
U.S. Army Chemical Materiel Destruction Agency

Old Chemical Weapons: Munitions Specification Report



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September 1994

FOREWORD

The following pages present detailed information on the characteristics and critical dimensions for chemical weapons developed during World War I and II, the Cold War Era, and interim time periods. Chemical weapons developed by Britain, France, Germany, Japan, and the United States.

This compilation is intended to aid technically qualified personnel in the identification of these older munitions, as well as to provide data for decision-makers on methods for munitions handling and ultimate disposition. The information provided here should not be construed as inclusive of all possible agent fills, physical characteristics, and explosive train of each munition. In addition, the authors recognize that munitions other than those described here were utilized by each of the respective nations in experimentation or actual production of chemical stockpiles. This document is, however, based on the best information available at the time of publication. Data and drawings of each munition or series of munitions will vary as a function of the quality and or quantity of the resource material.

The information used to compile this data is based on historical documents that describe ammunition development and manufacture, technical manuals, munitions specifications, and other related sources. Data from various repositories were reviewed for applicability. These repositories include:

- Ordnance Museum, Aberdeen Proving Ground, Maryland
- Picatinny Arsenal Museum and Technical Library, Dover, New Jersey
- U.S. Army Chemical and Biological Defense Command Historical Office, Aberdeen Proving Ground, Maryland
- U.S. Army Chemical School, Ft. McClellan, Alabama
- U.S. Army Technical Escort Unit, Aberdeen Proving Ground, Maryland
- U.S. Army Foreign Science and Technology Center, Charlottesville, Virginia
- U.S. Navy Explosive Ordnance Disposal Center, Indian Head, Maryland
- United States National Archives and Records Administration, Suitland, Maryland
- Ministry of Defence, Chemical and Biological Defence Establishment, Porton Down, England

The data are arranged in a standard format compatible with U.S. Army technical data sheets prepared for ordnance characteristics. Included on each data sheet are the following elements:

- weapon nomenclature;
- tabulated data, including critical dimensions such as length, diameter, agent fill, and fill weight;
- markings on the weapon exterior;
- description of the weapon characteristics;
- explosive train information, including types of fuses, bursters, and boosters;
- construction and materials used; and
- references associated with the compiled data.

The data sheets are accompanied by drawings of the exterior surface of each munition, as well as a cutaway drawing that shows interior design components. The drawings are not to scale, but they represent best available renderings for illustration purposes only.

This volume is arranged in alphabetical order by country, with the United States last. Each country section is separate, as indicated by a *document tab*, with an index to each munitions sheet listed at the beginning of each section. To the extent possible, munitions in the World War I and II timeframes are specifically identified on their applicable data sheets; however, to some extent, the exact development date may be unknown. Within each country section, weapons are arranged primarily by size within the following categories:

- grenades and rockets,
- mortars,
- artillery shells,
- aerial bombs and spray tanks,
- chemical mines, and
- other items.

Included in this document are two sections (Acronyms/Abbreviations and Glossary) to assist the reader with acronyms, abbreviations, and terms that are used.

All personnel utilizing this document are urged to send comments to:

U.S. Army Chemical Materiel Destruction Agency
Office of the Program Manager for Non-Stockpile Chemical Materiel
ATTN: SFIL-NSP
Aberdeen Proving Ground, MD 21010-5401

It is requested that all comments regarding technical discrepancies include reproductions of the specific portions of the applicable verification documentation. This will allow revisions to be performed in an efficient and accurate manner.

TABLE OF CONTENTS

Section	Title	Page
	FOREWORD	i
	ACKNOWLEDGEMENTS	vi
	ACRONYMS/ABBREVIATIONS	vii
	GLOSSARY OF TERMS	xi
1	BRITISH CHEMICAL MUNITIONS	1-1
2	FRENCH CHEMICAL MUNITIONS	2-1
3	GERMAN CHEMICAL MUNITIONS	3-1
4	JAPANESE CHEMICAL MUNITIONS	4-1
5	AMERICAN CHEMICAL MUNITIONS	5-1

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The Munitions Specification Package development could not have been possible without the assistance of many organizations. Special acknowledgement is made to the following organizations:

- Ordnance Museum, Aberdeen Proving Ground, Maryland
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- U.S. Army Technical Escort Unit, Aberdeen Proving Ground, Maryland
- U.S. Army Foreign Science and Technology Center, Charlottesville, Virginia
- U.S. Navy Explosive Ordnance Disposal Center, Indian Head, Maryland
- United States National Archives and Records Administration, Suitland, Maryland
- Ministry of Defence, Chemical and Biological Defence Establishment, Porton Down, England

ACRONYMS/ABBREVIATIONS

AC	hydrogen cyanide
AK	hydrocyanic acid (AC) and ethyl iodoacetate
AN-M	nomenclature reflecting use by U.S. Army and Navy
Aub	Aub for Aubervilliers
B-stoff	bromacetone
BA	bromacetone (bromoacetone)
BB	sulfur mustard
BBC	brombenzylcyanide (bromobenzylcyanide)
BM	Berger Mixture
BN-stoff	brommethylethyketone
BW/CW	biological weapons/chemical weapons
C.W.R.-N	chemical warhead rocket - Navy
CA	brombenzylcyanide
CBR	50% CG, 50% arsenic trichloride
CC	cyanogen chloride
CG	phosgene
CK	cyanogen chloride
CL	chlorine (military symbol, not chemical symbol)
cm	centimeter
CN	chloracetophenone
CNS	mixture of CN, PS, and chloroform
CO	collongite opacite (mixture of CG and stannic chloride)
D.A.	direct action (British fuze nomenclature)
DA	diphenylchlorarsine
DC	diphenylchlorarsine (diphenylcyanarsine in Japanese text)
DESA	mustard prepared by sulfur monochloride process
DESAV	viscous DESA
DM	adamsite
DP	diphosgene
ED	ethylchlorarsine (dichlorethylarsine in German text)
EOD	Explosive Ordnance Disposal
FM	field manual
FM	titanium tetrachloride (smoke)
FS	sulphur trioxide (smoke) trioxide-chlorsulfonic acid
G	tabun (German nerve agent)
g	gram
G10	hydrocyanic acid (AC)
GA	tabun plus 20% chlorobenzol

Gb	gelb (German abbreviation for yellow)
GB	Sarin (nerve agent)
Gr	Grün (German abbreviation for green)
H	mustard
H/B/gel 1, Y18	50% benzene, 50% HB plus 2.6% by weight of crepe rubber
H/B/gel 2, Y18A	50% benzene, 50% HB plus 3.9% by weight of crepe rubber
H/L	mixture of mustard and Lewisite
H.E.	high explosive
HBV	mustard plus monochlorobenzene (HM) made viscous with chlorinated rubber
HBDV	mustard plus monochlorobenzene (HM) made viscous with chlorinated rubber
HCN	hydrogen cyanide
HD	distilled mustard
HL	mixture of mustard and Lewisite (Winterlost in German text)
HM	mustard plus monochlorobenzene
HMV	viscous mustard plus monochlorobenzene
HN (1/2/3)	nitrogen mustard
HS (also BB)	sulfur mustard [HS (mustard gas) was prepared by the sulfur dichloride process and contained 15% carbon tetrachloride as a diluent]
HT	60% mustard, 40% vesicant T [HT (mustard gas) was prepared by the thiodiglycol process and contained 60% dichlorodiethyl sulphide and 40% di-chloroethylthiodiethyl ether]
JBR	50% hydrogen cyanide (AC), 20% arsenic trichloride, 25% chloroform
JL	50% hydrogen cyanide (AC) and 50% chloroform
KSK	ethyliodoacetate and ethyl alcohol
KF	stannic chloride
kg	kilogram
L.C.	light case (British bomb nomenclature)
L	Lewisite
LACH	lachrymatory
lb	pound
Mk	Mark (normally British or U.S. Naval weapons model number)
mm	millimeter
n.d.	no date
N.p.	no place
n.p.	no publisher
NC	80% chloropicrin plus 20% stannic chloride
No.	number

oz	ounce
P.Cx	Pont-de-Claix
PD	mixture of phosgene and diphenylchlorarsine
PETN	pentaerythritol tetranitrate (high explosive)
PG	50% chloropicrin, 50% phosgene (CG)
PS	chloropicrin
PWP	Plasticized white phosphorous
RDX	Royal Dutch Explosive (cyclotrimethylenetrinitramine or cyclonite; high explosive)
Ref.	reference
SCI	Smoke Curtain Installation
SK	75% ethylidoacetate, 25% alcohol
T-stoff	xylyl bromide
T	di-chloroethylthiodiethyl ether
TH	thermite
TM	technical manual
TNT	trinitrotoluene (high explosive)
USN	U.S. Navy
V4	vincennite quarternaire
Vis	Vincennes
VN	50% hydrogen cyanide (AC), 30% arsenic trichloride, 15% stannic chloride, 5% chloroform
VN	vincennite
VX	persistent nerve gas
WP	white phosphorous (smoke/incendiary)
WWI	World War I
WWII	World War II
Y1	sulfur mustard
Y2	viscous sulfur mustard
Y3	strong vesicant (HT)
Y4	viscous form of HT (HTV)
Y5,Y5A,Y5B,Y5C	mustard plus monochlorobenzene (HM)
Y6	viscous mustard plus monochlorobenzene (HMV)
Y7	Lewisite
Y9, YN	mixture of mustard and lewisite (HL)
Y10	viscous mixture of mustard and Lewisite (HLV)
Y13	HB-mustard from the sulfur dichloride process, CCl4 removed by stripping and monochlorobenzene added; made viscous with chlorinated rubber

