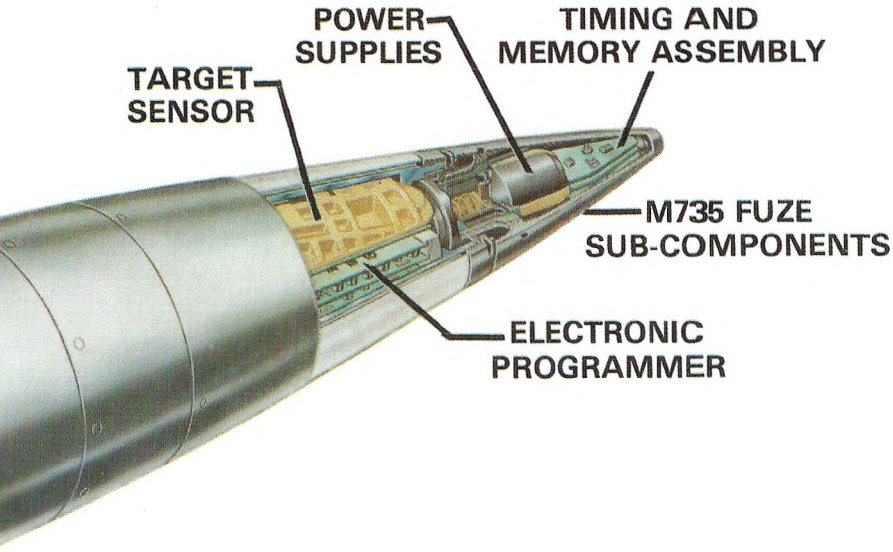
G76 HAND CRANKED GENERATOR

H4272 EXTRACTION TOOL





PROJECTILE, 8


POWER SUPPLIES
TIMING AND MEMORY ASSEMBLY
TARGET SENSOR
M735 FUZE SUB-COMPONENTS
ELECTRONIC PROGRAMMER

INCH, XM753

PROJECTILE, 8 INCH, XM753

Due to security restrictions, information on the XM753 Projectile is being withheld pending type classification.

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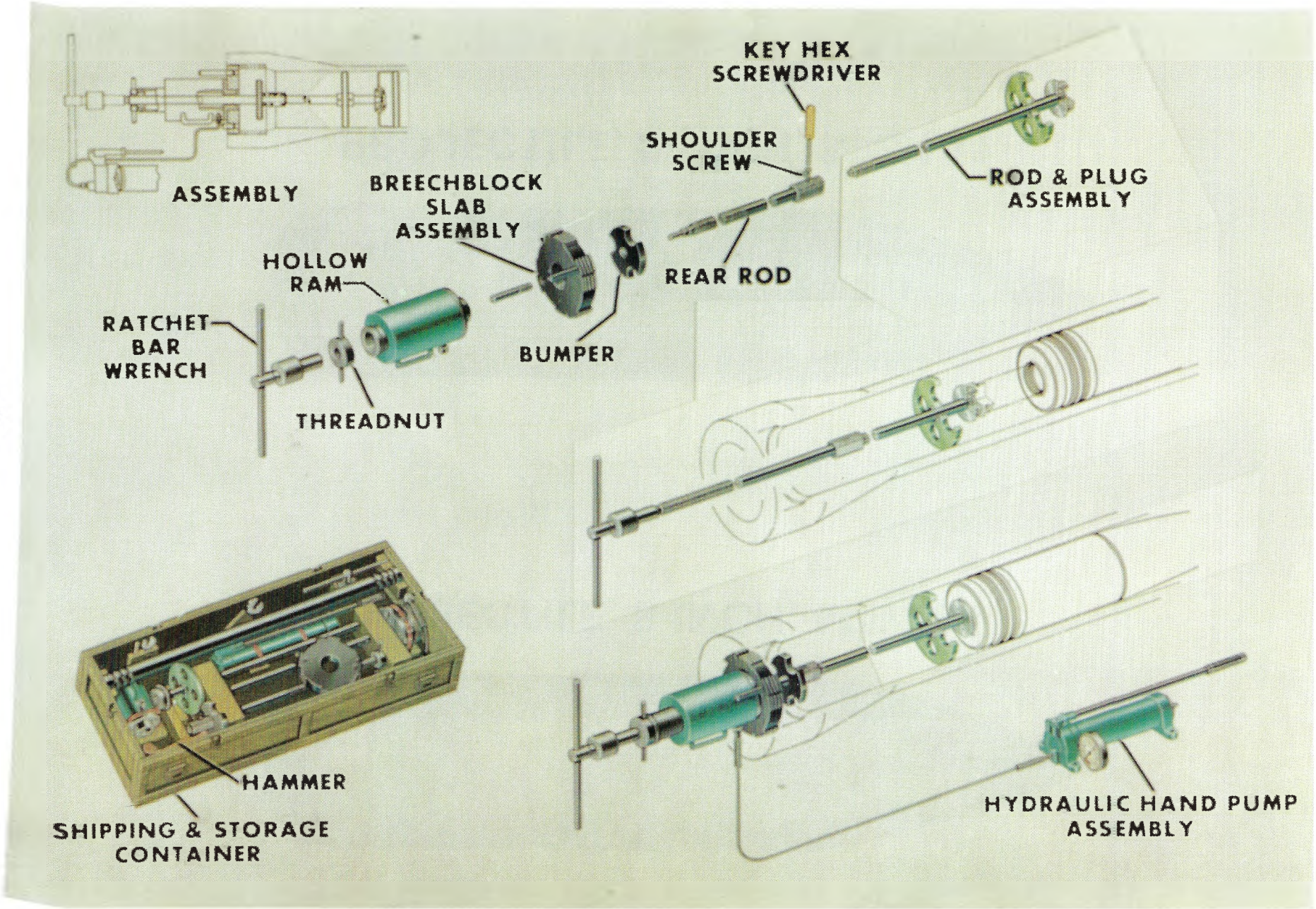
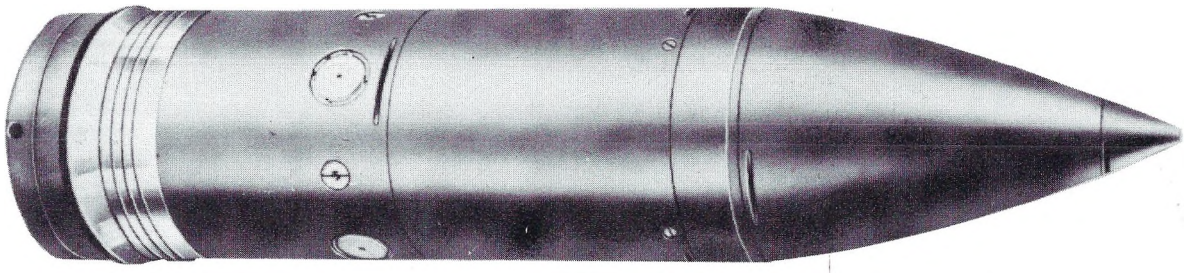
M422A1 PROJECTILE SYSTEM

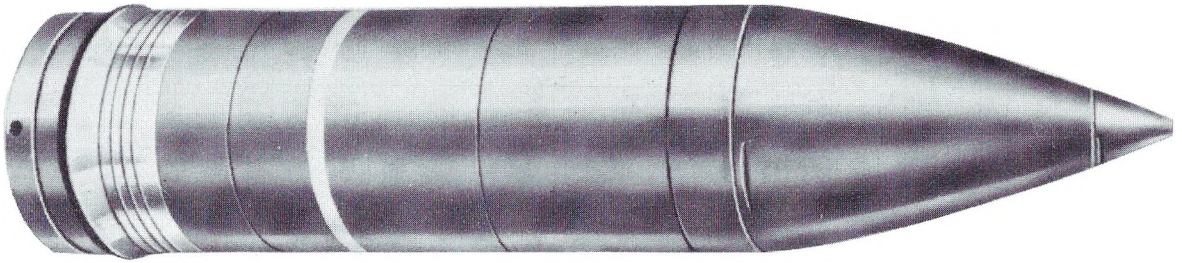
- PROJECTILE, NUCLEAR, M422A1
  - M542 FUZE
- PROJECTILE, HE, M424A1
  - M591 FUZE
- PROJECTILE, TRAINING, M423A1
- PROJECTILE, TRAINING, XM440
- PROJECTILE LOCKING DEVICE, M83
- PROJECTILE EXTRACTION TOOL, H4277
- TOOLS TO ASSEMBLE AND FUZE PROJECTILE

H4277 EXTRACTION TOOL





PROJECTILE, 8 INCH, M422A1



PROJECTILE, 8 INCH, M424A1

PROJECTILE, 8 INCH, M422A1/M424A1

OBJECT OF DEVELOPMENT:

The M422 Projectile was developed initially for use in the M115 and M110 Howitzers for the purpose of providing a first generation 8 Inch nuclear capability against selected tactical targets.

ITEM DESCRIPTION:

The M422A1 is an 8 Inch nuclear projectile consisting of the M542, MT Fuze, projectile metal parts and nuclear components. Fully assembled the M422A1 Projectile measures 37 inches in length and weighs 243 pounds. In the stockpiled configuration, these three groups of components are stored in separate containers.

OPERATION:

The M422A1 Projectile is compatible with the 8 Inch, M115, M110 and M110A2 Howitzers and is capable of achieving a maximum range of 18,200 meters when fired from the M110A2 SP Howitzer with the M188A1 Zone 8 Propelling Charge. In the normal stockpile configuration, the M422A1 Projectile is stored in separate containers. At some time prior to firing, the projectile is put into the assembled configuration. The fuze is set and installed into the projectile just before it is rammed into the cannon. In the event the mission is cancelled after the projectile has been rammed, the M422A1 Projectile can be extracted from the cannon with the aid of the M4277 Extracting Tool. The ballistically similar 8 Inch, M424A1 Projectile is used exclusively as a spotting round for the M422A1 Projectile for the purpose of providing a check on firing accuracy.

STATUS:

The M422 Projectile was type classified in March 1960. In January 1977, the projectile was redesignated the M422A1 following design modifications which permit the projectile to be fired in the M110A2 Self Propelled Howitzer with the M188A1 Zone 8 Propelling Charge.

INTERIOR BALLISTIC PARAMETERS
OF M422A1 PROJECTILE FIRED IN M110A2 SP HOWITZER

(70 DEGREES F)

CHG/ZONE	NORMAL CHAMBER PRESSURE (PSI)	AVERAGE MUZZLE VELOCITY (FPS)	PROJECTILE SET BACK (G'S)	MAX ANGULAR VELOCITY (RAD/SEC)	MAX ANGULAR ACCELERATION (RAD/SEC^2)
M80/1	9300	859	1906	404	28907
M80/2	15000	1249	3074	588	46620
M80/3	30000	1849	6148	871	93242
M188A1/8	37500	2187	7684	1030	116537

GUN TUBE TWIST: 20 CAL/TURN

CHAMBER VOLUME W/M422A1: 2093 IN^3

PROJECTILE TRAVEL: 273 INCHES

RANGE ZONING AND RANGE OVERLAP AT 70° F
M422A1 PROJECTILES WITH M80 AND M188A1
CHARGES IN M201 CANNON FOR M110A2 SP HOWITZER

CHARGE (MODEL)	ZONE	MUZZLE VELOCITY (F/S)	RANGE		RANGE OVERLAP	
			MAX @ 45° QE (METERS)	MIN @ 65° QE (METERS)	METERS	PERCENT (%)
M80	1	859	5800	4400		
M80	2	1249	9800	7600	NA	NA
M80	3	1849	15000	11600	NA	NA
M188A1	8	2187	18200	14500	NA	NA

INTERIOR BALLISTIC PARAMETERS
OF M424A1 PROJECTILE FIRED IN M110A2 SP HOWITZER

(70 DEGREES F)

CHG/ZONE	NORMAL CHAMBER PRESSURE (PSI)	AVERAGE MUZZLE VELOCITY (FPS)	PROJECTILE SET BACK (G'S)	MAX ANGULAR VELOCITY (RAD/SEC)	MAX ANGULAR ACCELERATION (RAD/SEC^2)
M80/1	9300	859	1906	404	28907
M80/2	15000	1249	3074	588	46620
M80/3	30000	1849	6148	871	93242
M188A1/8	37500	2187	7684	1030	116537

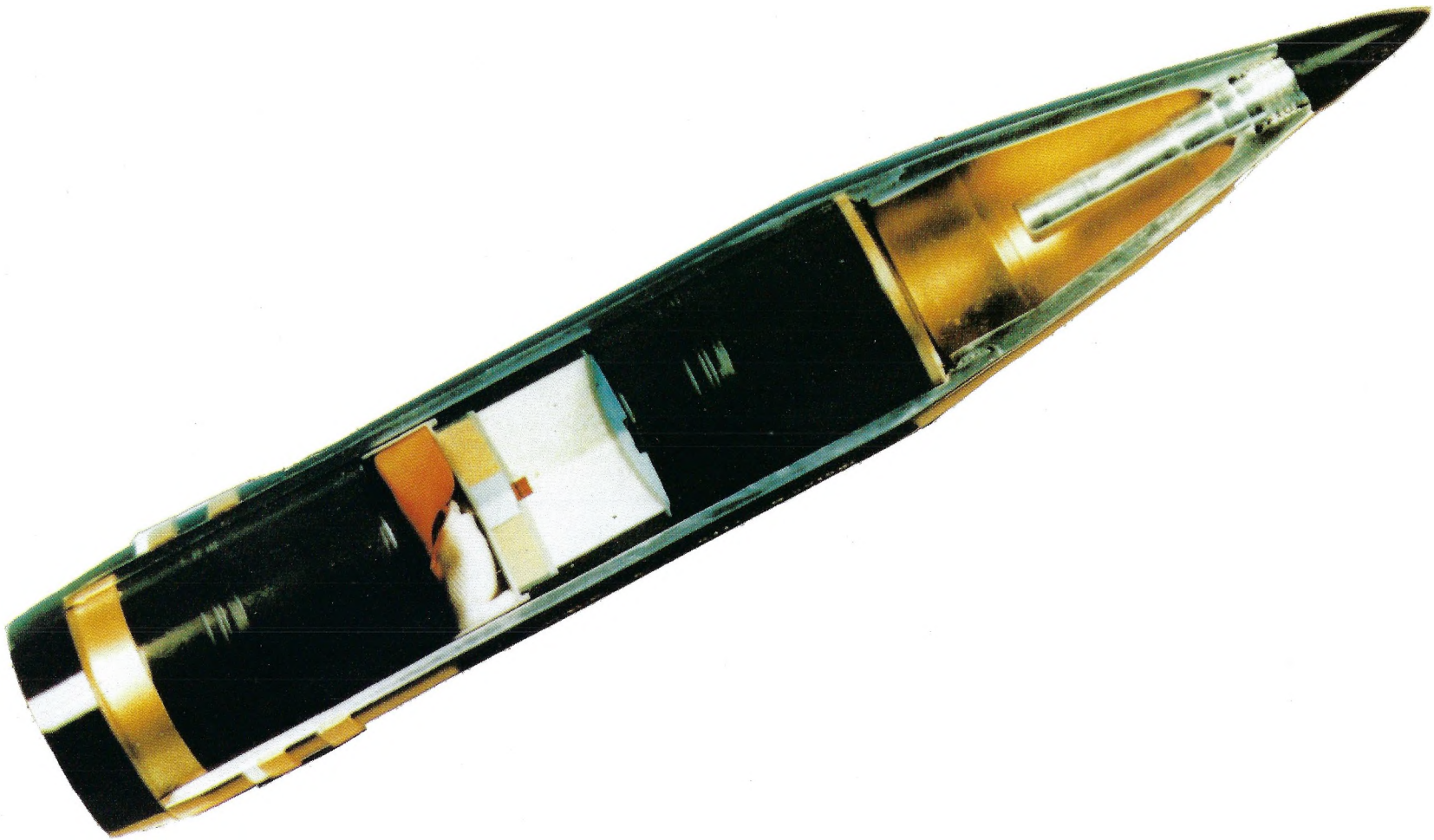
GUN TUBE TWIST: 20 CAL/TURN

CHAMBER VOLUME W/M424A1: 2093 IN^3

PROJECTILE TRAVEL: 273 INCHES

RANGE ZONING AND RANGE OVERLAP AT 70° F
M424A1 PROJECTILES WITH M80 AND M188A1
CHARGES IN M201 CANNON FOR M110A2 SP HOWITZER

CHARGE (MODEL)	ZONE	MUZZLE VELOCITY (F/S)	RANGE		RANGE OVERLAP	
			MAX @ 45°QE (METERS)	MIN @ 65° QE (METERS)	METERS	PERCENT (%)
M80	1	859	5800	4400		
M80	2	1249	9800	7500	NA	NA
M80	3	1849	14900	11700	NA	NA
M188A1	8	2187	18100	14400	NA	NA



PROJECTILE, 8 INCH, XM836

PROJECTILE, 8 INCH, XM836

Due to security restrictions, information on the XM836 Projectile is being withheld pending type classification.

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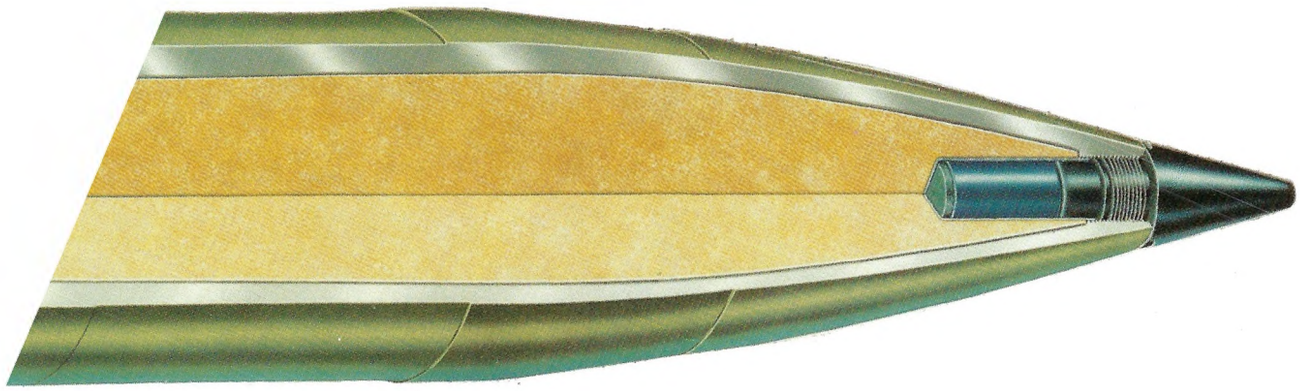

CTILE, 8 INCH: HE, XM711

PROJECTILE, 8 INCH XM711

OBJECT OF DEVELOPMENT: The objective for developing the XM711 Projectile is to provide a new high explosive round that is more effective than the standard M106 Projectile, and that is ballistically compatible with the new family of 8 inch projectiles.

ITEM DESCRIPTION: The XM711 is a high explosive projectile consisting of a HF-1 steel warhead filled with 49 pounds of TNT, and the M739 fuze. Fully assembled the projectile measures approximately 39 inches in length and weighs 203 pounds.

OPERATION: The XM711 Projectile is designed to be fired in the M110A2 SP Howitzer with the M1, M2, M188 and M188A1 propelling charges. Chambering and firing of the projectile is conducted in a conventional manner and requires no special training or skill. Depending on the type of fuze and fuze setting used, the projectile may be set to produce an air burst or ground burst at a predetermined time in its trajectory.

PROGRAM STATUS: This program is currently in the advanced development stage, but has remained dormant since FY78 because of zero funding.

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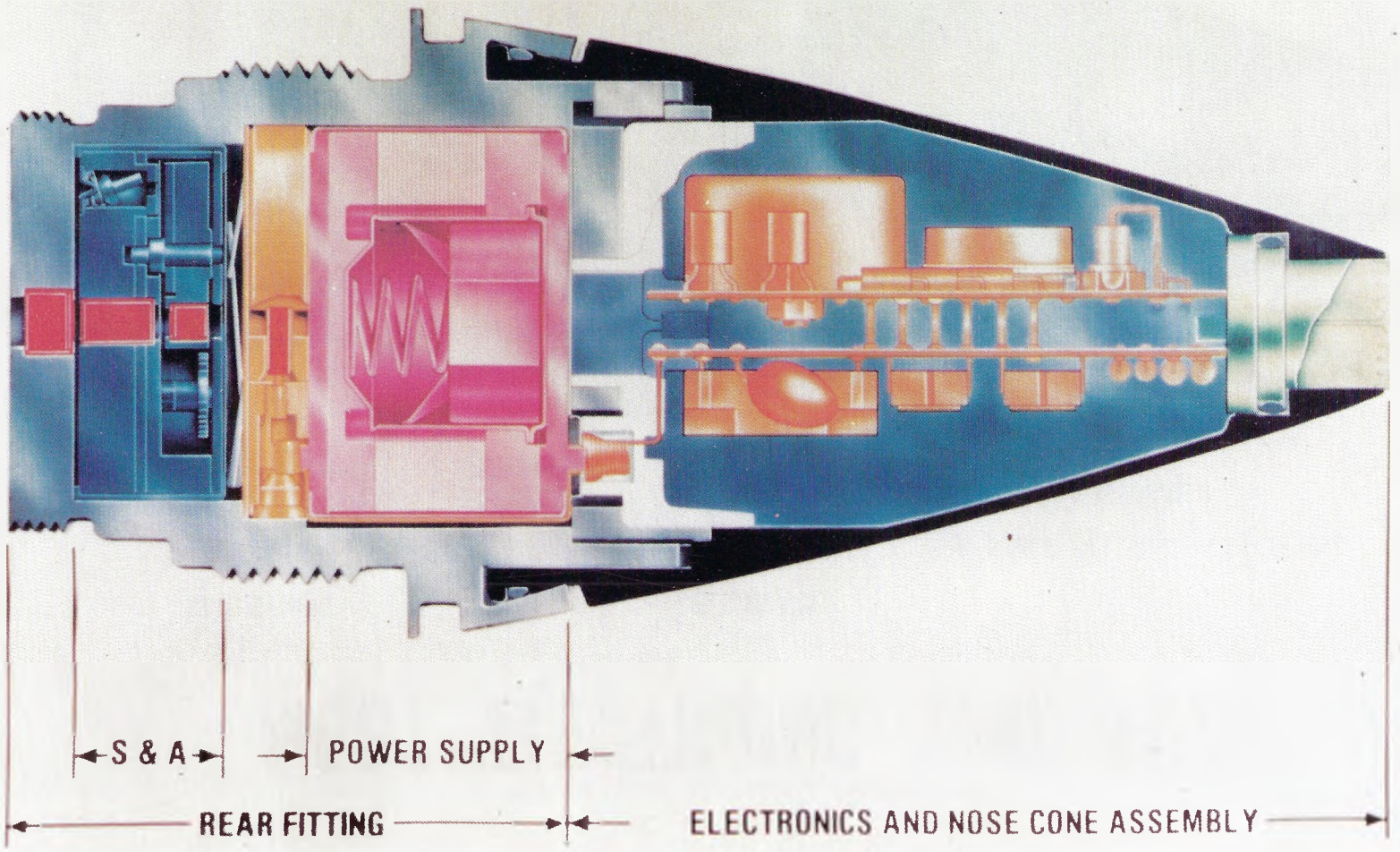
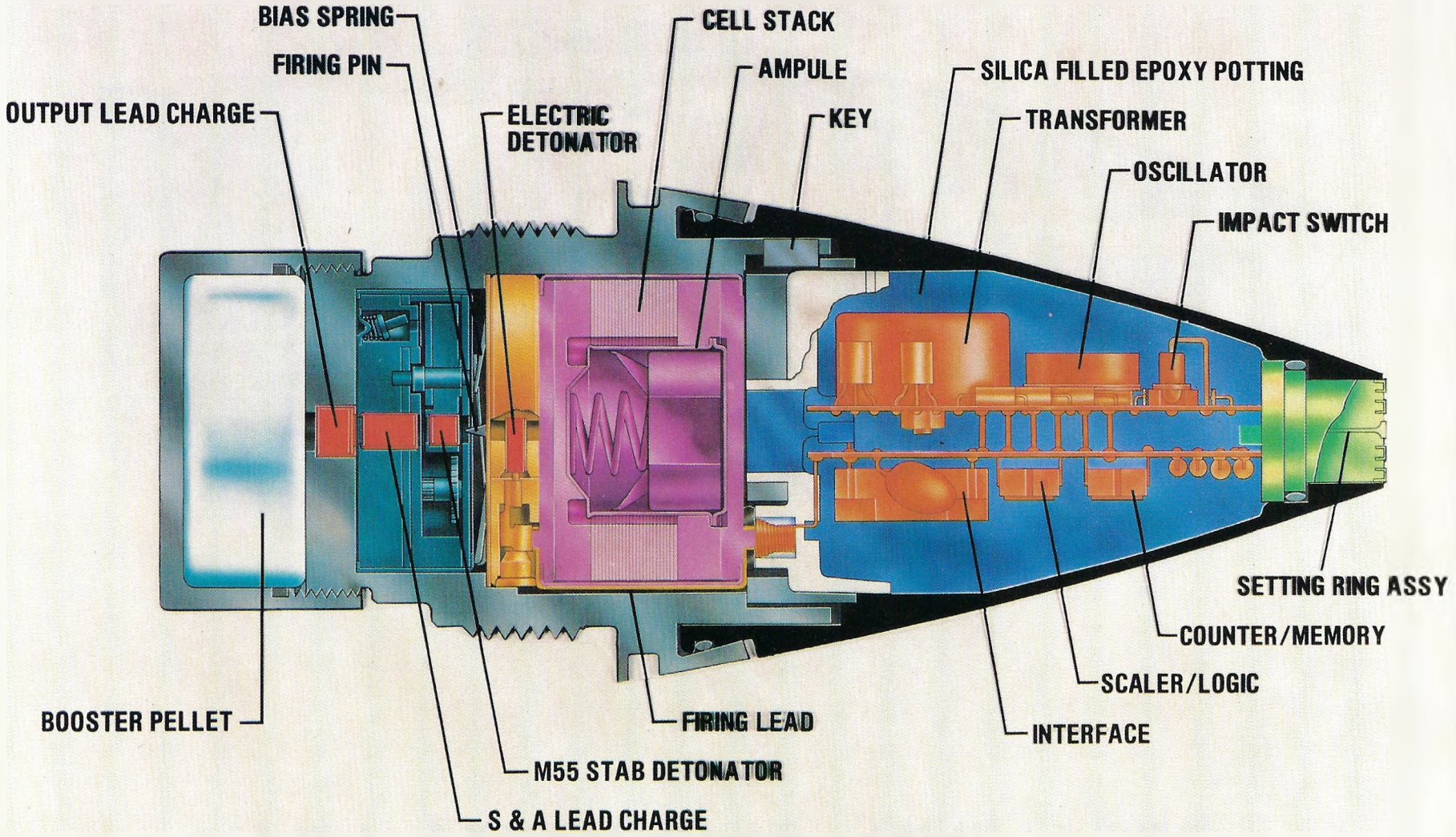
CHAPTER 5

FUZES

M724 ELECTRONIC TIME FUZE



M587 ELECTRONIC TIME FUZE



FUZE, ELECTRONIC TIME (ET) M587/M724

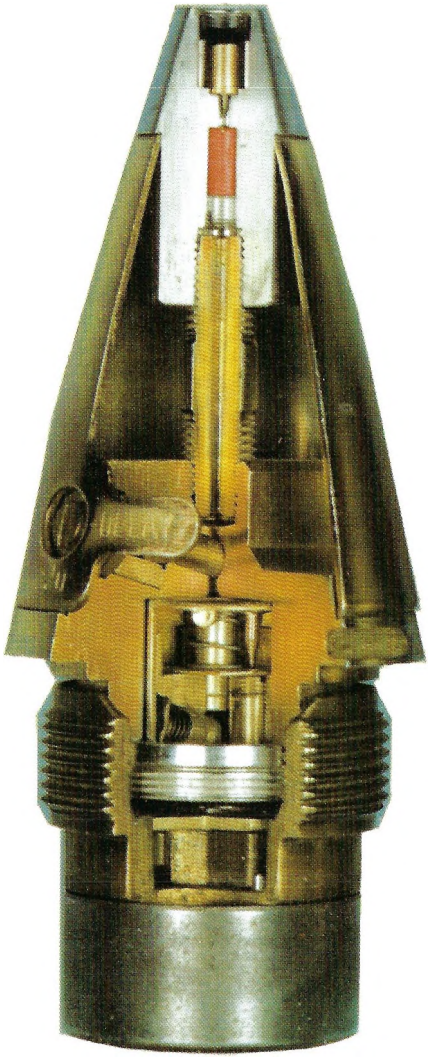
OBJECT OF DEVELOPMENT: The purpose of the M587/M724 Fuze program was to develop electronic time and superquick fuzes which provide closer projectile air burst to target accuracy, and which lend themselves to potential growth and production capability.

ITEM DESCRIPTION: By design, the M587 and the M724 ET fuzes are identical in every respect with the exception that the M587 Fuze comes equipped with a removable booster cup and a Point Detonating (PD) backup feature that consists of a fixed firing pin and a spring loaded Safety and Arming (S&A). The design configuration of the M587/M724 fuze consists of a plastic nose cone and a steel body which contain the electronic time base oscillator, digital electronic timing circuit, set back actuated power supply, mechanical safing and arming mechanism and other electronic components. The fuze setting ring assembly is located in the nose of the fuze. Fully assembled, the M587 Fuze has an overall length of 5.97 inches and weighs approximately 1.81 pounds. By contrast, the M724 Fuze measures 5.27 inches in length and weighs approximately 1.69 pounds.

OPERATION: Operationally, the M587 Fuze is used to detonate high explosive projectiles where as the M724 Fuze is used to function cargo carrying, base ejecting projectiles. To operate effectively, it is mandatory that the M587/M724 fuzed projectile be fired from a cannon with a minimum set back acceleration of 1200 G's and a minimum spin rate of 1700 RPM. On setback, the force of acceleration releases the S&A safety pin and simultaneously opens the battery ampule allowing the electrolyte to flow out. Under the effect of spin, the S&A safety detents are released, the S&A rotor is moved to the armed position and the released electrolyte is forced into the battery cells activating the battery. Arming of the S&A mechanism takes place after the projectile has travelled 400 to 800 caliber lengths in flight. Overhead safety is provided electronically by preventing the charging of the firing circuit until 3.5 seconds before set time (.2 to 199.9 seconds). Functioning occurs within $\pm$.05 seconds of set time with the initiation of the explosive train by the electric detonator. Should the M587 Fuze fail to function electrically, it will function mechanically on impact provided the S&A mechanism becomes armed during launching. Time setting of the M587/M724 Fuze is accomplished with the M36 Fuze Setter.

STATUS: The M587/M724 Fuzes were type classified during the first quarter of FY79. First lot acceptance and transition were completed in the third quarter of FY81.

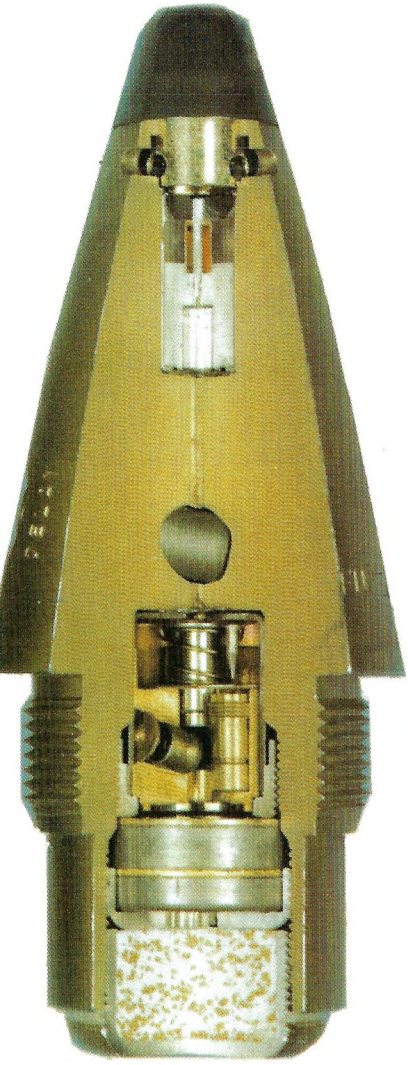
ARTILLERY PD



M557/M572 *

***W/EPOXY FILLED OGIVE**

FUZES



M739

FUZE, POINT DETONATING, M572

OBJECT OF DEVELOPMENT:

The M572 PD Fuze was developed initially for the .175MM HE projectile. By design, the M572 fuze is structurally constructed to withstand the high acceleration forces of the 175MM weapon system.