Y14	mustard plus monochlorobenzene (HM) made viscous with chlorinated rubber
Y15	mustard prepared by sulfur monochloride process
Y16	viscous DESA
Yc	yperite dissolved in monochlorobenzene
Yp	mixture of dichlorodiethyl sulfide and carbon tetrachloride
Yt	yperite dissolved in carbon tetrachloride

GLOSSARY OF TERMS

<u>Term</u>	<u>Explanation</u>	<u>Abbreviation</u>
adamsite	diphenylchlorarsine	DA
aquimite	chloropicrin	
aquimite (No. 7)	75% chloropicrin, 25% opacite	
B-Stoff	bromacetone	
Berger Mixture	zinc dust 25%, carbon tetrachloride 50%, zinc oxide 20%, kieselguhr 5%	BM
barometric fuze	fuze that functions upon change in barometric pressure	
bertholite	chlorine	
Bn-Stoff	brommethylethylketone	
bretonite	iodoacetate	
C-Stoff	same as K-stoff	
camite	brombenzylcyanide	
cartridge holder	primer holder/tail boom	
chlor	chlorine	
chloropicrin	nitrochloroform	
Clark I	diphenylcyanarsine	DA
Clark II	diphenylchlorarsine	DC
collongite(No. 5)	75% phosgene, 25% opacite or tin tetrachloride	
cyclonite	RDX	
D-Stoff	phosgene (also shown as dimethyl sulfate)	
Dick	ethyldichlorarsine	
diphosgene	trichlormethylchloroformate	
Driving band	rotating band	
Explosive D	ammonium picrate	
Fraissite	benzyl iodide	
gaine	adapter booster/burster	
homomartonite	brommethylethylketone (B-Stoff)	
hydrocyanic acid	hydrogen cyanide	AC
hydrogen cyanide	hydrocyanic acid	AC
K-Stoff	chlormethylchloroformate	
Klop	chloropicrin (nitrochloroform)	

lacrimite (No. 15) Lost	75% triphosgene, 25% opacite dichlorethyl sulfide	
manganite (No. 4)	50% hydrocyanic acid, 50% arsenic trichloride	
marsite	arsenic trichloride	
mauguinite	cyanogen chloride	CK
opacite	stannic chloride	KF
papite	acrolein	
Perstoff	trichlormethylchloroformate (diphosgene)	
phosgene	carbonyl chloride	CG
semisteel	cast iron of low carbon content	
sulvanite (No. 13)	75% ethylsulfuryl chloride, 25% opacite	
surpalite	diphosgene	
T-Stoff	xylyl bromide	
tetryl	trinitrophenylmethylnitramine	
tonite	chloracetone	
Trotly exploder	booster	
vincennite	50% hydrocyanic acid,	
quarternaire (V4)	15% opacite, 30% arsenic	
(No. 4)	trichloride, 5% chloroform	
vitrite (No. 4B)	cyanogen chloride plus arsenic trichloride	
Winterlost	mustard plus Lewisite	HL
yperite	dichlorethyl sulfide, Lost, mustard gas	
yperite (No. 20)	mustard	H
zinntetrachloride	tin tetrachloride	

**BRITISH
CHEMICAL MUNITIONS**

TABLE OF CONTENTS

Section	Title	Page
	LIST OF ILLUSTRATIONS	1-ii
	LIST OF TABLES	1-ii
1	BRITISH CHEMICAL MUNITIONS	
1.1	INTRODUCTION	1-1
1.2	MUNITION MARKINGS	1-2
1.3	TECHNICAL DESCRIPTIONS	1-4
1.3.1	Mortar, 4-inch Stokes	1-5
1.3.2	Livens Projectile, MK I	1-9
1.3.3	Artillery Chemical Shell, 18 pounds	1-13
1.3.4	Artillery Chemical Shell, 4.5-inch Howitzer, Container Type, MK IV	1-16
1.3.5	Artillery Chemical Shell, 4.5 inches, Double-diaphragm, MK III	1-19
1.3.6	Artillery Chemical Shell, 60 Pounds, 5 Inches	1-22
1.3.7	Artillery Chemical Shell, 60-pounds, 5-inch, Container Type MK III	1-25
1.3.8	Artillery Chemical Shell, 6-inch Howitzer, Container Type, MK III	1-28
1.3.9	Artillery Chemical Shell, 8-inch Howitzer	1-31
1.3.10	5-inch Chemical Rocket, U (Unrotating)	1-32
1.3.11	Mortar, 4.2 inches, MK Is	1-35
1.3.12	Aerial Spray Tank, SCI, 250, 500 and 1000 pound	1-38
1.3.13	Bomb, Ground, 6-pound	1-43
1.3.14	Bomb, Aircraft, L.C. 65 Pound	1-46
1.3.15	250-pound L.C. (Light Case) Bomb, MK I and MK II	1-49
1.3.16	500-pound L.C. (Light Case) Bomb, MK I and MK II	1-52
1.3.17	Mine, Chemical, No.1, MK II	1-55
1.3.18	22-centimeter Catapult Mine	1-58
1.3.19	English Gas Hand Grenade (Smoke/Fog)	1-60
1.3.20	English Overhand Grenade Type "E" Pepper Grenade	1-63

LIST OF ILLUSTRATIONS

Figure	Title	Page
1.3.1-1	Mortar, 4-inch Stokes (old style)	1-8
1.3.2-1	Livens Projectile, MK I	1-12
1.3.3-1	Artillery Chemical Shell, 18 Pounds	1-15
1.3.4-1	Artillery Chemical Shell, 4.5-inch Howitzer,	1-18
1.3.5-1	Artillery Chemical Shell, 4.5 inches, Double-diaphragm, MK III	1-21
1.3.6-1	Artillery Chemical Shell, 60 Pounds, 5 Inches	1-24
1.3.7-1	Artillery Chemical Shell, 60 pounds, 5 inches, Container Type MK III	1-27
1.3.8-1	Artillery Chemical Shell, 6-inch Howitzer, Container Type, Mark III	1-30
1.3.9-1	Artillery Chemical Shell, 8-inch Howitzer	1-32
1.3.10-1	5-inch Chemical Rocket, U (Unrotating)	1-34
1.3.11-1	Mortar, 4.2 inches, MK Is	1-37
1.3.12-1	Aerial Spray Tank, S.C.I. (Smoke Curtain-Installation), MK IV	1-41
1.3.12-2	Aerial Spray Tank, S.C.I. (Smoke Curtain-Installation), MK V	1-42
1.3.13-1	Bomb, Ground, 6-pound	1-45
1.3.14-1	Bomb, Aircraft, L.C. 65 pound	1-48
1.3.15-1	250-pound L.C. (Light Case) Bomb, MK I and MK II	1-51
1.3.16-1	500-pound L.C. (Light Case) Bomb, MK I and MK II	1-54
1.3.17-1	Mine, Chemical, No. 1, MK II	1-57
1.3.18-1	22-centimeter Catapult Mine	1-59
1.3.19-1	English Gas Hand Grenade (Smoke/Fog)	1-62
1.3.20-1	English Overhand Grenade Type "E" Pepper Grenade	1-65

LIST OF TABLES

Table	Title	Page
1-1	British Chemical Fill Designations	1-1
1-2	British World War I Chemical Weapons Marking Schemes	1-3
1-3	British World War II Chemical Weapons Marking System	1-3

SECTION 1

BRITISH CHEMICAL MUNITIONS

1.1 INTRODUCTION

The British chemical weapons program remained active during and subsequent to each World War. The inventory of weapons includes artillery and mortar shells, aerial bombs, spray tanks, and chemical mines.

Very little information is available concerning details of British chemical weapons. In this report, much information regarding markings was taken from a review of available photographs and drawings. Information on the construction of the munition as well as its explosive train is limited.

The British system of marking is similar to the American in that the gas shells were painted gray, with the gas filling indicated by a system of colored bands (white and/or red) encircling the body of the shell. Table 1-1 summarizes chemical fill designations used during World War I.

Table 1-1. British Chemical Fill Designations

British Designation	American Equivalent or Chemical Name
BBC	brombenzylcyanide (bromobenzylcyanide)
CBR	50% phosgene (CG), 50% arsenic trichloride
CC or CK	cyanogen chloride
CG	phosgene
DESA, Y15	mustard prepared by sulfur monochloride process
DESAV, Y16	viscous DESA
FM	titanium tetrachloride (smoke)
G10	hydrocyanic acid (AC)
HB/gel 1, Y18	50% benzene, 50% HB plus 2.6% by weight of crepe rubber
HB/gel 2, Y18A	50% benzene, 50% HB plus 3.9% by weight of crepe rubber
HBV, HBDV, Y14	mustard plus monochlorobenzene (HM) made viscous with chlorinated rubber
HS also BB	sulfur mustard

Table 1-1. British Chemical Fill Designations (Continued)

British Designation	American Equivalent or Chemical Name
JBR	50% hydrogen cyanide (AC), 20% arsenic trichloride, 25% chloroform
JL	50% hydrogen cyanide (AC), 50% chloroform
KSK	ethylidoacetate and ethyl alcohol
NC	80% chloropicrin plus 20% stannic chloride
PG	50% chloropicrin, 50% phosgene (CG)
PS	chloropicrin
SK	75% ethylidoacetate, 25% alcohol
TH	thermite
VN	50% hydrogen cyanide (AC), 30% arsenic trichloride 15% stannic chloride, 5% chloroform
WP	white phosphorous (smoke/incendiary)
Y1	sulfur mustard
Y2	viscous sulfur mustard
Y3	strong vesicant (HT)
Y4	viscous form of HT (HTV)
Y5, Y5A, Y5B, Y5C	mustard plus monochlorobenzene (HM)
Y6	viscous mustard plus monochlorobenzene (HMV)
Y7	Lewisite
Y9, YN	mixture of mustard and lewisite (HL)
Y10	viscous mixture of mustard and lewisite (HLV)
Y13	HB-mustard from the sulfur dichloride process, CCl ₄ removed by stripping and monochlorobenzene added; made viscous with chlorinated rubber

1.2 MUNITION MARKINGS

During World War I, the British used gray or blue-gray as the base color for chemical munitions. The type of fill in the gas shell was indicated by a series of colored bands or stripes painted around the shell body. The chemical fills and markings are shown in table 1-2. A red band around the nose of the projectile indicated that the shell was loaded.

Table 1-2. British World War I Chemical Weapons Marking Schemes

FILL	MARKING BANDS
JL (AC/chloroform)	unknown
VN (vincennite)	1 white, 1 red
CG (phosgene)	1 red, 1 white, 1 red
JBR (HCN and CHCl ₃)	3 red
CBR (phosgene and arsenic trichloride)	1 red
HS also BB (mustard)	4 red
PG (50% phosgene and 50% chloropicrin)	2 white
AK (ethyl iodoacetate and AC)	1 white, 2 red
PS (chloropicrin)	1 white

The marking scheme for chemical (gas) munitions changed with the beginning of chemical munitions production during World War II. The British had a large variety of chemical fillings for use during the second World War. Table 1-3 shows the fill (agent and code), and marking scheme used during this time period.

Table 1-3. British World War II Chemical Weapons Marking System

AGENT FILL	CODE	BAND COLOR AND NUMBER
H	Y0	1 yellow
HS	Y1	1 yellow
HSV	Y2	1 yellow, 1 red
HT	Y3	1 yellow
HTV	Y4	1 yellow, 1 red
HM	Y5/5A/5B/5C	1 yellow
HMV	Y6	1 yellow, 1 red
L	Y7	1 yellow, 1 white

**Table 1-3. British World War II Chemical Weapons
Marking System (Continued)**

AGENT FILL	CODE	BAND COLOR AND NUMBER
LV	Y8	1 yellow, 1 red, 1 white
HL	Y9	1 yellow, 1 white
HLV	Y10	1 yellow, 1 red, 1 white
HB	Y13	1 yellow
HB/HgO	Y13B	1 yellow
HBD/HgO	Y13C	1 yellow
HBV	Y14	1 yellow, 1 red
HBDV	Y14A	1 yellow, 1 red
DESA	Y15	1 yellow
DESAV	Y16	1 yellow, 1 red
HB/gel 1	Y18	1 yellow, 1 red
HB/gel 2	Y18A	1 yellow, 1 red
AC	G10	2 green
SK	unknown	no bands
KSK	unknown	no bands, marked with letters HVV
BBC	G-337	unknown
NC	...	1 white, 1 red, 1 white
WP	...	marked with SMOKE and A&W PHOS PHOS
CNS	unknown	unknown

1.3 TECHNICAL DESCRIPTIONS

The following pages present technical information on each British chemical munition.

1.3.1 NOMENCLATURE: Mortar, 4-inch Stokes

TABULATED DATA:

Length: 39.4 centimeters (15.52 in.) (without fuze)
48.7 centimeters (19.17 in.) (with fuze)

Diameter: 10.59 centimeters (4.17 in.)

Type of Fill and Fill Weight:

AK: unknown
CG: 1.8 kilograms (3.97 lb)
KSK: 3.3 kilograms (7.28 lb) (calculated)
NC: 3.6 kilograms (7.94 lb)
PG: unknown
PS: 3 kilograms (6.62 lb)
TH: 4.5 kilograms (9.92 lb)
WP: 3.4 kilograms (7.5 lb)

Total Weight with Fill:

AK: unknown
CG: 10.3 kilograms (22.71 lb)
KSK: 11.3 kilograms (24.92 lb) (calculated)
NC: 11.1 kilograms (24.48 lb)
PG: unknown
PS: 11 kilograms (24.26 lb)
TH: 11.6 kilograms (25.58 lb)
WP: 10.9 kilograms (24.03 lb)

Markings:

The British Stokes Mortar was painted gray. The CG round was marked with one red band, then one white band, followed by another red band. The AK round had three colored bands; one red followed a white band, this one followed by another red band. The PG round had two white bands. The NC round had three colored bands; one white followed a red one, this one followed by another white band. The PS round had a 0.5-inch (1.27 centimeters) white band in the center with the letters PS (white) below the white band. The KSK round had the letters LACH (lachrymatory) in red, and the letters SK in red on the center of the round. The WP round was stencilled with the letters SMOKE (smoke shell) and A & W PHOS, which meant the round contained phosphorus. The thermite round had the word INCDY stencilled without any bands. All rounds had bands that were 1.27 centimeters (0.5 inch) wide. Additionally, all filled rounds had a red band near the top of the body.

Description:

The British 4-inch Stokes mortar was divided into two general types: the old style and the new style. The new style was very similar to the Stokes used by the Americans; however, the British used the following fuzes: British Mills Pistol, British Allways or 146 fuze, and the 31-D fuze (used on thermite heavy smoke and ranging rounds). The complete British 4-inch Stokes mortar consisted of the shell body, burster, fuze, propellant charge and filling. The shell body is a cylinder 4.0 inches in diameter fabricated from drawn steel tubing or rolled metal with an overlapped weld.

The body of the new style contained a forward disk and a base disk. The forward or nose disk was machined to 10.61 centimeters (4.178 inches) in diameter and was designed to retain the forward end of the burster tube and fuze. The base disk was also machined to 10.61 centimeters (4.178 inches), but it was not designed to support the end of the burster tube. The cartridge container was a steel cylinder 7 centimeters (2.77 inches) in length, 2.54 centimeters (1 inch) in diameter, and perforated with holes to provide the outlets for the gases generated by the propellant. The forward end or nose disk and the base disk served as guides when the round was expelled from the mortar barrel.

The body of the old style contained a forward and a base disk. The forward and base disks were machined to 10.61 centimeters (4.17 inches) in diameter, and the forward or nose disk was designed to retain the forward end of the burster tube and fuze. The cartridge container was a steel cylinder 7 centimeters (2.77 inches) in length, 8.90 centimeters (3.5 inches) in diameter, and perforated with 16 holes to provide the outlets for the gases generated by the propellant. The forward end or nose disk and the base disk served as guides when the round was expelled from the mortar barrel.

The total length of the shell body assembly varied, depending on the type of filling that was required. For example, the 4-inch Stokes mortar designed for lethal gases is 48.90 centimeters (19.25 inches) long, the smoke model was 58.42 centimeters (23 inches) long, and the round designed for incendiary fills was 44.60 centimeters (17.56 inches) long.

Explosive Train:

The explosive train consisted of a burster and a detonator.