ITEM DESCRIPTION:

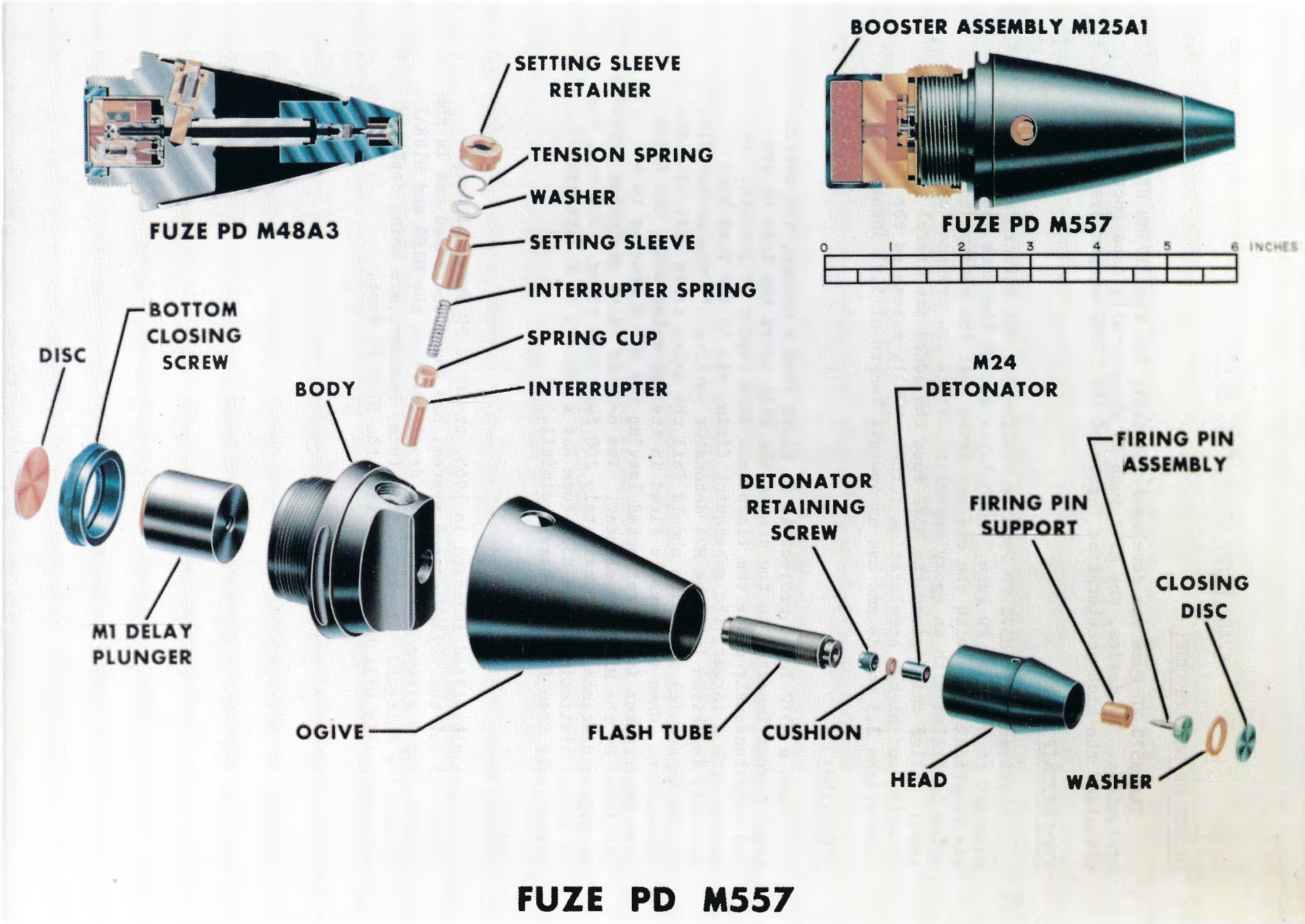
Physically the M572 PD Fuze is similar to, but structurally superior to the M557 PD Fuze. Both fuzes are of the same design and use identical parts with the one exception that the cavity in the M572 ogive is filled with an epoxy material. It is the presence of the epoxy filler which gives the M572 Fuze the added structural strength to withstand higher acceleration forces. Fully assembled the M572 fuze weighs 2.3 pounds and has an overall length of 5.93 inches.

OPERATION:

When a M572 fuzed projectile is fired from a cannon, the centrifugal forces imparted to the projectile will cause the fuze to arm, and simultaneously cause the flash tube interrupter to retract. On impact with a target, the superquick firing pin in the fuze head assembly is driven into the M24 detonator setting off the projectile. If the superquick mechanism should fail the delay train will initiate detonation. When the fuze is fired in the set delay mode, the flash tube interrupter is not retracted leaving the M17 detonator to be initiated by the M2 delay element. The booster delay mechanism provides an arming distance of approximately 200 feet when fired. However, due to design limitations, the M572 Fuze has a history of functioning prematurely when fired in heavy rainfall.

STATUS:

Type classified standard in 1965, the M572 PD Fuze, although developed for the .175MM weapon system, has found increased use in the 8 Inch weapon system following the development of the M188 and M188A1 propelling charges. Stocks of this fuze, however, are being depleted and eventually will be replaced with the M739 PD Fuze.


BOOSTER ASSEMBLY M125A1
FUZE PD M48A3
SETTING SLEEVE RETAINER
TENSION SPRING
WASHER
SETTING SLEEVE
INTERRUPTER SPRING
SPRING CUP
INTERRUPTER
FUZE PD M557
0 1 2 3 4 5 6 INCHES
DISC
BOTTOM CLOSING SCREW
BODY
M24 DETONATOR
FIRING PIN ASSEMBLY
DETONATOR RETAINING SCREW
FIRING PIN SUPPORT
CLOSING DISC
M1 DELAY PLUNGER
OGIVE
FLASH TUBE
CUSHION
HEAD
WASHER

FUZE PD M557

FUZE, POINT DETONATING (PD) M557

OBJECT OF DEVELOPMENT:

The M557 PD Fuze is a selective superquick or 0.05 second delay impact fuze designed for use on 75MM, 105MM, 155MM and 8 Inch spin stabilized munitions.

ITEM DESCRIPTION:

Construction of the M557 PD Fuze consists of a PD head assembly, fuze body, ogive and the M125A1 booster. The PD head assembly contains a firing pin held in position by a pin support which prevents initiation of the M24 detonator until impact. The fuze body houses the M1 delay plunger assembly and the interrupter/setting sleeve device which can be adjusted to provide point detonating or delay functioning capability. The M1 delay plunger assembly includes a firing pin and the M2 delay element which consists of the M54 primer, a black powder delay charge and the M7 relay. The M125A1 booster, located at the base end of the fuze, consists of a brass body, a booster charge, a delay mechanism and the M17 detonator. Fully assembled, the M557 fuze has an overall length of 5.93 inches and weighs 2.15 pounds.

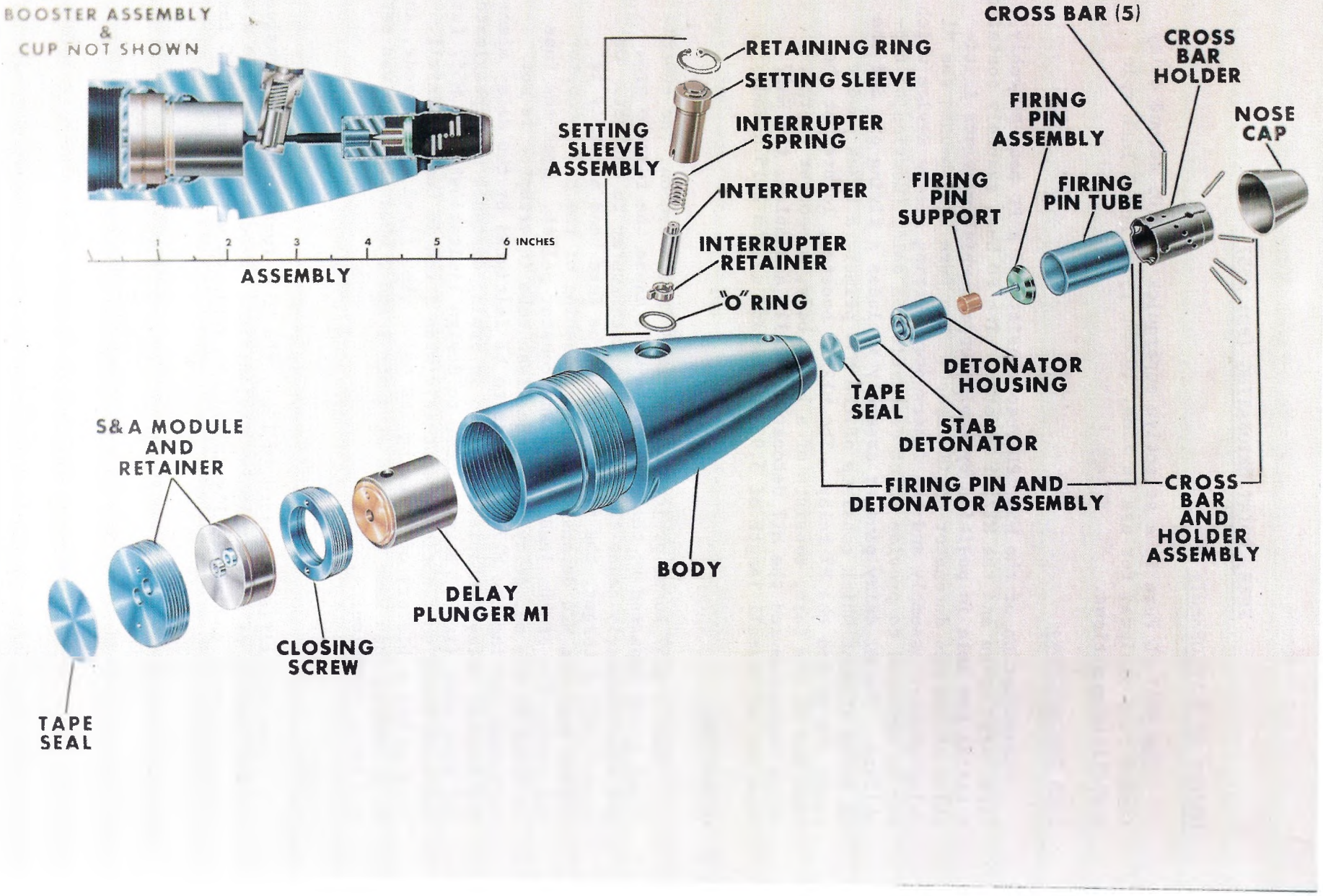
OPERATION:

When a M557 fuzed projectile is fired from a cannon, the centrifugal force imparted to the projectile will cause the fuze to arm, and simultaneously cause the flash tube interrupter to retract. On impact with a target, the firing pin in the fuze head assembly is driven into the M24 detonator causing flashing of the M17 detonator and activation of the lead charge and booster pellet. When the fuze is fired in the set delay mode, the flash tube interrupter is not retracted leaving the M17 detonator to be initiated by the delay element. The booster delay mechanism provides an arming distance of approximately 200 feet when fired. However, due to design limitations, the M557 fuze has been known to function prematurely when fired in heavy rainfall. It also has a history of throwing its ogive when fired at top zone, and on occasions duds have occurred at zones 1 and 2 when the fuze was set for delay functioning.

STATUS:

Type classified standard in 1967, the M557 fuze is used extensively in the testing of high explosive projectiles. Stocks of this fuze are being depleted and eventually it will be replaced with the M739 PD fuze.

FUZE, PD, M739 ASSEMBLY



FUZE, POINT DETONATING, M739

Object of Development:

The M739 Fuze is a selective superquick or 0.05 second delay impact fuze which is designed to be fired in heavy rainfall, and to exceed the functioning reliability of the M557 and M572 Fuzes.

Item Description:

The M739 is the latest improved version of a selective impact fuze consisting of a one-piece machined aluminum body and five modular subassemblies. The modular subassemblies include: (1) Crossbar and holder assembly, (2) firing pin and detonator assembly, (3) setting sleeve assembly, (4) M1 delay plunger assembly, and (5) the safe and arming assembly. The crossbar and holder assembly is a rain insensitive sleeve that allows firing the fuze through heavy rain fall. The firing pin and detonator assembly is located below the rain insensitive sleeve and is used to provide superquick action on impact. The setting sleeve assembly which extends through the flash tube can be adjusted to provide point detonating or delay functioning capability. The M1 delay plunger and the safe and arming assemblies are located below the setting sleeve assembly. Threaded into the base of the fuze body, below the safe and arming assembly, is the booster cup assembly. Fully assembled, the M739 Fuze has an overall length of 5.97 inches and weighs approximately 1.41 pounds.

Operation:

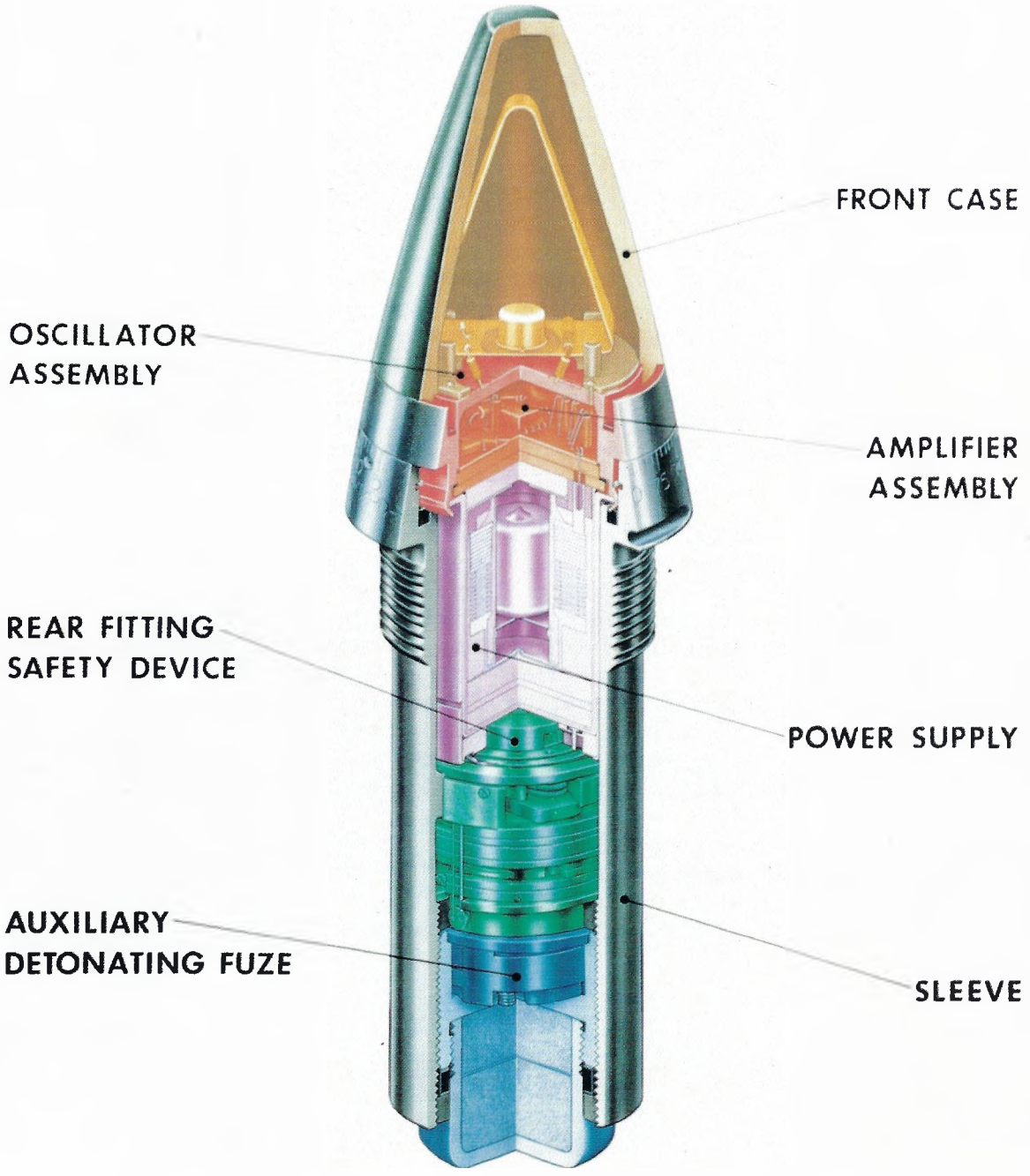
When a M739 fuzed projectile is fired from a cannon, the setback and centrifugal forces acting on the projectile cause the fuze to arm, and simultaneously cause the setting sleeve interrupter to retract. On impact with a target, the superquick firing pin, located below the rain insensitive sleeve, is driven into the detonator setting off the projectile. If the superquick mechanism should fail, the delay element will initiate detonation. When the fuze is fired in the set delay mode, the setting sleeve interrupter does not retract leaving only the M1 delay element to initiate the explosive train reaction through the booster cup into the high explosive projectile.