Fuze:

Model no.:	British Mills Pistol or British Allways (146)
Overall length:	9.14 centimeters (3.6 in.)
Total weight:	unknown

Burster:

Model no.: No. 3, MK I for use with pistol or
No. 4, MK I for use with percussion fuze (146)
Explosive type: unknown
Explosive weight: unknown

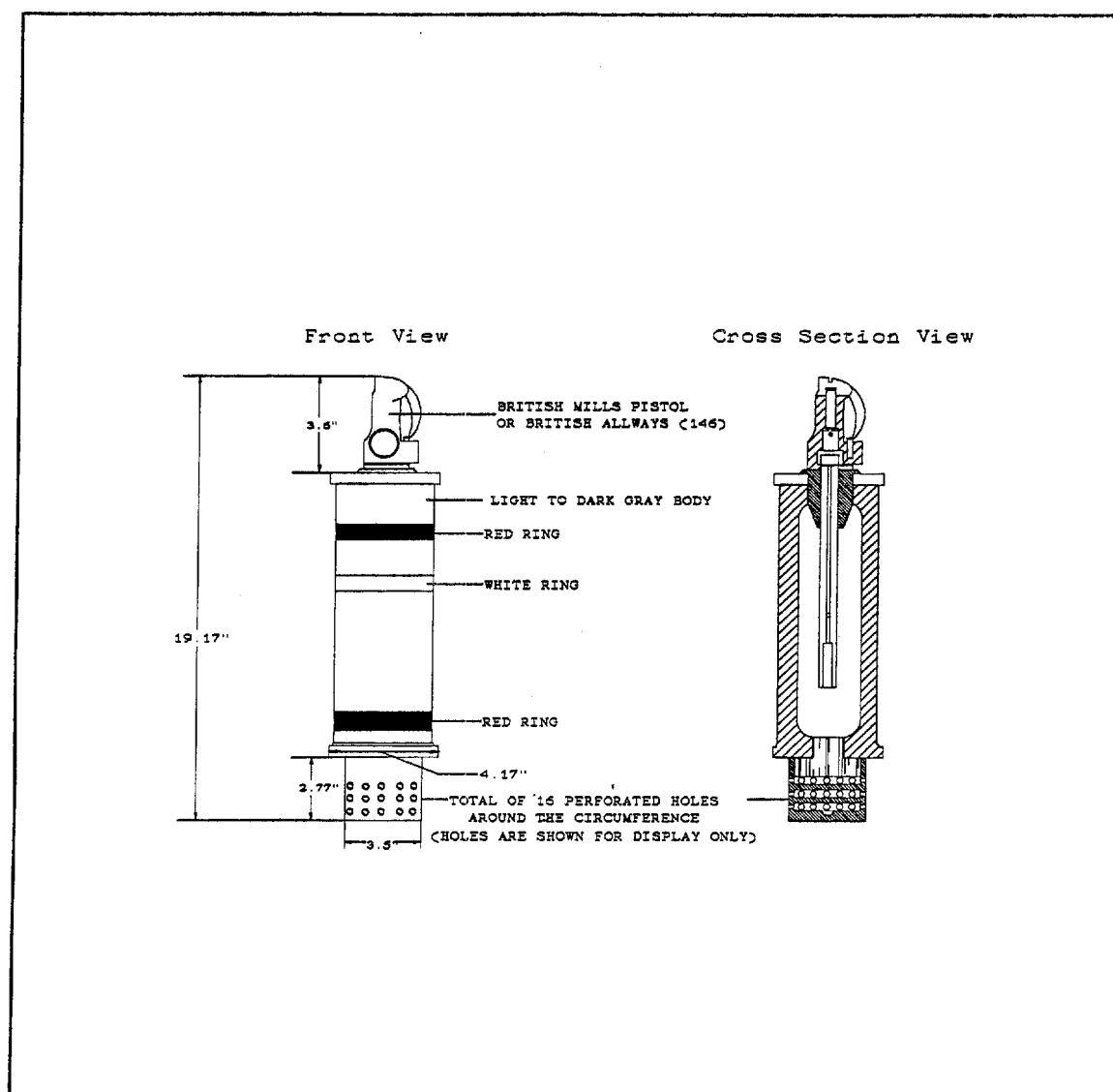
ENGINEERING DATA:

Construction:

Main body: drawn steel tubing or rolled metal with an overlapped weld
Wall thickness: CG: 0.6 centimeter (0.24 in.)
NC, PS, KSK: 0.5 centimeter (0.20 in.)
WP: 0.4 centimeter (0.16 in.)
TH: 0.45 centimeter (0.18 in.)

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedures German-Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918. Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April, 1976) (Washington, DC: n.p., April 1992) 1a, 1b, 3, 4, 4a, 5.
2. American Expeditionary Forces, Gas Manual Part III, Use of Gas by Gas Troops, General Headquarters American Expeditionary Forces (France: n.p., March 1919) 21-27, 54.



Drawing not to scale

Figure 1.3.1-1. Mortar, 4-inch Stokes (old style) (Ref. 2)

1.3.2 NOMENCLATURE: Livens Projectile, MK I

TABULATED DATA:

Length: 59.60 centimeters (23.46 in.)

Diameter: 19.50 centimeters (7.68 in.)

Type of Fill and Fill Weight:

CG:	13 kilograms (28.67 lb)
CK:	unknown
NC:	16 kilograms (35.28 lb)
FM:	13.64 kilograms (30.1 lb)
HD:	unknown (possible filler)
PS:	16 kilograms (35.28 lb)
magnesium arsenide:	unknown
surpalite (diphosgene):	unknown

Total Weight with Fill:

CG:	28.50 kilograms (62.84 lb)
CK:	unknown
NC:	31.50 kilograms (69.46 lb)
FM:	29.14 kilograms (64.25 lb)
HD:	unknown
PS:	31.50 kilograms (69.46 lb)
magnesium arsenide:	unknown
surpalite (diphosgene):	unknown

Markings:

The shell body of the CG round was black. Sometimes a gray diamond was painted in the center of the round. The shell body of the PS and NC rounds were dark gray with one white band followed by one red band. The red band was followed by another white band. The bands were 1.27 centimeters (0.5 inch) wide, with 1.27 centimeters (0.5 inch) between bands. A blue-gray diamond was painted in the center of the round. The smoke/oil-filled rounds were black overall, with a red band 1.27 centimeters (0.5 inch) wide on the filling plug end.

Description:

The shell body was made of seamless drawn steel tubing 0.51 centimeter (0.20 inch) thick with forged-steel welded hemispherical ends. It could be identified by the projections at each end, which were 4.29 centimeters (1.69 inches) in diameter and approximately 2.54 centimeters (1 inch) long. A central tube ran the length of the

shell and was welded into it at both ends. A steel plug (coupling plug) was welded into the tube to divide it into the section used to receive the burster tube and the section used for filling the shell. The shell filling passed from the tube into the shell through four holes located near the filling end of the shell. There were also two vent holes. After filling, the shell was sealed by screwing a tapered plug into the filling hole.

The common agent filling was CG. Chlorine and chloropicrin were used alone and in a mixture. Mustard was attempted. During World War I, titanium tetrachloride (FM) was a common smoke filling in the Livens projectile, with a total fill weight of 13.61 kilograms (30 pounds). Other materials that have been reported as possible filling agents were magnesium arsenide, cyanogen chloride, and surpalite (diphosgene).

Explosive Train:

The explosive train consisted of a burster tube, which contained a TNT charge, and a 22-second time fuze, which carried a primer at one end and a combination mercury fulminate tetryl detonator on the end. The pistol head consisted of a steel turning, 3.18 centimeters (1.25 inch) in diameter and 9.53 centimeters (3.75 inch) long, which screwed on the upper part of the adapter.

Fuze:

Model no.:	22-second Bickford time fuze
Overall length:	25.4 centimeters (10.0 in.)
Total weight:	unknown

ENGINEERING DATA:

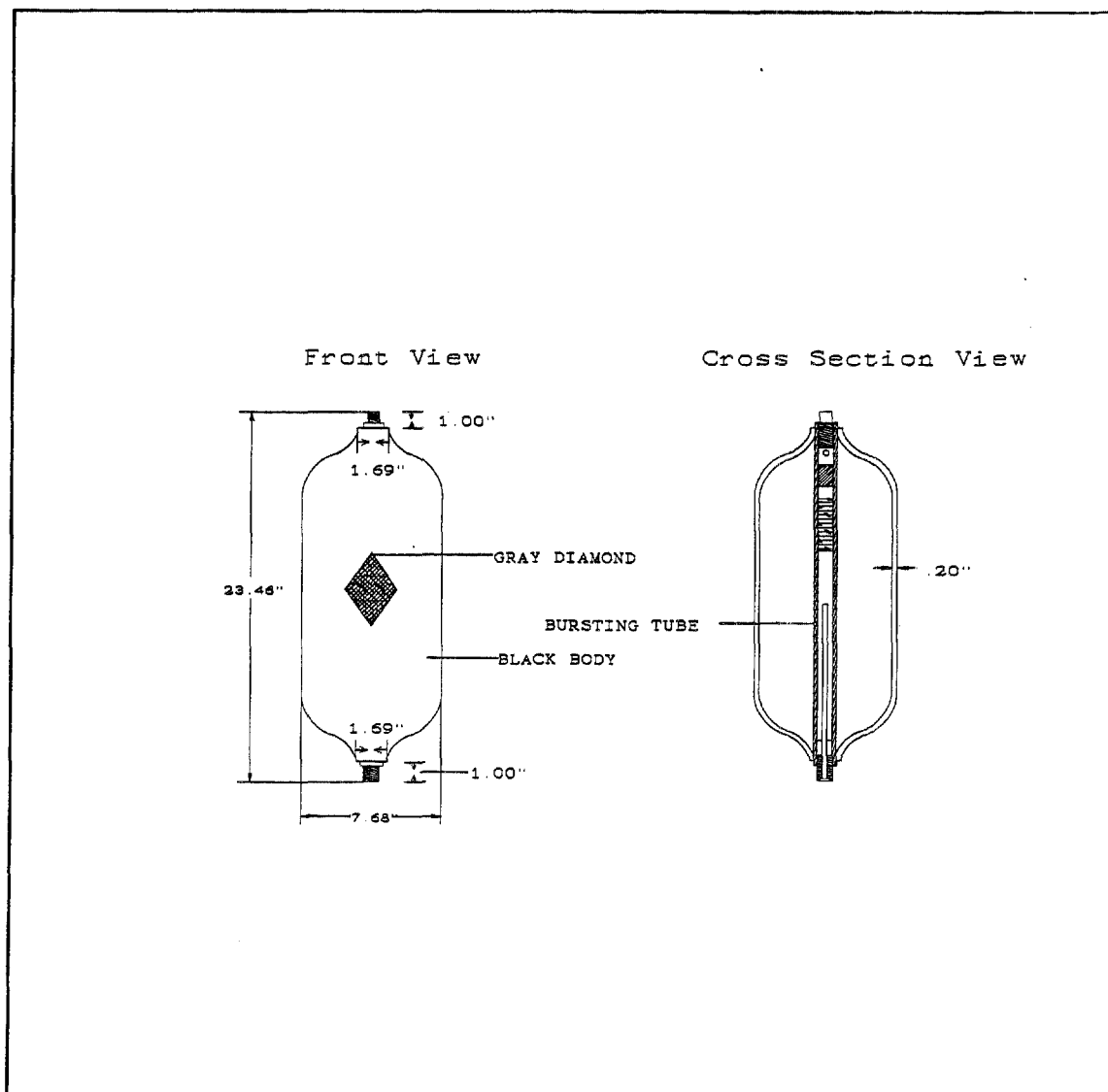
Construction:

Main body:	lap-welded or seamless drawn-steel pipe with welded hemispherical ends with a central burster well welded to the ends
Wall thickness:	0.51 centimeter (0.20 inch)

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937) 348.
2. Amos A. Fries, Brigadier General, American Expeditionary Forces Chemical Warfare Services, Manual of Gas Warfare (France: March 1919).

3. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedures German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian-1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April, 1976) (Washington, DC: n.p., April, 1992) 1a, 1b, 3, 4, 4a, 5.



Drawing not to scale

Figure 1.3.2-1. Livens Projectile, MK I (Ref. 3)

1.3.3 NOMENCLATURE: Artillery Chemical Shell, 18 pounds

TABULATED DATA:

Length: (without fuze) 24 centimeters (9.44 in.)

Diameter: 8.4 centimeters (3.31 in.)

Type of Fill and Fill Weight:

CG: 0.45 kilogram (1 pound)

HS: unknown

WP: unknown

Total Weight with Fill:

CG: 8.85 kilograms (19.5 lb)

HS: unknown

WP: unknown

Markings:

Photographic evidence was used to reconstruct markings on this munition. The shell was light gray overall with one red ring on the upper third of the projectile. Immediately below the red ring was a light brown ring, which distinguished the projectile as a cast iron shell. The filling date was marked below the brown ring, for example, W/9/9/18. On the middle section of the body were three rings; the middle ring appeared to be white. Following the three rings were the letters EXPR. C.E., which were above the numbers 27773. The meaning of these letters and numbers is unknown.

Description:

No description of this artillery shell could be found in the sources reviewed.

Explosive Train:

Fuze:

Model no.: 106, MK III

Overall length: unknown

Total weight: unknown

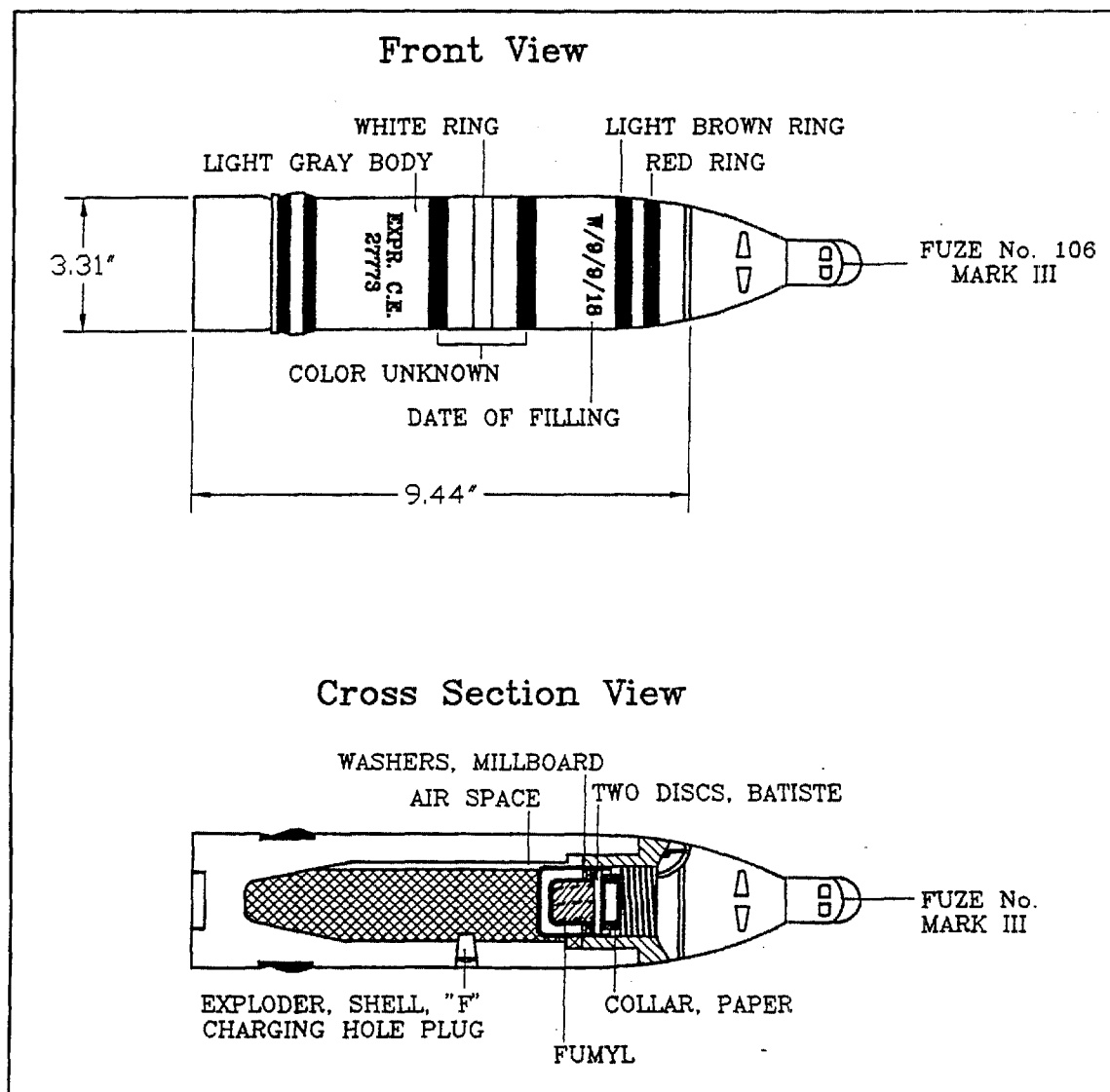
ENGINEERING DATA:

Construction:

Main Body: semisteel (cast iron of low carbon content)

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937) 461, 464.
2. GO A 8-1-2.