Status:

Type classified standard in 1974, the M739 Fuze is being produced and stockpiled in large quantities and is gradually replacing the M557 and M572 Point Detonating fuzes in the field.

FUZE, PROXIMITY, ARTILLERY

M728



FUZE, PROXIMITY, M728

OBJECT OF DEVELOPMENT:

The M728 Proximity Fuze was developed to replace the M513 and M514 Proximity Fuzes. Designed with an improved battery and a tubeless, semiconductor circuitry, the M728 fuze is built to operate in a broader temperature range, and provide improved reliability, producibility and cost.

ITEM DESCRIPTION:

The M728 Fuze is a long intrusion, adjustable delayed arming radio doppler type fuze which was developed for the 105MM, 155MM, 175MM, 8 Inch and 4.2 Inch mortar artillery weapon systems. The design configuration of the M728 fuze consists of a radio continuous wave transmitter/detector with antennas and a power supply to perform the target detection function. A plastic nose cone is fixed to a rotatable metal setting ring inscribed with a single index line. The setting ring is connected to a clockwork timing mechanism, located in the fuze sleeve, which serves as a power switching element to energize the proximity element. An electrical point detonating element is also provided. The shoulder of the sleeve is inscribed with a Point Detonating (PD) set line, and with graduated time markings (5 to 100) representing seconds to target. Fully assembled, the M728 Fuze has an overall length of 8.60 inches and weighs approximately 2.20 pounds.

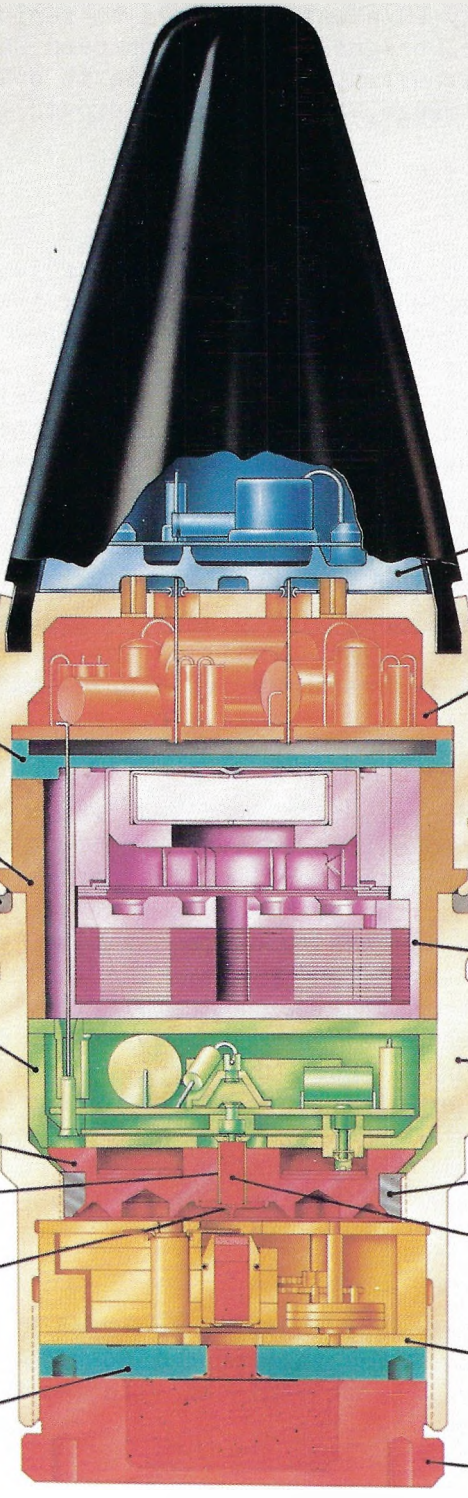
OPERATION:

When a M728 fuzed projectile is fired from a cannon, set back forces acting on the projectile activate the fuze arming cycle by releasing the timing mechanism and initiating the power supply. After three seconds of flight, the point detonating element becomes armed. At approximately three seconds prior to set time, proximity arming and radio wave transmission take place. The radio waves emitted from the fuze travel to the target and are reflected back to the fuze. The interaction between the transmitted waves and the reflected waves produces a doppler signal. When the doppler signal reaches a predesignated amplitude, an electronic switch in the fuze initiates the explosive train detonating the projectile at an optimum distance from the target. Should the proximity device fail to function, the projectile will be detonated by the PD element on impact.

STATUS:

Type classified standard in 1972, the M728 Proximity Fuze is stockpiled, but, is no longer in production. Stocks of the M728 fuze are being depleted and will be replaced with the M732 Proximity Fuze.

M 732
FUZE, PROXIMITY, ARTILLERY



SPACER, AMPL
D11716465

BODY EXTENSION
D11718414

WASHER,
WATERPROOFING
B11718226

TIMER HOUSING ASSY
A11716959

DET BLOCK ASSY
A11716936

CLIP, DET
C11718234

PIN, FIRING
C11716725

BARRIER LEAD CUP
ASSY (LOADED)
C11718279

OSCILLATOR ASSY
D11718271

AMPLIFIER ASSY
F11716460

RING, SPLIT
RETAINING
C11707373

POWER SUPPLY ASSY
A11007046

SLEEVE
F11718320

RING, HOLDING
B11716470

ELECTRIC DETONATOR
ASSY D11722405

S&A MODULE
A11716741

BOOSTER CUP ASSY
D11716740

FUZE, PROXIMITY, M732

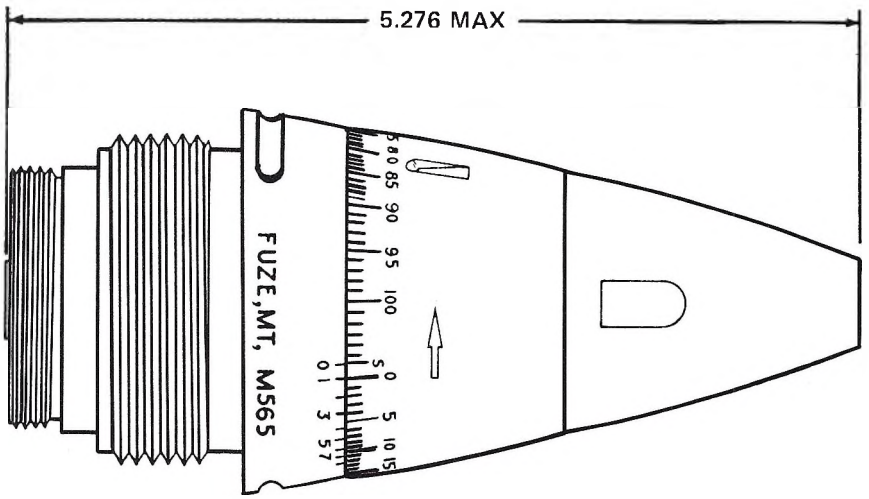
OBJECT OF DEVELOPMENT: The M732 Proximity Fuze is a radio doppler, short intrusion fuze which was developed to replace the long intrusion M728 Proximity Fuze. The M732 Fuze is designed to fit all conventional shallow cavity 105MM, 155MM, 175MM, 4.3 Inch and 8 Inch high explosive, spin stabilized projectiles. It is also designed to provide increased drop reliability, less sensitivity to triboelectric charging and improved over all system functioning.

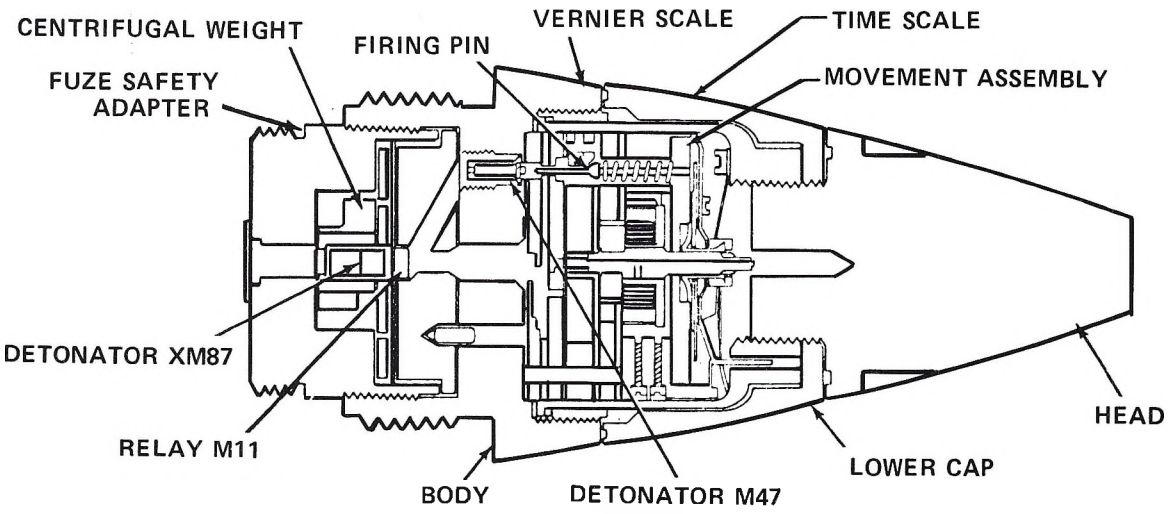
ITEM DESCRIPTION: The M732 Proximity Fuze is composed of a plastic nose cone and a two piece rotatable steel sleeve containing five modular subassemblies. The modular subassemblies include the oscillator, amplifier, power supply, timer and Safety and Arming (S&A) module. The oscillator assembly, housed in the nose cone, consists of an antenna and a radio wave transmitter/receiver. The amplifier assembly contains an electrical impact switch, the integrated circuit amplifier and the firing circuit. The power supply is a liquid reserve battery containing an electrolyte in a copper ampule. The timer consists of an electronic cirucitry which is connected to the rotatable, indexed sleeve used for setting the fuze time of flight. The Safety and Arming module consists of a rotor, set back pin, safety dentents and a sliding stab detonator in a modified M125A1E1 Booster. A unique feature of the M732 Fuze is that it has the same intrusion (2.2 inches) length as standard point detonating and mechanical time fuzes, and unlike other proximity fuzes, it does not require a deep intrusion shell cavity. Fully assembled, the M732 Fuze has an overall length of 5.97 inches and weighs approximately 1.75 pounds.

OPERATION: To operate effectively, it is mandatory that a M732 fuzed projectile be fired from a cannon with a minimum spin rate of 2500 RPM. On set back, the force of acceleration releases the S&A set back pin, and simultaneously opens the battery ampule allowing the electrolyte to flow out. Under the effect of spin, the S&A safety detents are released, the S&A rotor is moved to the armed position and the released electrolyte is forced into the battery cells activating the battery. Arming of the S&A mechanism takes place after the projectile has traveled 400 caliber lengths in flight. Arming of the fuze in the proximity mode is attained after the electronic timer has run down to within three seconds of the fuze set time (5 to 150 seconds). Operating on the doppler wave principal, the M732 Proximity Fuze will detonate a projectile at optimum distance from a target. Should the proximity element fail to function, the electrical impact switch or the mechanical backup element will detonate the projectile on impact.

STATUS: Type classified standard in July 1979, the M732 Proximity Fuze will be produced in large quantities and eventually it will replace the M728 (long intrusion) Proximity Fuze.

FUZE, MECHANICAL TIME, M565





FUZE, MECHANICAL TIME (MT), M565

OBJECTIVE OF DEVELOPMENT:

The M565 Mechanical Time Fuze was designed to operate on a variety of 105MM, 155MM, 8 Inch and 4.2 Inch spin stabilized projectiles not requiring a superquick point detonating capability.

ITEM DESCRIPTION:

The M565 MT Fuze consists of a solid head, lower cap fuze body, clock movement, explosive train, and the M125 safety adapter. The rotable lower cap has a time scale graduated from 0 to 100 seconds in increments of 1.0 second. The vernier scale located on the body permits setting in increments of .10 seconds (fuze has a setting range of 2.0 to 100 .0 second). The setting pin located in the bell housing engages the movement timing disc. The greater part of the movement is a clock type mechanism for controlling the time of fuze function. The movement is located in the body, the body also houses the M47 stab detonator and closing plug with the M11 relay. The safety adapter assembled to the base of the fuze consists of a rotor with an out of line detonator (M17) featuring a delayed arming mechanism.

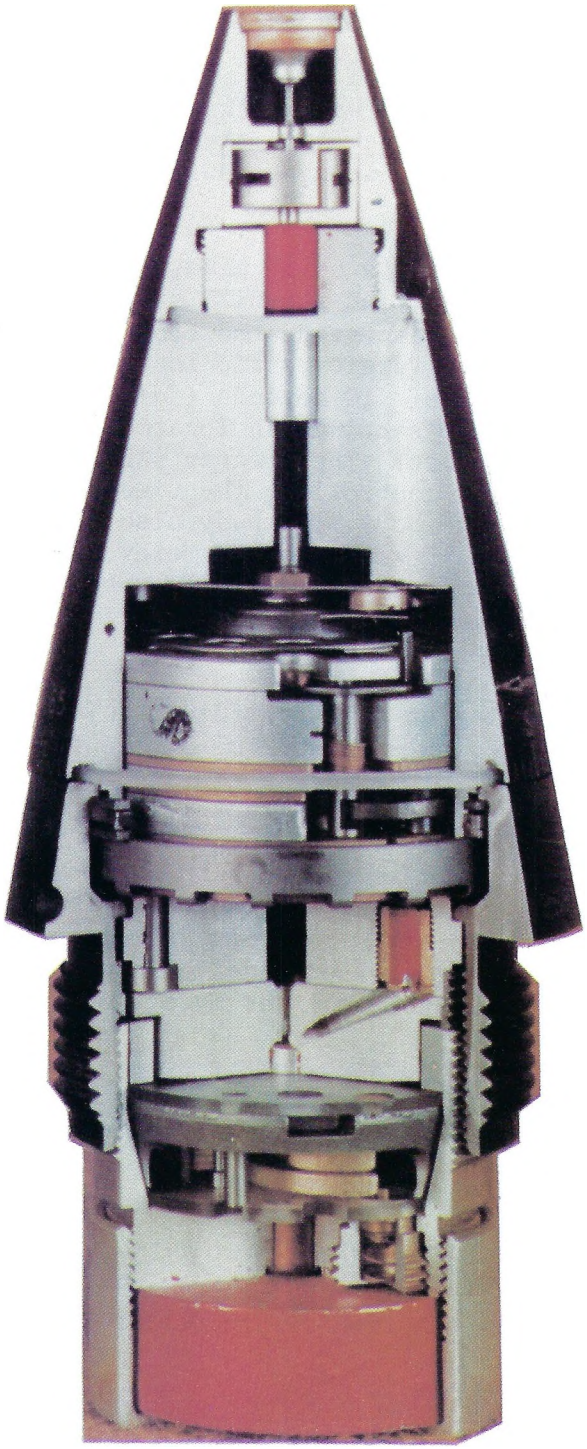
OPERATION:

Gun setback force acting on the M565 fuzed projectile causes the fuze hammer spring to strike an upraised lug on the timing disc which disengages the setting pin from the timing disc. When the projectile rotation develops sufficient centrifugal force, the detents holding the movement escapement, and detents holding the rotor in the safety adapter move outward releasing both the movement escapement and safety adapter rotor, permitting them to run. The time required for the rotor to move into an armed position (when the M17 detonator is in line with the M11 relay) will provide a minimum of 66 meters (200 feet) safe function distance from the muzzle of the gun.