Drawing not to scale

Figure 1.3.3-1. Artillery Chemical Shell, 18 Pounds (Ref. 1)

1.3.4 NOMENCLATURE:

**Artillery Chemical Shell, 4.5-inch Howitzer,
Container Type, MK IV**

TABULATED DATA:

Length: 33.8 centimeters (13.3 in.)

Diameter: 11.43 centimeters (4.5 in.)

Type of Fill and Fill Weight:

CBR: unknown

CG: 0.95 kilogram (2.1 lb)

JBR: 0.9 kilogram (1.98 lb)

NC: 1.5 kilograms (3.31 lb)

PG: unknown

PS: 1.5 kilograms (3.31 lb)

VN: unknown

WP: 1.8 kilograms (3.97 lb)

Total Weight with Fill:

CBR: unknown

CG: 16.69 kilograms (36.8 lb)

JBR: 14.42 kilograms (31.8 lb)

NC: 13.74 kilograms (30.3 lb)

PG: unknown

PS: 13.74 kilograms (30.3 lb)

VN: unknown

WP: 15.29 kilograms (33.7 lb)

Markings:

The CG shell was blue-gray (gas shell) with a red band followed by a white band and by another red band. The WP shell was painted green (incendiary and smoke fill), with yellow-brown paint on the head with a green ring. The numbers, for example 24907, indicated the amount and type of the charge. The shell also had a red band around the nose tip, which meant it was loaded. The letters SMK were stamped onto the base. The JBR shell was blue-gray (gas shell) with three red rings around the shell body and sometimes the letters JBR (which indicated the agent fill). Around the end of the shell head the numbers 25524 were painted. This designation was an explosive charge number and it indicated the size and composition of the explosive charge. The NC shell was blue-gray (gas shell) with a white band followed by a red band. The red band was followed by another white band. These three bands were on the middle of the round. The PS shell was blue-gray, with a white band on the middle with the letters PS in red.

Description:

The 4.5-inch container-type munition was the shell that superseded the double-diaphragm shell. It was constructed of semisteel. It had a filling hole plug on the side of the shell for filling with chemical agent. These shells used the number 44 fuze. The burster was composed of a bursting and smoke mixture.

Explosive Train:

Fuze:

Model no.:	44
Overall length:	unknown
Total weight:	unknown
Explosive type:	TNT
Explosive weight:	52 grams (1.82 ounces)

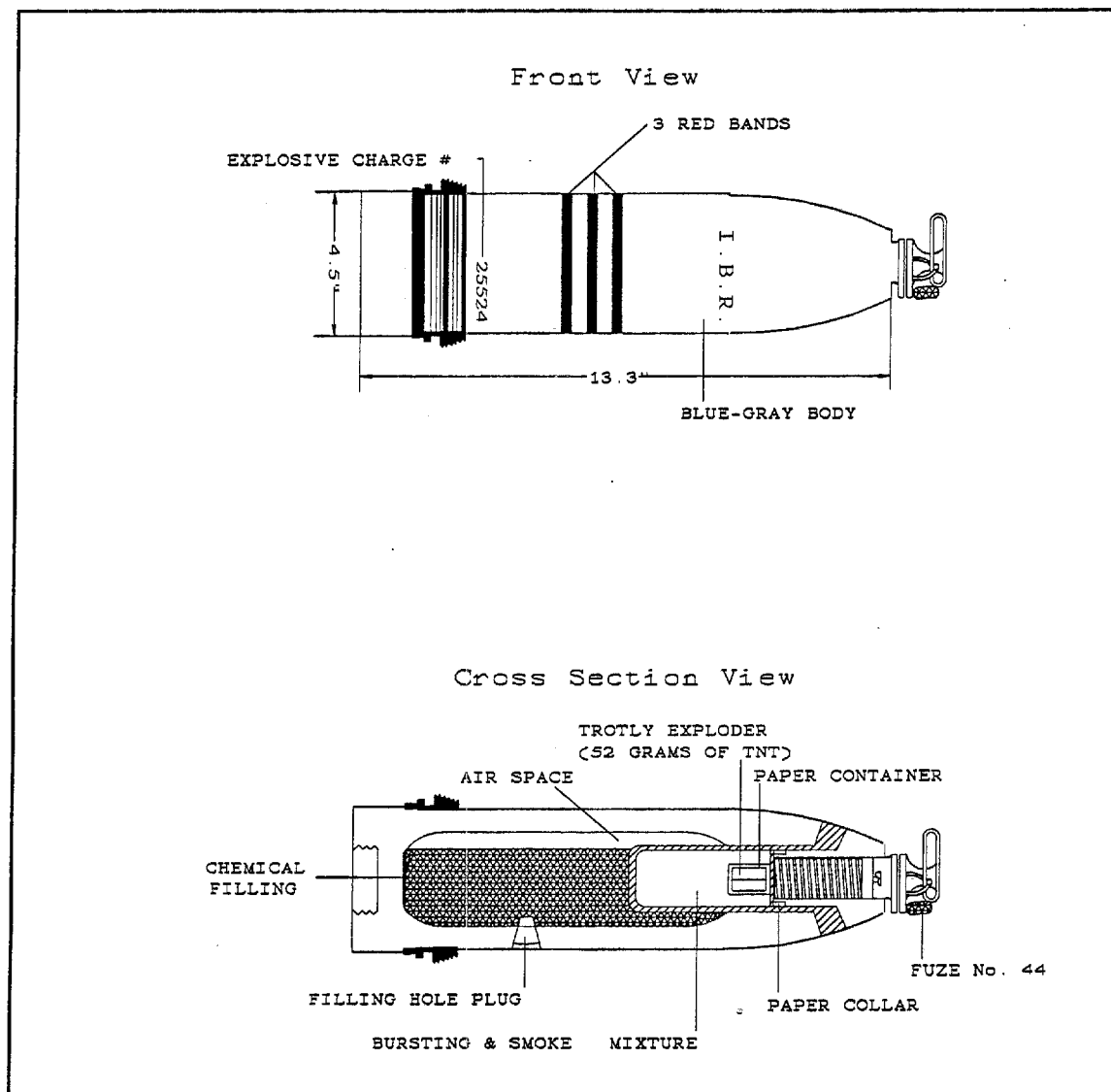
ENGINEERING DATA:

Construction:

Main Body: semisteel (cast iron of low carbon content)

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937) 452-453.
2. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedures German - Intelligence Data Sheets on World War I Chemical Ammunition -British, French, Italian, Russian-1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April 1992) 10-12.



Drawing not to scale

Figure 1.3.4-1. Artillery Chemical Shell, 4.5-inch Howitzer, Cont. Type, MK IV (Ref. 1)

**1.3.5 NOMENCLATURE: Artillery Chemical Shell, 4.5 inches,
Double-diaphragm, MK III**

TABULATED DATA:

Length: 36.40 centimeters (14.33 in.)

Diameter: 11.43 centimeters (4.5 in.)

Type of Fill and Fill Weight:

CBR: 1.6 kilograms (3.53 lb)
CG: 1.6 kilograms (3.53 lb)
NC: 1.85 kilograms (4.08 lb)
PS: 1 kilogram (2.2 lb)
SK: 1.52 kilograms (2.76 lb)
VN: 1 kilogram (2.2 lb)

Total Weight with Fill:

CBR: 14.3 kilograms (31.53 lb)
CG: 14.3 kilograms (31.53 lb)
NC: 14.95 kilograms (32.96 lb)
PS: 14.64 kilograms (32.2 lb)
SK: 14.2 kilograms (31.31 lb)
VN: 14 kilograms (30.87 lb)

Markings:

The overall color of the rounds was blue-gray. The VN-filled shells had the letters CH for chemical (gas shell). These munitions had one white and one red ring (which indicated a VN fill) around the shell body. The VN round also had a number, such as 26046, which was an explosive charge number to indicate the amount and composition of the explosive charge. The CG-filled round had one red ring around the center of the shell body (which indicated a phosgene fill). The SK-filled round had red letters (S.K.) on the center of the round. The NC-filled filled rounds had one white, one red, and another white band around the middle of the shell body. The CBR-filled shells had one red band around the center of the shell body. The munitions filled with VN, CG, SK, NC, and CBR had one red ring around the top of the shell head (which indicated that the munition was loaded), one green ring around the base of the shell head (explosive charge).

Description:

The 4.5-inch double-diaphragm type shell was the earliest pattern of the 4.5-inch rounds. The construction was very complicated and frequently gave rise to leakage

troubles. This shell was made of cast iron, had a filling hole plug in the side of the 4.5-inch container type, and used the number 44 fuze. The burster was composed of a paper tube shellacked to the diaphragm.

Explosive Train:

Fuze:

Model no.: CG 44 with adapter No. 2
Overall length: unknown
Total weight: unknown

Booster Charge:

Model no.: unknown
Explosive type: TNT
Explosive weight: 0.025 kilogram (0.055 pound)

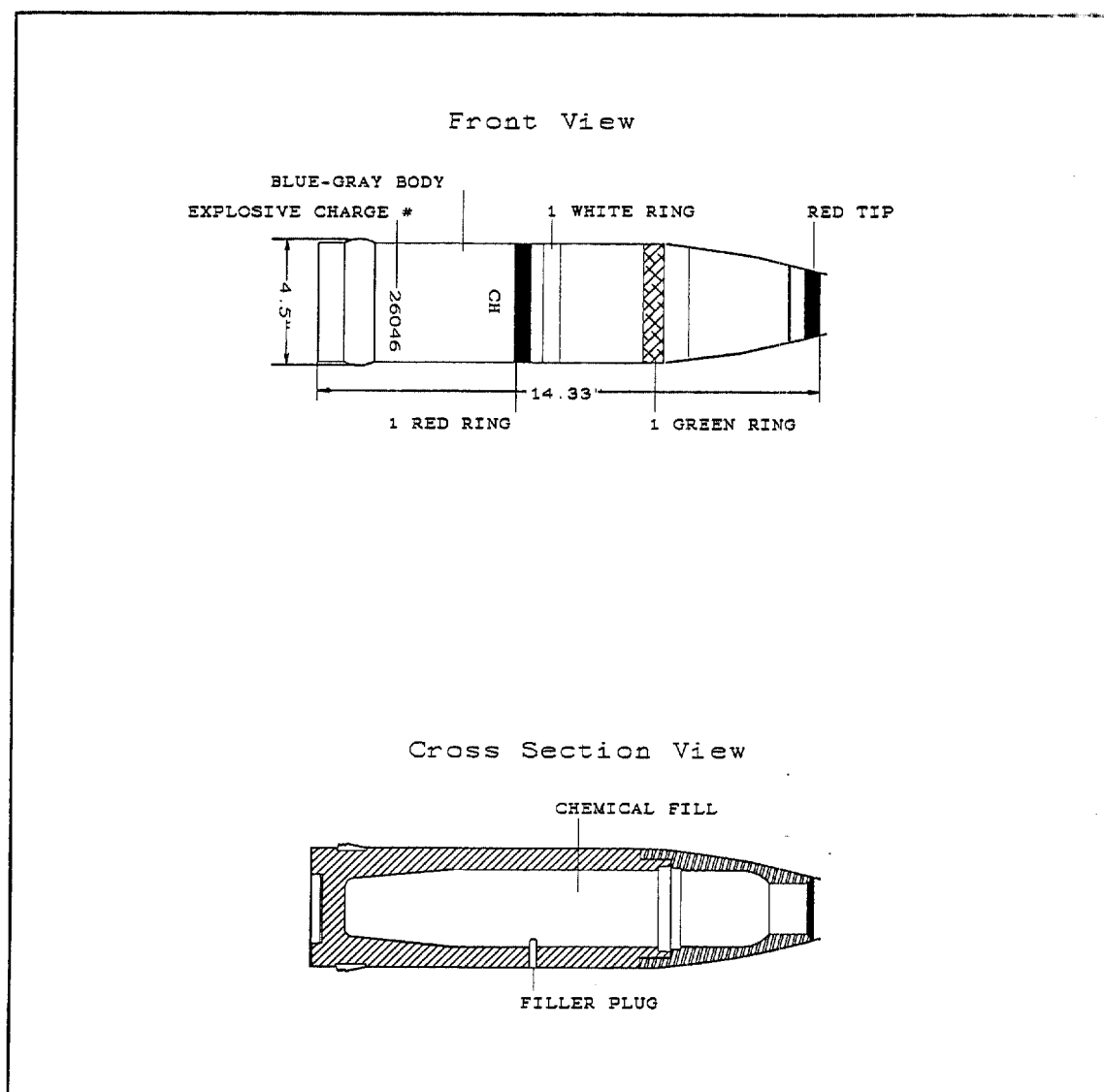
Burster:

Model no.: unknown
Diameter: unknown
Length: unknown
Explosive type: TNT/ammonium chloride (smoke mixture)
Explosive weight: 0.29 kilogram (0.63 pound)

ENGINEERING DATA: unknown

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedures German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian-1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April, 1992) 13, 13a, 13b, 13c, and 14.
2. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937) 452-454.



Drawing not to scale

Figure 1.3.5-1. Artillery Chemical Shell, 4.5 inches, Double-diaphragm, MK III (Ref. 2)

**1.3.6 NOMENCLATURE: Artillery Chemical Shell, 60 Pounds, 5
Inches**

TABULATED DATA:

Length: 45.4 centimeters (17.9 in.)

Diameter: 12.7 centimeters (5 in.)

Type of Fill and Fill Weight:

CBR: 2.4 kilograms (5.29 lb)

KSK: 2.0 kilograms (4.41 lb)

PS: 2.1 kilograms (4.62 lb)

VN: 1.5 kilograms (3.3 lb)

Total Weight with Fill:

CBR: 25.85 kilograms (57 lb)

KSK: 25.40 kilograms (56 lb)

PS: 24.60 kilograms (54.12 lb)

VN: 24.95 kilograms (51.6 lb)

Markings:

These munitions were painted blue-gray overall. The CBR-filled shell had one red band on the center of the shell. The KSK-filled shell had the letters SK in red near the nose fuze.

Description:

No description of this munition could be found in sources reviewed.

Explosive Train: unknown

ENGINEERING DATA:

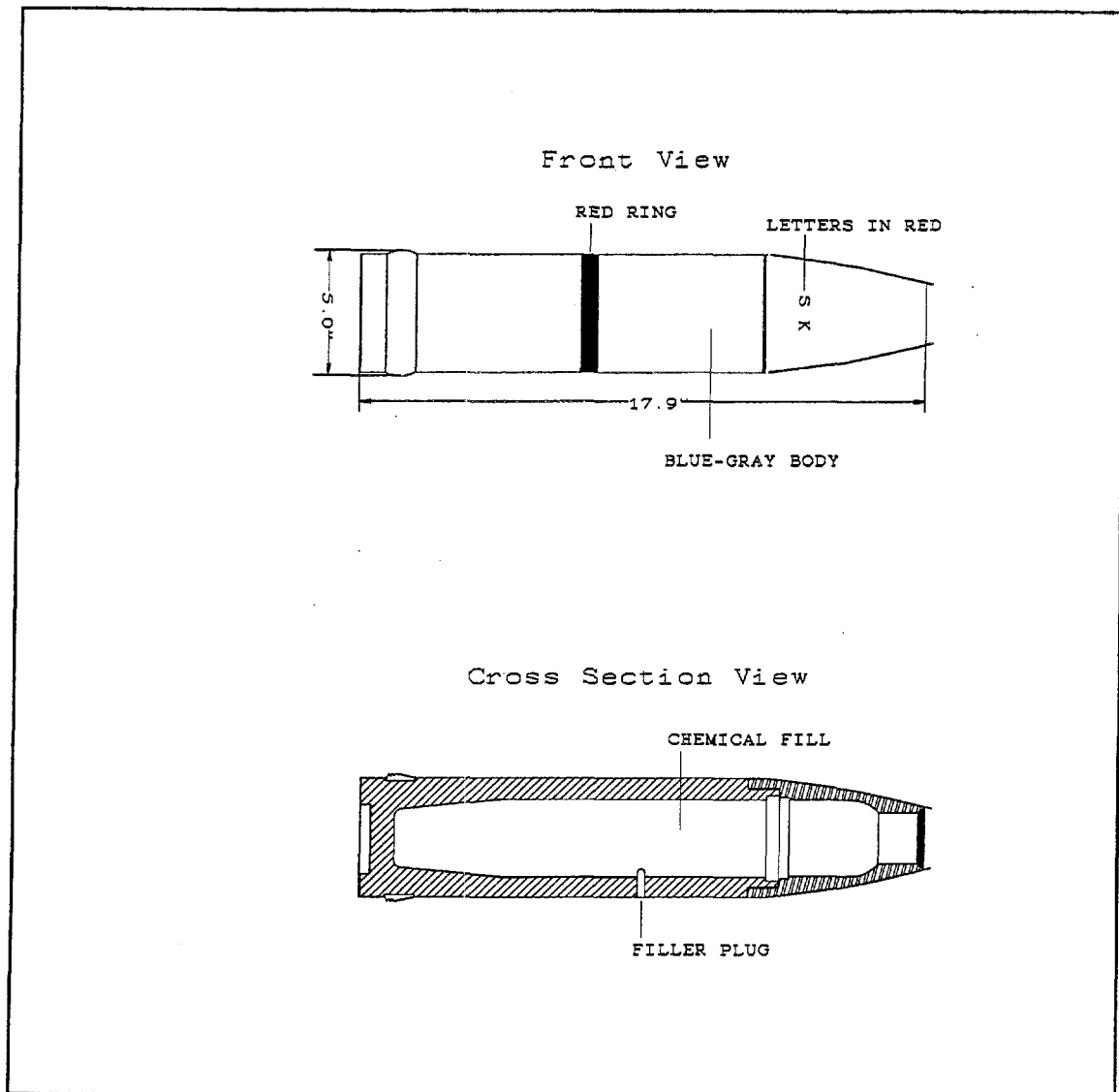
Construction:

Main body: semisteel (cast iron of low carbon content)

Wall thickness: 2.06 centimeters (0.81 inch)

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedures German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian-1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April 1992) 18-19.