When the timing disc has rotated to the preset number of seconds the firing arm will enter a slot in the timing disc releasing the firing pin. The firing pin will strike the M47 detonator initiating the explosive train to function the projectile.

STATUS:

Type classified standard in 1964, the M565 fuze is now used mostly for testing projectiles. Stockpiles of this fuze are being depleted, however, and no resumption of production is contemplated.



FUZE, MTSQ M564

FUZE, MECHANICAL TIME AND SUPERQUICK (MTSQ) M564

OBJECT OF DEVELOPMENT:

The M564 Mechanical Time and Superquick Fuze was designed to operate on a variety of spin stabilized high explosive projectiles. These projectiles are used in the 105MM, 155MM and 8 Inch Howitzers, and the 4.2 Inch Mortar.

ITEM DESCRIPTION:

The M564 MTSQ Fuze consist of a head, lower cap, fuze body, clock movement, safety adapter and booster. The head contains the point detonating assembly, consisting of firing pin, support cup, and spin detents. The rotable lower cap has a time scale graduated from 0 to 100 seconds in increments of 1.0 second. The vernier scale located on the body permits setting in increments of .10 seconds (Fuze setting range is 2.0 to 100.0 sec). The setting pin located in the lower cap engages the movement timing disc. The greater part of the movement is a clock type mechanism for controlling the time of fuze function. The movement is located in the body, the body also contain the M47 stab detonator and closing plug with the M7 relay. The safety adapter assembled to the base of the fuze consists of a rotor with an out of line detonator (M17) featuring a delayed arming mechanism.

OPERATION:

Gun setback force acting on the M564 fuzed projectile causes the fuze hammer spring to strike an upraised lug on the timing disc which disengages the setting pin from the timing disc. When the projectile rotation develops sufficient centrifugel force, the detents holding the movement escapement, and detents holding the rotor in the safety adapter move outward releasing both the movement escapement and safety adapter rotor permitting them to run. The time required for the rotor to move into an armed position (when the M17 detonator is in line with the M11 relay) will provide a minimum of 66 meters (200 ft) safe function distance from the muzzle of the gun.

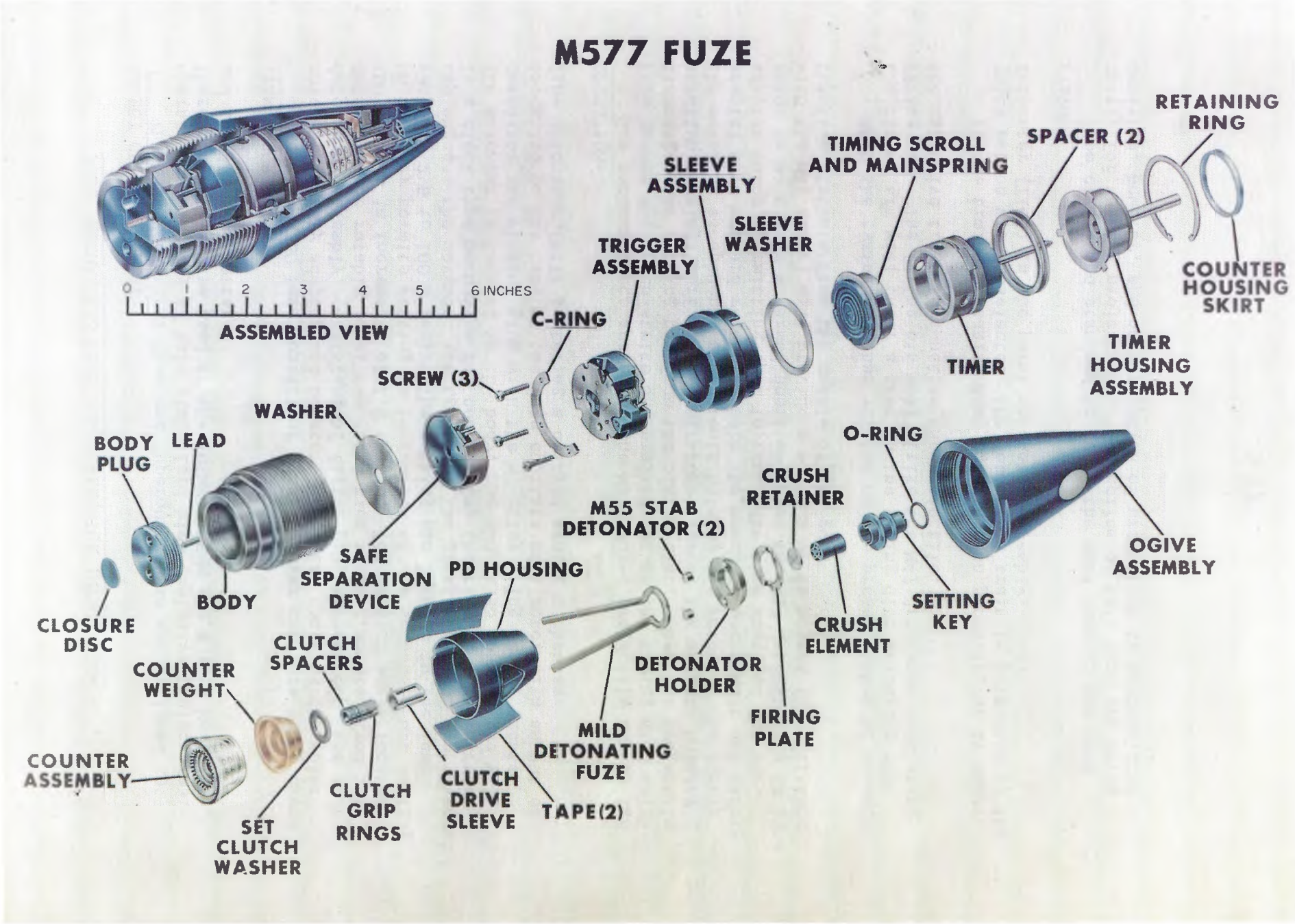
When the timing disc has rotated to the preset number of seconds, the firing arm will enter a slot in the timing disc releasing the firing pin. The firing pin will strike the M47 detonator initiating the explosive train to function the projectile.

If the timing mechanism does not function properly, or if super-quick action was preselected, the detonation train is initiated by the detonator (T103) in the point detonator assembly.

STATUS:

Type classified standard in 1962, the M564 fuze is now used mostly for testing projectiles. Stockpiles of this fuze are being depleted, however, and no resumption of production is contemplated.

M577 FUZE


ASSEMBLED VIEW
0 1 2 3 4 5 6 INCHES
RETAINING RING
SPACER (2)
TIMING SCROLL AND MAINSPRING
SLEEVE ASSEMBLY
SLEEVE WASHER
TRIGGER ASSEMBLY
C-RING
SCREW (3)
WASHER
BODY PLUG
LEAD
BODY
CLOSURE DISC
SAFE SEPARATION DEVICE
PD HOUSING
M55 STAB DETONATOR (2)
CRUSH RETAINER
O-RING
OGIVE ASSEMBLY
SETTING KEY
CRUSH ELEMENT
DETONATOR HOLDER
FIRING PLATE
MILD DETONATING FUZE
TAPE (2)
CLUTCH DRIVE SLEEVE
CLUTCH GRIP RINGS
SET CLUTCH WASHER
CLUTCH SPACERS
COUNTER WEIGHT
COUNTER ASSEMBLY
TIMER
TIMER HOUSING ASSEMBLY
COUNTER HOUSING SKIRT

FUZE, MECHANICAL TIME AND SUPERQUICK (MTSQ) M577

OBJECT OF DEVELOPMENT:

The M577 is a mechanical time and superquick fuze designed to operate on a variety of 105MM, 155MM and 8 Inch spin stabilized, flash initiated projectiles with improved timing accuracy.

ITEM DESCRIPTION:

The M577 MTSQ Fuze contains four interrelated modules and an explosive train contained in an aluminum ogive and stainless steel lower body. The four modules, from nose to base of the fuze, are the Counter Assembly, Timer Assembly, Trigger Assembly and Safe Separation Device.

The Fuze can be set for both time (airburst) up to 200 seconds in increments of .1 seconds and impact (point detonating) function. Setting is made through the nose of the fuze with a screwdriver type setter. The setting is read on the counter through a window in the ogive of the fuze.

Safety is provided by spin and setback sensing devices in the Timer and Trigger modules and spin sensing devices in the Safe Separation Device. In addition, the Safe Separation Device is interlocked to the Timer in such a manner that the explosive train is held out of line until two to four seconds prior to functioning time. This provides overhead safety. The M577 Fuze has an overall length of 5.28 inches and weighs approximately 1.42 pounds.

OPERATION:

The proper sequence of setback and spin produced in a ballistic environment causes the release of the spin and setback sensing safety devices in the M577 Fuze. This sequence also starts the timer running when the fuze is in the set time mode. Approximately two to four seconds prior to reaching the set time, the interlocking device that holds the rotor (in the Safe Separation Device) in the unarmed position is released. This allows the detonator in the rotor to rotate in line with the firing pin in the trigger. When set time is reached, the firing pin is released striking the detonator. The detonator then sets off the lead in the base of the fuze which in turn initiates the projectile.

When set for impact function, the interlocking device is released immediately along with the other spin and setback sensing devices. The fuze must hit a target with sufficient force to crush a crush element in the setting key. A flange on the setting key strikes the firing pins which initiate two detonators in the nose portion of the fuze. They in turn initiate a mild detonating fuze cord which initiates the detonator in the Safe Separation Device. From that point the projectile explosive sequence is the same as the airburst mode.

STATUS: Type classified standard in June 1972, the M577 Fuze is being produced and stockpiled in large quantities and has replaced the M565 as the primary fuze for flash initiated projectiles.

FUZE, MECHANICAL TIME AND SUPERQUICK (MTSQ) M582

OBJECT OF DEVELOPMENT:

The M582 is a mechanical time and superquick fuze designed to operate on a variety of 105MM and 8 Inch spin stabilized, high explosive projectiles with improved timing accuracy.

ITEM DESCRIPTION:

Physically the M582 Fuze and the M577 Fuze are identical in design. The only difference between them is that the M582 comes equipped with a booster cup for high explosive application. Attached to the base of the steel body, the booster cup gives the M582 Fuze a longer overall length of 5.82 inches and a slightly higher weight of 1.51 pounds.

OPERATION:

Operation of the M582 is the same as the M577 except the lead in the base of the fuze initiates the booster which initiates the projectile.

STATUS:

Type classified standard in June 1972, the M582 Fuze is used exclusively by the US Marine Corps. The fuze is not currently produced or stockpiled by the US Army.

FUZE PHYSICAL PROPERTIES

FUZE	M557	M577	M582	M587	M732	M739	M724	M728	M572	M564 M565
POLAR MOMENT OF INERTIA ($Lb\text{-}In^2$)	1.02** .86*	.71	.72	1.01	1.06	.64	.97	NA	1.08** .91*	3.16
TRANSVERSE MOMENT OF INERTIA $Lb\text{-}In^2$)	2.92** 3.36*	2.17	2.54	3.02	2.66	2.57	2.58	NA	3.19** 2.46*	5.36
CENTER OF GRAVITY FROM NOSE END (INCHES)	3.49** 3.52*	3.42	3.51	3.63	3.78	3.43	3.48	5.24	3.65** 3.45*	3.50
WEIGHT (LBS)	2.07** 1.75*	1.42	1.51	1.81	1.75	1.41	1.69	2.19	2.20** 1.89*	2.10

*WEIGHT WITH ALUMINUM BOOSTER

**WEIGHT WITH BRASS BOOSTER

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CHAPTER 6

MISCELLANEOUS ITEMS

PROJECTILE PALLET

1. Pallets for 8 Inch projectiles are designed to hold as many as six projectiles and are constructed of a nailed wooden base and plywood decking, a nailed wooden cover assembly and a 1¼ inch wide, heavy steel strapping. Skids are provided on the pallet base for fork lifting, sling handling and stacking. Holes are drilled through the plywood layer on the pallet base to secure the projectile base, and tapered holes are provided in the cover to secure the projectile nose.

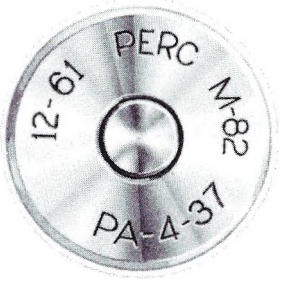
2. In the 8 Inch ammunition inventory there are currently three different pallet designs which are being used to palletize the following projectiles:

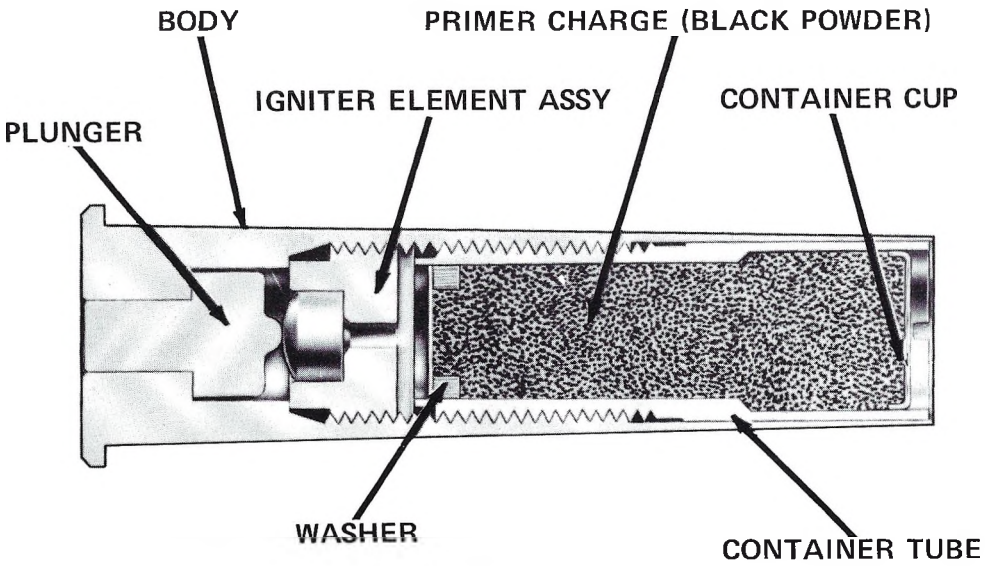
a. The first design configuration measures $28\frac{3}{8}$"L X 19¼"W X 39½" high and is used exclusively for the M106, M404 and M426 projectiles.

b. The second configuration measures $31\frac{3}{8}$"L X 22½"W X $45\frac{3}{8}$" high and is used solely for the M650 Rocket Assisted Projectile.

c. The third design configuration measures $31\frac{5}{8}$"L X 22½"W X $48\frac{1}{8}$" high and will be used to palletize the M509E1, XM736 and the XM836 projectiles when they are fielded.

3. Each pallet of six 8 Inch projectiles has an average gross weight of approximately 1250 to 1300 pounds and a displacement of 12.4 cubic feet.





PRIMER, PERCUSSION, M82

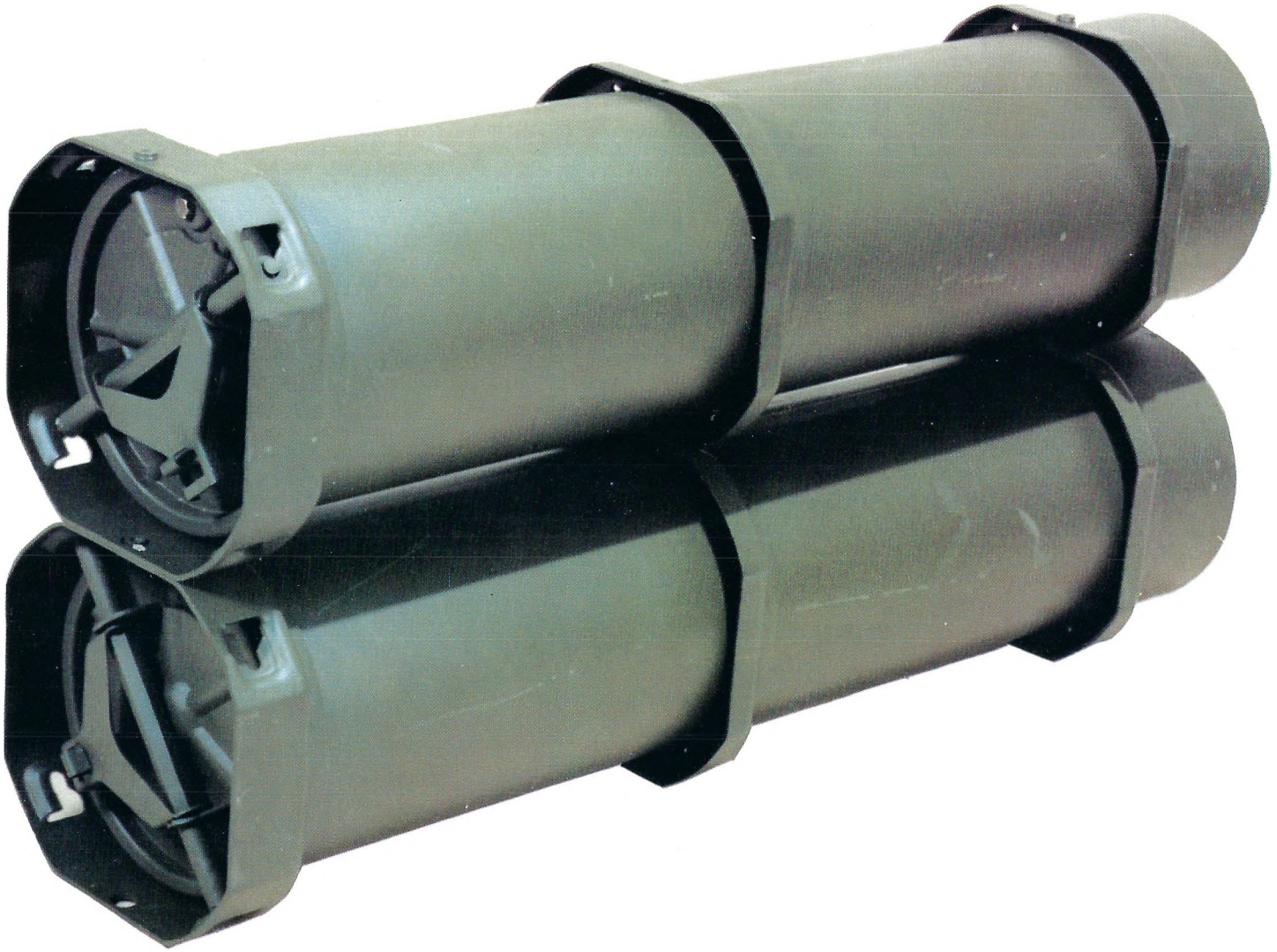
PRIMER, PERCUSSION, M82

OBJECT OF DEVELOPMENT: To produce a more reliable and cost effective percussion primer for the 155MM, 175MM and 8 Inch Howitzers.

ITEM DESCRIPTION: The M82 Percussion Primer is composed of four major parts which include a plunger, igniter element assembly, primer charge assembly and a tapered brass body. The igniter element assembly consists of a brass ignition cup and a number 34 Percussion Primer or commercial equivalent. The primer charge assembly contains 22 grains of Class 3 Black Powder. Fully assembled the M82 Primer measures 1.944 inches in length, 0.492 inch in diameter (tapered to 0.443") and weighs 30.6 grams.

OPERATION: After the weapon has been loaded and the breech has been closed, the M82 Primer is inserted into the spindle primer hole in preparation to fire. On command, the gunner moves the firing lock to the firing position and triggers the firing mechanism. This action causes the weapon's firing pin to strike the M82 plunger setting off the M34 Primer and producing a high speed burning train reaction through the black powder primer charge into the chambered propelling charge.

STATUS: Type classified standard in 1961, the M82 Percussion Primer is the Army's standard primer for the 8 Inch M110, M110A2 and the 155MM, M109, M109A1/A2/A3 Howitzers.



PROPELLING CHARGE CONTAINER, PA 92

PROPELLING CHARGE CONTAINER

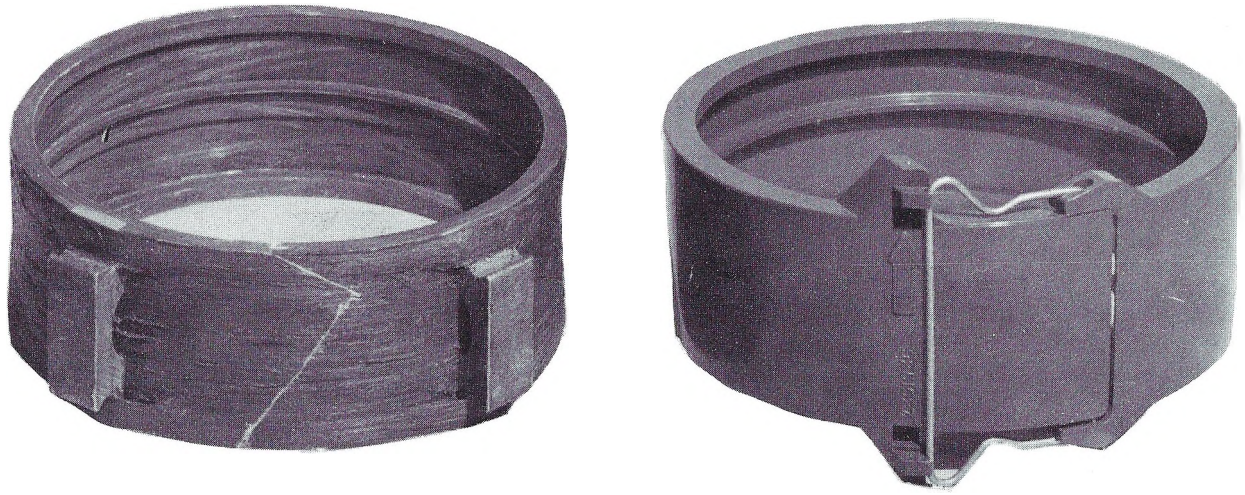
1. Propelling charge containers provide environmental protection for propelling charges for the 155MM, 175MM and 8 Inch Artillery Weapon Systems.

2. Normally, propelling charges are wrapped in a single faced corrugated fiberboard material and packed in specially designed steel containers. Cushions are used at the inner ends of the container to protect propelling charges with center core igniters. Each container comes equipped with a steel cover containing a moisture sealing rubber gasket.

3. In the 8 Inch artillery weapon system, the M1 and M2 propelling charges will continue to be shipped in the M18A1 and M19A1 containers respectively. The PA92 container, however, will eventually replace the older PA66 as the standard container for the M188A1 propelling charge. As shown in the photograph, the square rim and ring configuration of the PA92 design permits two or more containers to be stacked vertically and side by side without rolling. It also includes a cover which is easier to open and close.

4. The following physical characteristics are provided for comparison.

	PA66	PA92
Length (IN.)	37 3/4	36 11/16
Diameter/Width (IN.)	10 15/32 DIA.	9 1/4 x 9 1/4 (across flats)
Weight (LBS.)	26.3	25.3
Displacement (FT^3)	2.4	1.8
No. in pallet	25	36



GROMMET FOR 8 INCH PROJECTILES

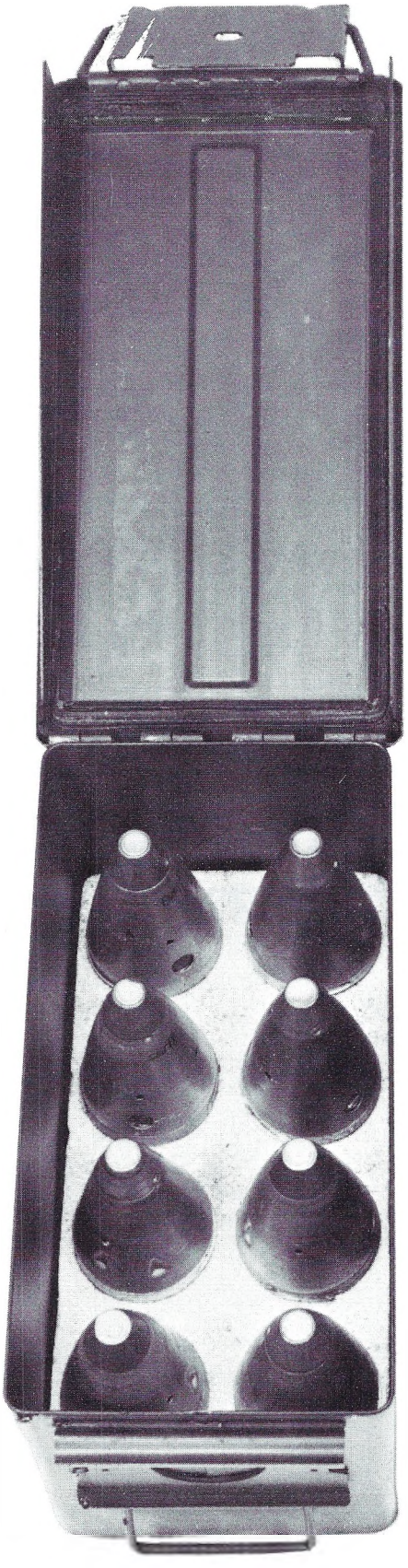
GROMMET

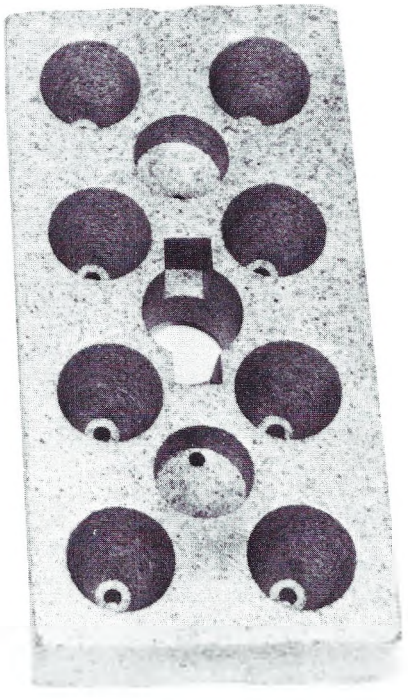
Grommets provide protection to projectile rotating bands and obturators. Projectiles in stockpile have grommets installed of any one of three differing designs. The older stockpiled projectiles may have grommets fabricated from thin sheet metal (steel) and lined with an asphalt impregnated paper. This grommet is held in place by a thin wire. Most of these grommets are pre 1955 vintage and have serious drawbacks in that they provide marginal protection to the rotating band, are unwieldy to apply and remove, and also require periodic maintenance (scraping and painting).

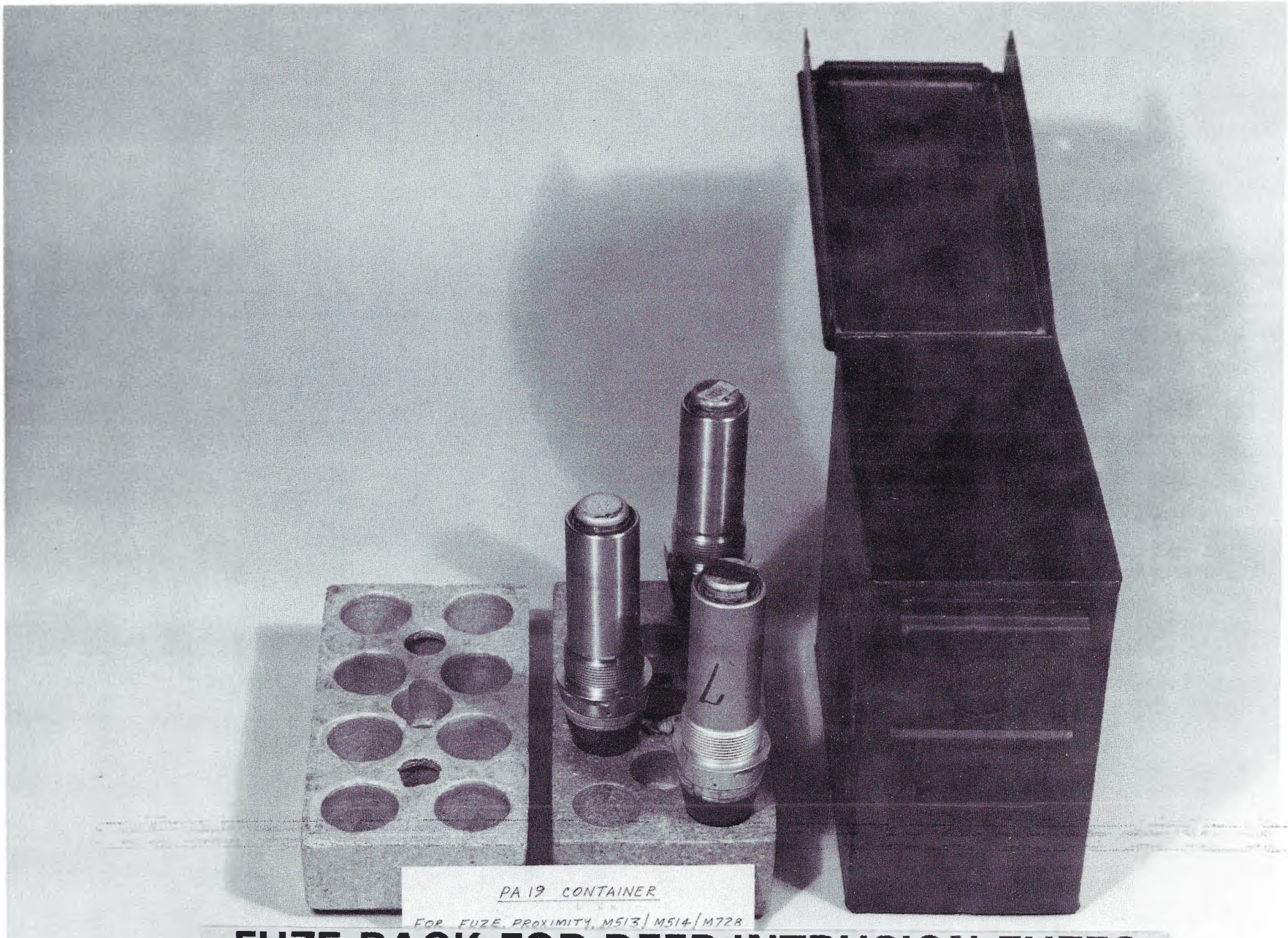
The steel grommet was replaced by a much improved version consisting of a glass filament, wound and impregnated with polyester (left side of attached photographs). This variety was, for the most part, used exclusively during the 1955 to 1974 time frame. It provided a much higher level of protection to the rotating bands and eliminated entirely, the problem of high cost maintenance. Its main drawback, however, centered on difficulty in application and removal, particularly as rotating bands became wider and obturators were introduced. As this grommet was forced to grow in width to accommodate projectile changes the opening force required to apply and remove them became inordinately high.

As a consequence of the problems with opening force, the polycarbonate grommets were developed and subsequently replaced the glass-polyester type (right side of attached photograph). This variety of grommet is currently specified on all technical data packages for separate loaded projectiles. They provide physical protection equal to or better than the glass polyester type, are easily applied and removed, require no maintenance and are less costly to produce.

METAL PACK, FUZE







FUZE PACK FOR DEEP INTRUSION FUZES

NON-PROPAGATION PACK

FUZE PACK

1. The packaging design for artillery fuzes consists of placing eight fuzes into an M2A1 metal (steel) box having a plastic support system (top and bottom support). The metal box is a hermetically sealed box having a rubber gasket and is equipped with a quick opening and closing metal hasp. Each box contains a one unit (one ounce) desiccant bag tucked away in a plastic holder contained in a cavity in the upper support. Two metal boxes (16 fuzes) are overpacked with a wood wirebound box.

2. A modification of the above design is represented by the pack for the M513, M514 and M728 proximity fuzes. They are placed in a slightly deeper M2A1 box, designated as the PA19, so as to house the longer fuzes. The fuzes are packed in a nose down manner.

3. A recent development is the non-propagation pack for the M557 and M739 PD fuzes. This pack by preventing propagation of fuzes within and without the metal box may be shipped as a Level C explosive saving shipping costs and providing additional safety. This pack is identically the same as the M2A1 fuze pack except that the plastic bottom support is replaced with 5/16 inch thick paper tubes (eight). This pack was tested, approved and released for production .

BORESCOPE

INSPECTION DEVICE, BORESCOPE

OBJECT OF DEVELOPMENT:

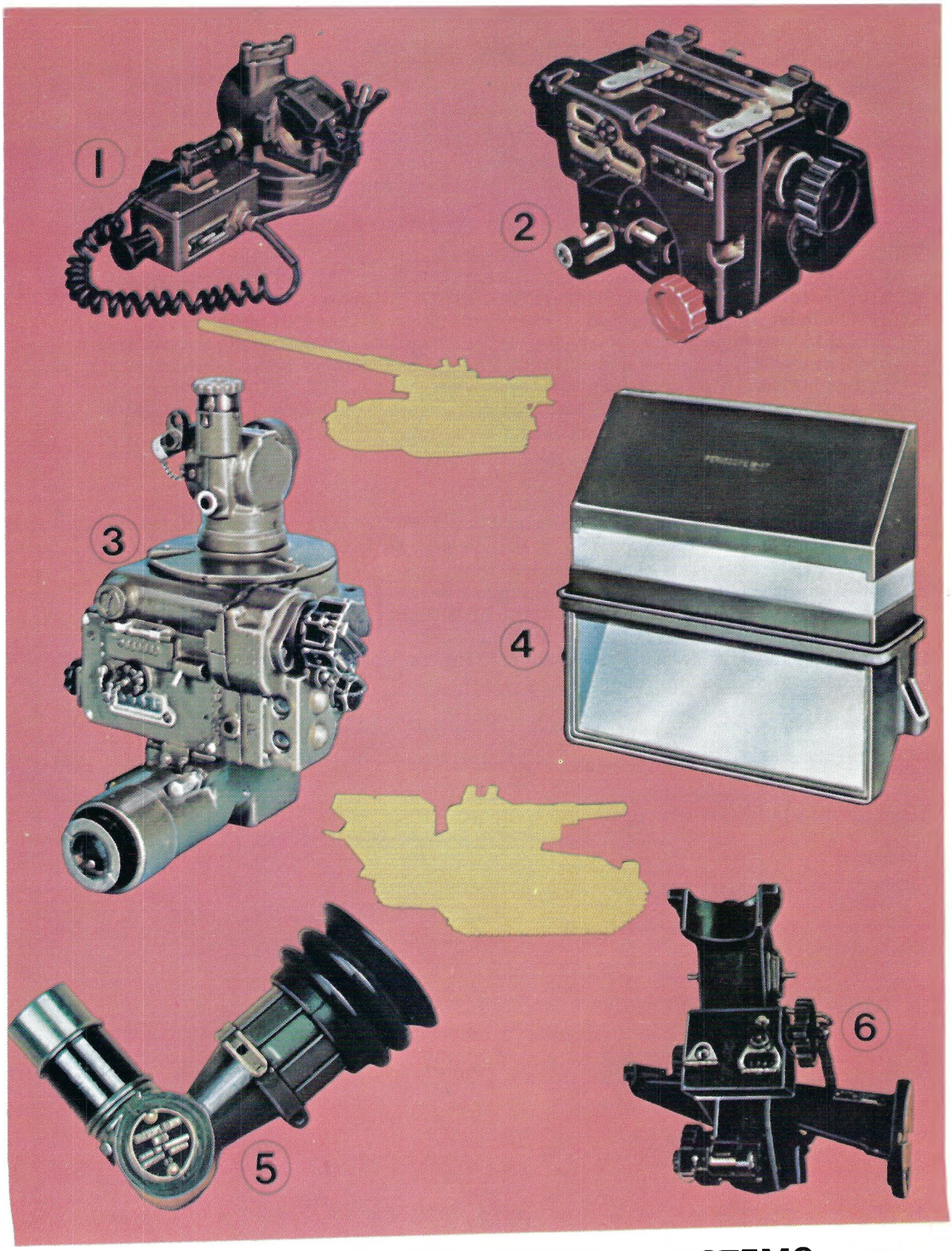
The Borescope was developed for the purpose of providing field units the capability to visually inspect cannon bores just forward of the origin of rifling for cannon land damage.

ITEM DESCRIPTION:

The Borescope is basically a straight tube telescope using a mirror set at a fixed, predetermined angle to present a normal view of the bore being inspected. The Borescope consists of an eyepiece assembly, adaptor tube assembly, objective tube assembly, illuminating head assembly, support assemblies, power cord and an accessory cable. Illumination is provided by an incandescent 20V, 100 watt lamp for 24 volt operation. A complete borescope comes packaged in a special carrying case with a combined weight of approximately 45 pounds.

OPERATION:

Insert the borescope into the breech end of the cannon. With the borescope light on, focus the eyepiece and lock in place. As the bore is examined, revolve the borescope to provide 360 degree viewing. After one revolution of the borescope, move it one inch or more, as desired, and repeat the examination. Personnel operating the borescope should be able to distinguish between damaged and undamaged lands. For condemnation data of damaged rifling refer to TM9-1000-202-14, Evaluation of Cannon Tubes.



SIGHTING AND FIRE CONTROL SYSTEMS

1. Telescope Mount M138

Telescope Mount M138 adapts Elbow Telescopes M116 and M139 to self-propelled weapons M107 and M110A2. The telescope mount provides adjustments in elevation and deflection (azimuth) for direct fire with the 175MM self-propelled gun M107 and the 8 Inch self-propelled howitzer M110A2.

2. Elevation Quadrant M15

Elevation Quadrant M15 is mounted directly on the right-hand trunnion and is used for adjustment of the weapon in elevation when two men are orienting the weapon. Elevation Quadrant M15 is equipped with a mechanical mil counter for elevation readings. Gunner's aid counters are built in to permit quick, accurate insertion of elevation correction factors peculiar to the individual cannon and cannon emplacement.

3. Panoramic Telescope M115

Panoramic Telescope M115 is a hermetically sealed unit. When mounted in telescope mount M137 with four screws and four washers, the telescope is used primarily to lay 8 Inch self-propelled howitzer M110A2 or 175MM self-propelled gun M107 in deflection (azimuth) for indirect fire, and to correct for angles of cant. The eyepiece is the fixed-focus type. The telescope is equipped with one permanently mounted reticle. An instrument light, (component of Telescope Mount M137) with a 24-volt lamp, illuminates the reticle markings so they will be clearly defined in a darkened area.

4. Periscope M17

Periscope M17 is a standard one power daylight driver's periscope for most combat vehicles. The M17 is generally used in groups. Three periscopes are mounted on the hull just front of the operator's compartment hatch cover, providing external frontal view for the operator.

5. Elbow Telescope M139

The Elbow Telescope M139 is a standard three-power elbow telescope. Mounted on the telescope mount M138, the elbow telescope M139 is used to lay the howitzer M110A2 in elevation and deflection for direct fire.

6. Telescope Mount M137

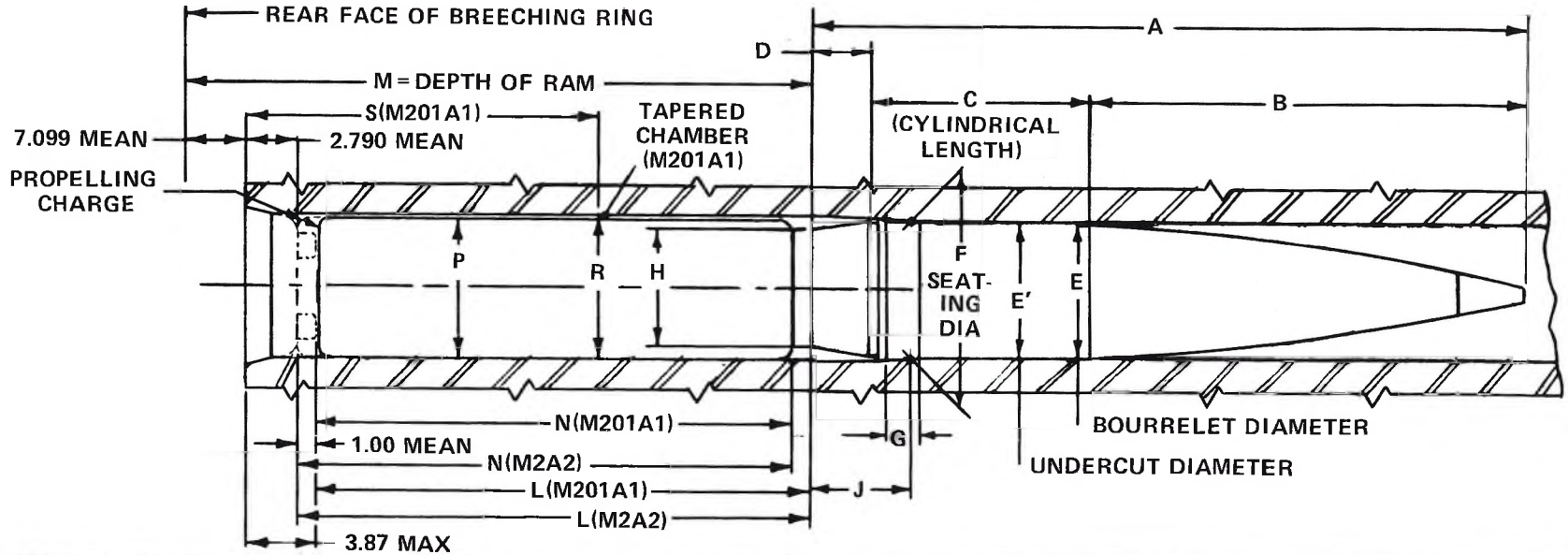
The Telescope Mount M137 adapts Panoramic Telescope M115 to the field artillery gun M107 and heavy howitzer M110A2. The mount provides adjustments in elevation and cant (cross-level) for indirect fire with the gun. The mount consists of two subassemblies, one mounted on top of the other, and secured by four screws.

PHYSICAL CHARACTERISTICS

TELESCOPE MOUNT M138:	
WEIGHT	3 LB
HEIGHT	4-1/2 IN
WIDTH	5-1/4 IN
LENGTH	9-5/8 IN
ELEVATION QUADRANT M15:	
WEIGHT	23-1/4 LB
HEIGHT	9 IN
WIDTH	9 IN
LENGTH	12 IN
ELEVATION	– 228 TO +1,383 MILS
ELEVATION CORRECTION	± 50 MILS
CROSS LEVEL	± 34 DEG
PANORAMIC TELESCOPE M115:	
WEIGHT	8 LB
HEIGHT	11 IN
WIDTH	8-1/4 IN
LENGTH	9-1/2 IN
MAGNIFICATION	4 POWER
FIELD OF VIEW	10 DEG
PERISCOPE M17:	
WEIGHT	6-1/2 LB
HEIGHT	8-3/4 IN
WIDTH	3 IN
LENGTH	8-1/4 IN
MAGNIFICATION	1 POWER
FIELD OF VIEW (HORIZONTAL)	150 DEG
FIELD OF VIEW (VERTICAL)	50 DEG
ELBOW TELESCOPE M139	
WEIGHT	2-1/3 LB
HEIGHT	2-7/8 IN
WIDTH	1-1/4 IN
LENGTH	5-3/4 IN
DIFFERENCES AMONG MODELS	RETICLE
MAGNIFICATION	3 POWER
FIELD OF VIEW	13 DEG 20 MIN
TELESCOPE MOUNT M137:	
WEIGHT	38 LB
HEIGHT	13 IN
WIDTH	9-3/4 IN
LENGTH	14-1/8 IN
ELEVATION	+ 1333 TO – 89 MILS
CROSS-LEVEL	± 20 DEG

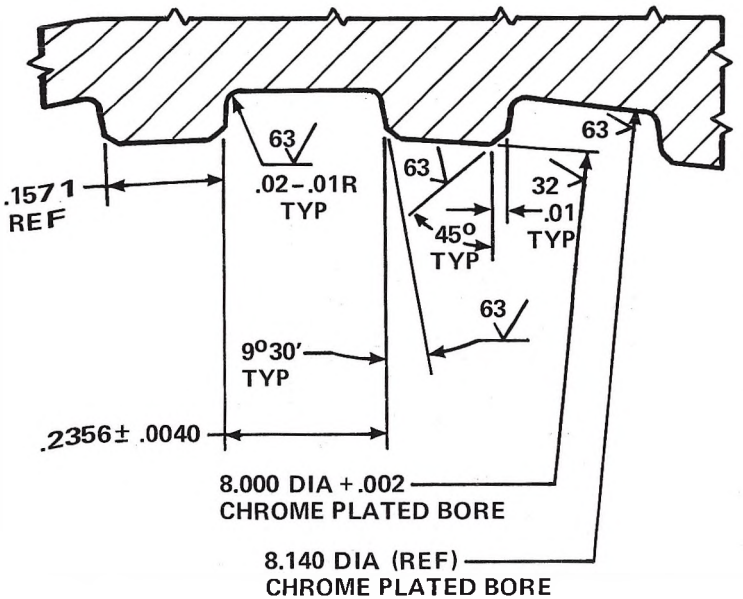
CHAPTER 7

INTERFACE CHARTS



PROJECTILE/CANNON/CHARGE INTERFACE PARAMETERS										
	M106	M509E1	M650	XM753	XM736	M426	M422	M424A1	XM711	M404
A	35.02 ± .14	43.892 ± .046	43.86 ± .06	43.880 ± .049	43.864 ± .055	32.855 MAX	36.99 MAX	36.96 MAX	39.11 ± .03	35.24 + .02
B	18.16 ± .37	19.861 ± .095	24.017 ± .147	24.017 ± .131	19.844 ± .095	16.915 ± .015	12.56 ± .03	12.56 ± .03	19.84 ± .137	18.92 + .03
C	12.85 ± .58	21.324 ± .131	16.242 ± .246	16.251 ± .257	21.325 ± .120	11.805 ± .010	23.480 ± .045	23.775 ± .065	16.566 ± .236	12.00 + .03
D	4.015 ± .11	2.708 ± .053	3.601 ± .069	3.612 ± .077	2.696 ± .050	3.985 ± .040	0.53 ± .02	0.53 + .02	2.708 ± .053	4.32 – .04
E	7.994 MAX*	7.994 MAX*	7.994 MAX*	7.990 ± .004	7.997 MAX*	7.998 MAX*	7.994 MAX*	7.97 – .01*	7.994 MAX*	7.994 MAX*
E'	7.97 ± .01	7.97 ± .01	N/A	N/A	7.97 ± .01	7.97 ± .01	7.98 – .01	N/A	7.97 ± .01	7.97 ± .01
F	8.280 ± .004	8.186 BSC	8.1519 BSC	8.1519 BSC	8.186 BSC	8.280 ± .004	8.150 ± .005	8.150 ± .005	8.186 REF	8.280 ± .004
G	1.94 – .04	2.29 ± .03	2.00 – .02	2.00 – .02	2.29 ± .03	1.94 – .04	3.27 – .04	3.27 – .04	2.29 ± .03	1.94 – .04
H	6.70 MEAN	7.252 REF	7.039 MEAN	7.039 MEAN	7.252 REF	6.69 REF MEAN	3.95 MEAN	3.95 MEAN	7.252 REF	6.66 REF
J	6.51 ± .03	5.947 ± .063	5.935 ± .045	5.935 ± .045	5.898 ± .047	6.51 ± .03	5.315 ± .150	5.325 ± .140	5.947 ± .063	5.83 – .03
L (M201A1)	32.29 MIN	33.806 MIN	34.22 MIN	34.22 MIN	33.815 MIN	32.29 MIN	34.48 MIN	34.48 MIN	33.806 MIN	32.29 MIN
L (M2A2)	25.43 MIN	26.941 MIN	27.35 MIN	27.35 MIN	26.950 MIN	25.43 MIN	27.62 MIN	27.62 MIN	26.941 MIN	25.43 MIN
M (M201A1)	43.35 MEAN	44.775 MEAN	45.25 MEAN	45.25 MEAN	44.784 MEAN	43.35 MEAN	45.97 MEAN	45.97 MEAN	44.775 MEAN	43.35 MEAN
M (M2A2)	35.40 MEAN	36.83 MEAN	37.30 MEAN	37.30 MEAN	36.839 MEAN	35.40 MEAN	38.02 MEAN	38.02 MEAN	36.83 MEAN	35.40 MEAN
N (M2A2)	M2 = 24	M2 = 24	M2 = 24	M2 = 24	M2 = 24	M2 = 24	M80 = 24.25	M80 = 24.25	M2 = 24	M2 = 24
N (M201A1)	M188A1 = 32	M188A1 = 32	M188A1 = 32	M188A1 = 32	M188A1 = 32	M188A1 = 32	M188 = 29	M188 = 29	M188A1 = 32	M2 = 24
P (M2A2)	M2 = 7.75	M2 = 7.75	M2 = 7.75	M2 = 7.75	M2 = 7.75	M2 = 7.75	M80 = 7.75	M80 = 7.75	M2 = 7.75	M2 = 7.75
P (M201A1)	M188A1 = 8	M188A1 = 8	M188A1 = 8	M188A1 = 8	M188A1 = 8	M188A1 = 8	M188 = 8	M188 = 8	M188A1 = 8	M2 = 7.75
R	8.443DAT.D	8.443DAT.D	8.443DAT.D	8.443DAT.D	8.443DAT.D	8.443DAT.D	8.443DAT.D	8.443DAT.D	8.443DAT.D	8.443DAT.D
S	22.00 + 1.20	22.00 + 1.20	22.00 + 1.20	22.00 + 1.20	22.00 + 1.20	22.00 + 1.20	22.00 + 1.20	22.00 + 1.20	22.00 + 1.20	22.00 + 1.20

8 INCH CANNON PARAMETERS



ENLARGED VIEW OF RIFLING DETAIL

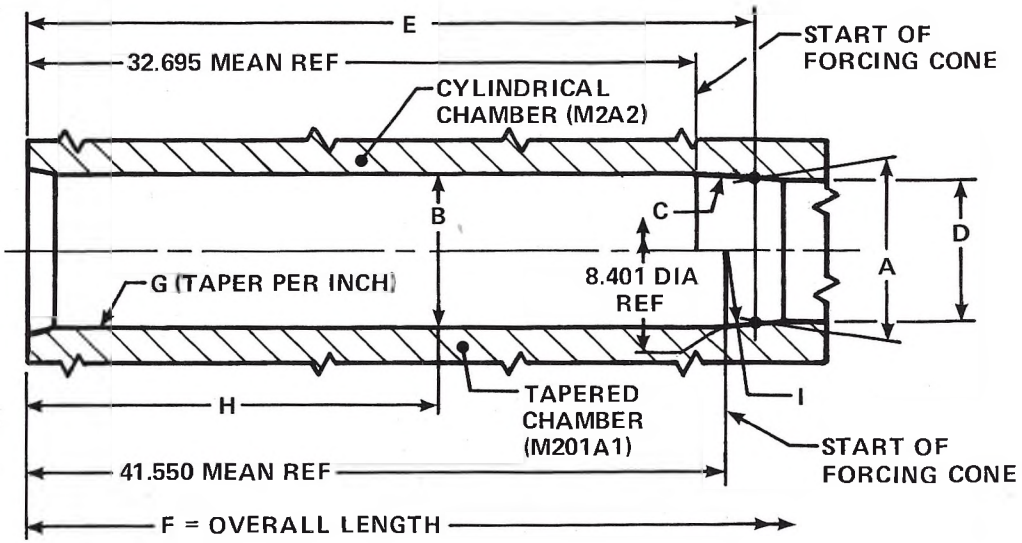
NO. OF GROOVES = 64

DEPTH OF GROOVES = .07

TWIST OF RIFLING-UNIFORM-RIGHT HAND
1 TURN IN 20 CALIBERS

* WTV-F24184 IS A MODIFIED TAPERED CHAMBER-.005 THICK CHROME PLATED

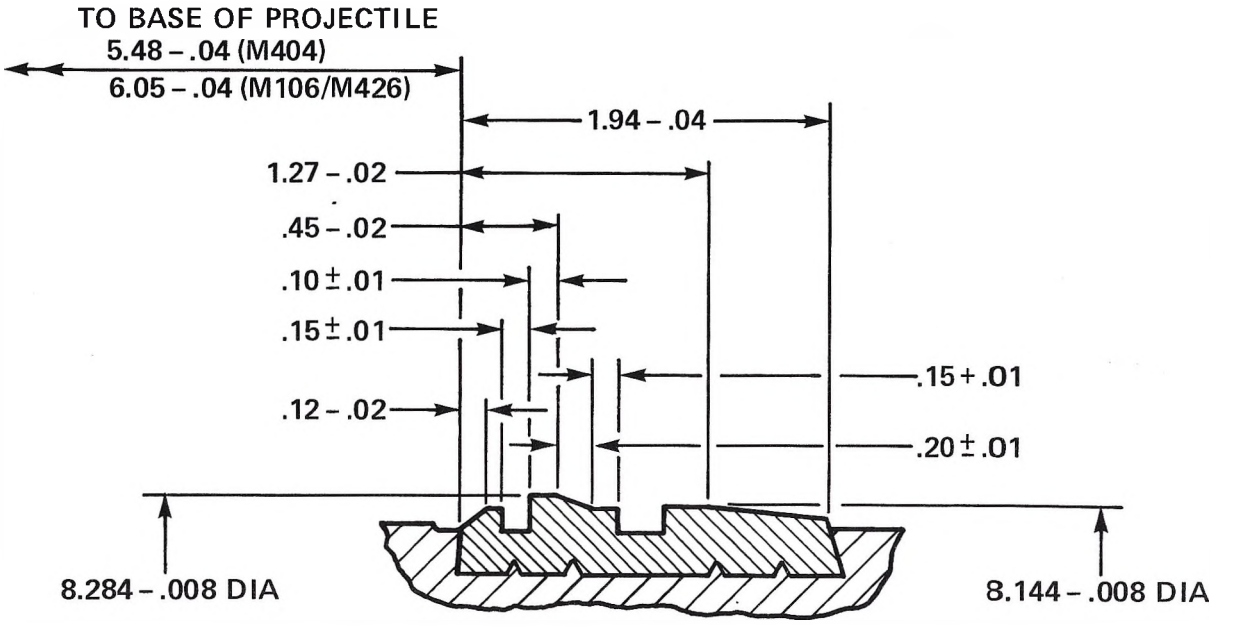
WTV-F24184 IS THE STANDARD GUN TUBE DESIGN. THE XM201 (CYLINDRICAL) DESIGN SHOULD NOT BE USED FOR INTERFACE. ONLY A FEW GUN TUBES WITH XM201 (CYLINDRICAL) CONFIGURATION REMAIN.



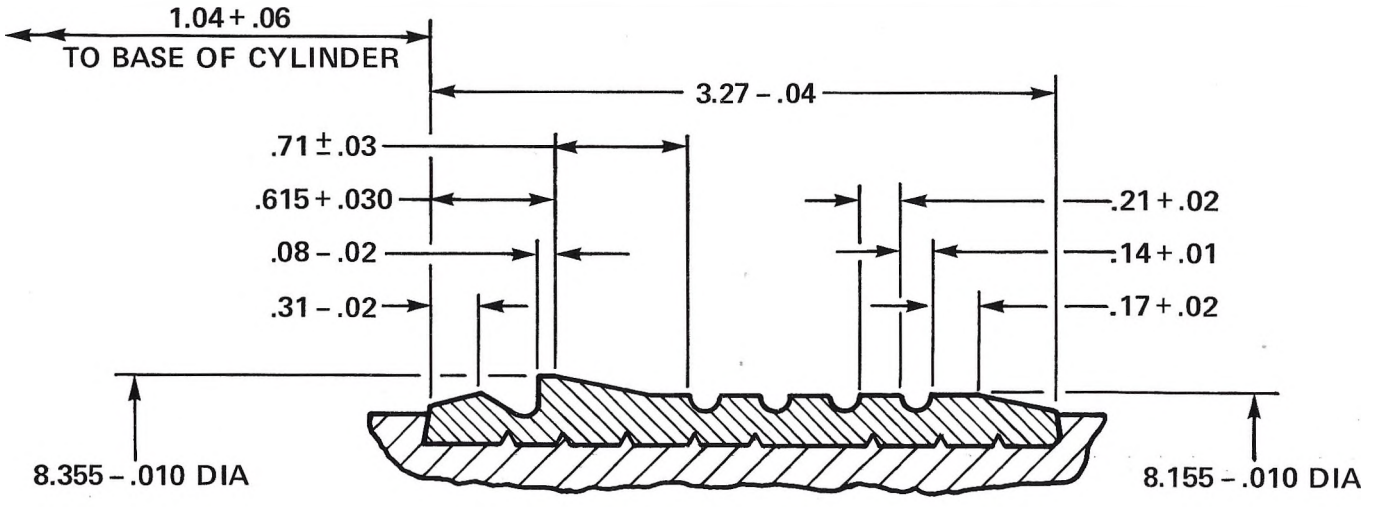
CANNON PARAMETERS

	M2A2 REF DWG 7309174	M201A1 F-24184*	XM201 (CYLINDRICAL)
A	8.350 DATUM DIA	8.2491 DATUM DIA	8.350 DATUM DIA
B	8.490 +.004 DIA	8.443 DATUM DIA	8.490 +.004 DIA
C	.1000 TPI ON DIA	.1000 TPI ON DIA	.1000 TPI ON DIA
D	8.000 +.003 DIA	8.000 +.002 DIA	8.000 +.003 DIA
E	34.10 +.03	43.055 +.030	41.695 +.030
F	202.50 ±.06	315.86 -.20	315.86 -.20
G	NONE	.00215 TPI ON DIA	NONE
H	N/A	22.00 +1.20	N/A
I		3.75 R MAX	

8 INCH ROTATING BAND CONFIGURATIONS

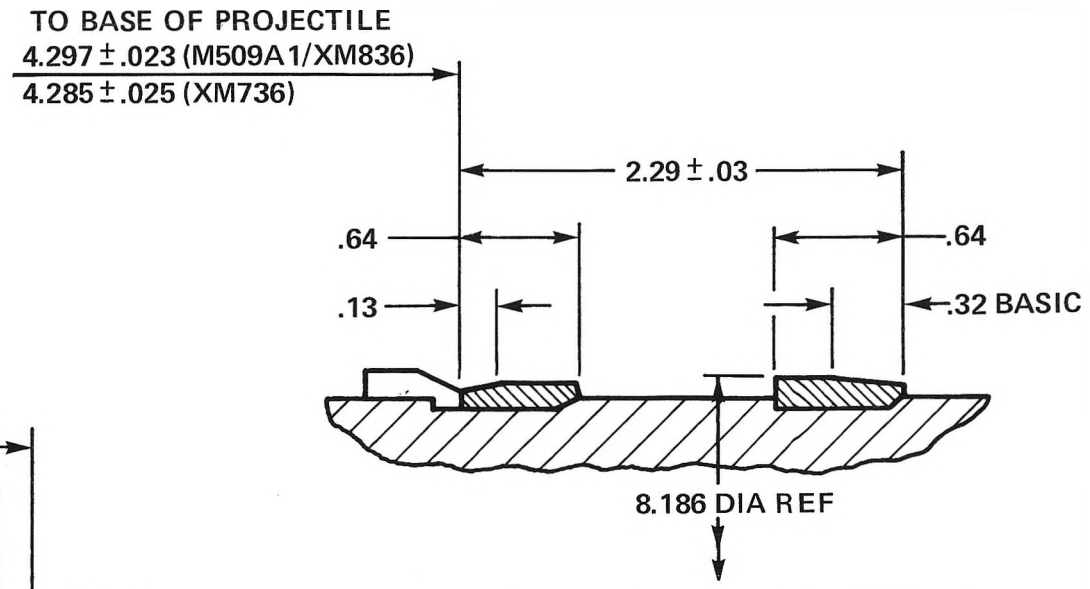


M106/M404/M426 ROTATING BAND

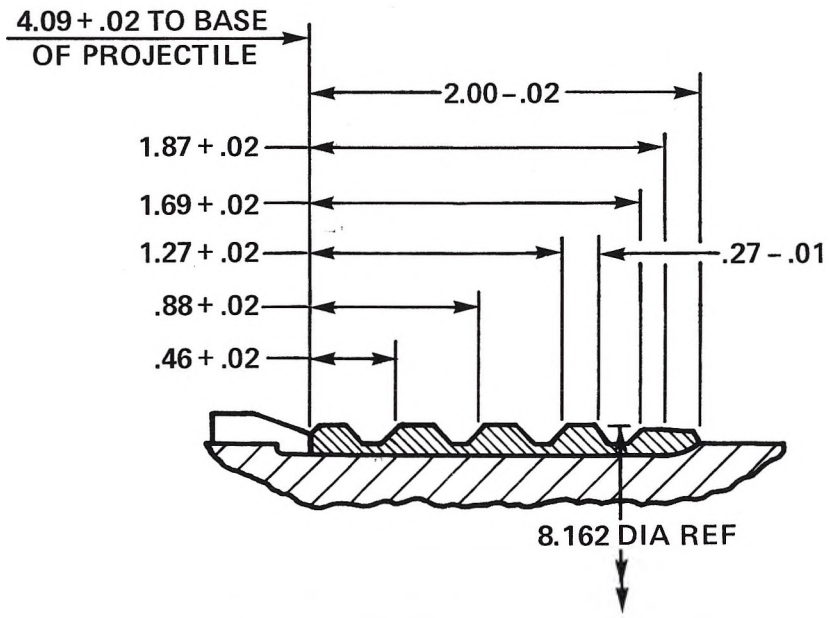


M424A1/M422 ROTATING BAND

8 INCH ROTATING BAND CONFIGURATIONS



XM711/XM836/XM736/M509A1 ROTATING BAND



M753/M650 ROTATING BAND

FUZE/PROJECTILE COMPATIBILITY

PROJECTILE / FUZE	POINT DETONATING			MECHANICAL TIME				ELECTRONIC TIME		PROXIMITY (VT)	
	M557	M572	M739	M577	M582	M564	M565	M587	M724	M732	M728
M106 HE	●	●	●		●	●●		●		●	●
XM836 SADARM				■					■		
M509 ICM				●					■		
M404 ICM				●			●		■		
XM736 CHEMICAL				●					■		
M426 CHEMICAL	●		●							■	■
M650 HE, RAP	●	●	●		●●	●●		●		●●	
XM753 NUC,RAP	S	P	E	C	I	A	L	F	U	Z	E
M422 NUC	S	P	E	C	I	A	L	F	U	Z	E
M424 HE	S	P	E	C	I	A	L	F	U	Z	E

■ PROBABLY COMPATIBLE

● PROVEN COMPATIBLE

● NOT FIRED AT ZONE 9

●● ROCKET OFF ONLY

BLANK SPACE INDICATES NO REQUIREMENT

PROJECTILE/CHARGE COMPATIBILITY IN M110A2 SP HOWITZER

PROJECTILE / CHARGE	M188A1	M188	M2	M1	M80
M106 HE	●	●	●	●	
XM836 SADARM	■	■	■	■	
M509 ICM	●	●	●	●	
M404 ICM	▲	▲	●	●	
XM736 CHEMICAL	●	●	●	●	
M426 CHEMICAL	●	●	●	●	
M650 HE, RAP	●	●	●	●	
XM753 NUC, RAP	●	●	●	●	
M422 NUC	●•	●			●
M424 HE	●•	●			●

■ PROBABLY COMPATIBLE

▲ ASSESSED INCOMPATIBILITY

● PROVEN COMPATIBILITY

• FIRED AT ZONE 8 ONLY

BLANK SPACE INDICATES NO REQUIREMENT

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" LCA-------2
" " -F-----3
" " G----15
" LCE-------3
" LCE-D-----5
" LCM-------5
" LCM-E-----5
" LCN-------3
" LCN-P-----7
" " T----10

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" LCW-A------6
" LCW-E-----10
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" CLN-------15
" SC---------5
" SCF--------5
" BL---------5
" BLL--------5
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" SE---------5
" TS---------3
" QA---------3
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