Drawing not to scale

Figure 1.3.6-1. Artillery Chemical Shell, 60 Pounds, 5 Inches (Ref. 1)

1.3.7 NOMENCLATURE:

**Artillery Chemical Shell, 60-pounds, 5-inch,
Container Type MK III**

TABULATED DATA:

Length: 40.4 centimeters (15.91 in.) and 42.2 centimeters (16.61 in.)

Diameter: 12.7 centimeters (5 in.)

Type of Fill and Fill Weight:

VN: 1.5 kilograms (3.31 lb)

NC: 1.8 kilograms (3.97 lb)

ethyl iodoacetate 75%,
alcohol 25% (SK): 2.1 kilograms (4.63 lb)

PS: 2.0 kilograms (4.41 lb)

ethyl iodoacetate (KSK): unknown

Total Weight with Fill:

VN: 26.1 kilograms (57.55 lb)

NC: 26.2 kilograms (57.77 lb)

SK: 26.1 kilograms (57.55 lb)

PS: 26.0 kilograms (57.33 lb)

KSK: unknown

Markings:

The shell was painted with the characteristic blue-gray paint for a gas shell, with one white and one red ring around the shell body for VN, a gas agent. The PS shell had a white band around the center of the round. The KSK round had no bands around the shell body but had the letters HVY stenciled below the center. The KSK round also had the numbers 260271 just above the driving band. The SK round had red markings on the center of the round. The VN, NC, and KSK munitions were also marked with one red ring around the tip (loaded), and one green ring around the end of the shell head (brisant explosive charge).

Description:

No description of this munition could be found in sources reviewed.

Explosive Train:

KSK Explosive type: 50 grams TNT (booster), and 150 grams of TNT ammonium chloride 60/40 mixture for a total of 200 grams (7.0 oz)
NC Explosive type: 25 grams TNT (booster), 150 grams TNT plus ammonium chloride for a total of 175 grams (6.13 oz)
VN Explosive type: ammonium chloride for a total of 190 grams (6.65 oz)

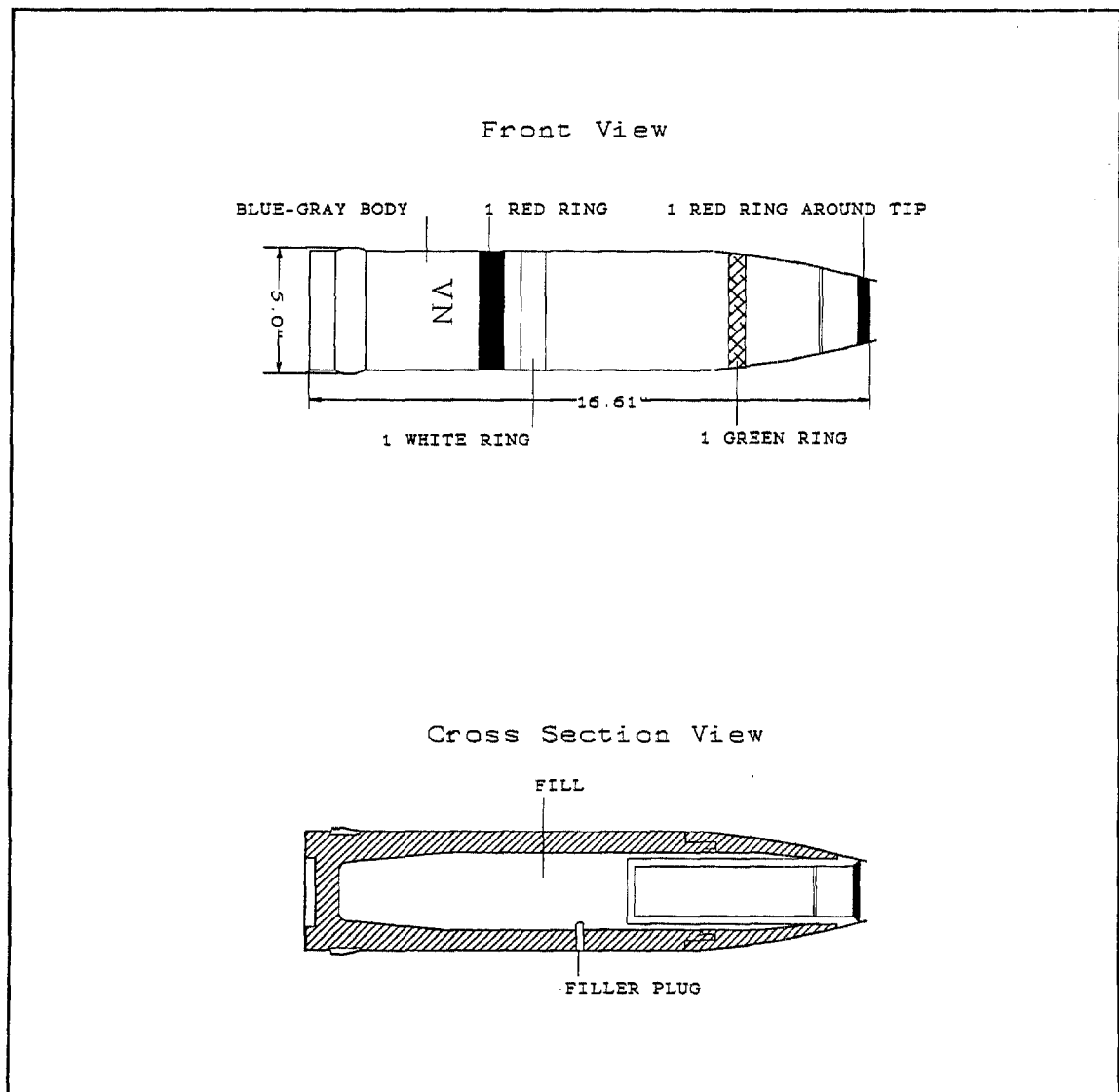
ENGINEERING DATA:

Construction:

Wall thickness: 2.01 centimeters (0.79 inch)

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedures German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian-1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April 1992) 16, 16a, 17, 17a, and 17b.



Drawing not to scale

Figure 1.3.7-1. Artillery Chemical Shell, 60 pounds, 5 inches, Container Type MK III (Ref. 1)

**1.3.8 NOMENCLATURE: Artillery Chemical Shell, 6-inch Howitzer,
Container Type, MK III**

TABULATED DATA:

Length: 53.2 centimeters (20.94 in.)

Diameter: 15.24 centimeters (6.0 in.)

Type of Fill and Fill Weight:

NC: 4.9 kilograms (10.80 lb)

SK: 4.15 kilograms (9.15 lb)

Total Weight with Fill:

NC: 44.3 kilograms (97.68 lb)

SK: 43.55 kilograms (96.03 lb)

Markings:

These shells were painted blue-gray overall. The SK shell had no colored bands around the shell body; the NC round had one white, one red and another white band around the shell body. These shells also had one red ring around the nose tip, which meant that the round was loaded. There were vertical black stripes on opposite sides, which meant the round had a new type of rotating band. It had the numbers 26479 toward the bottom of the round, which indicated the amount and composition of the explosive charge.

Description:

The 15.24-centimeter (6.0-inch) round consisted of a one-piece semisteel case projectile body, with a number 106 or number 44 fuze in the adapter number 2. There was a filling hole plug on the side of the round. This filling hole plug was used to fill the round with the desired type of fill. The explosive charge was composed of 25 grams (0.88 ounce) of trinitrotoluene (TNT) for the booster and 160 grams (6.37 ounces) of trinitrotoluene plus ammonium chloride 60/40 (smoke mixture).

Explosive Train:

Explosive charge: 25 grams (0.88 ounces) of TNT (booster), and
180 grams (6.37 ounces) of TNT
plus ammonium chloride (smoke mixture)
for a total of 205 grams (7.25 ounces)

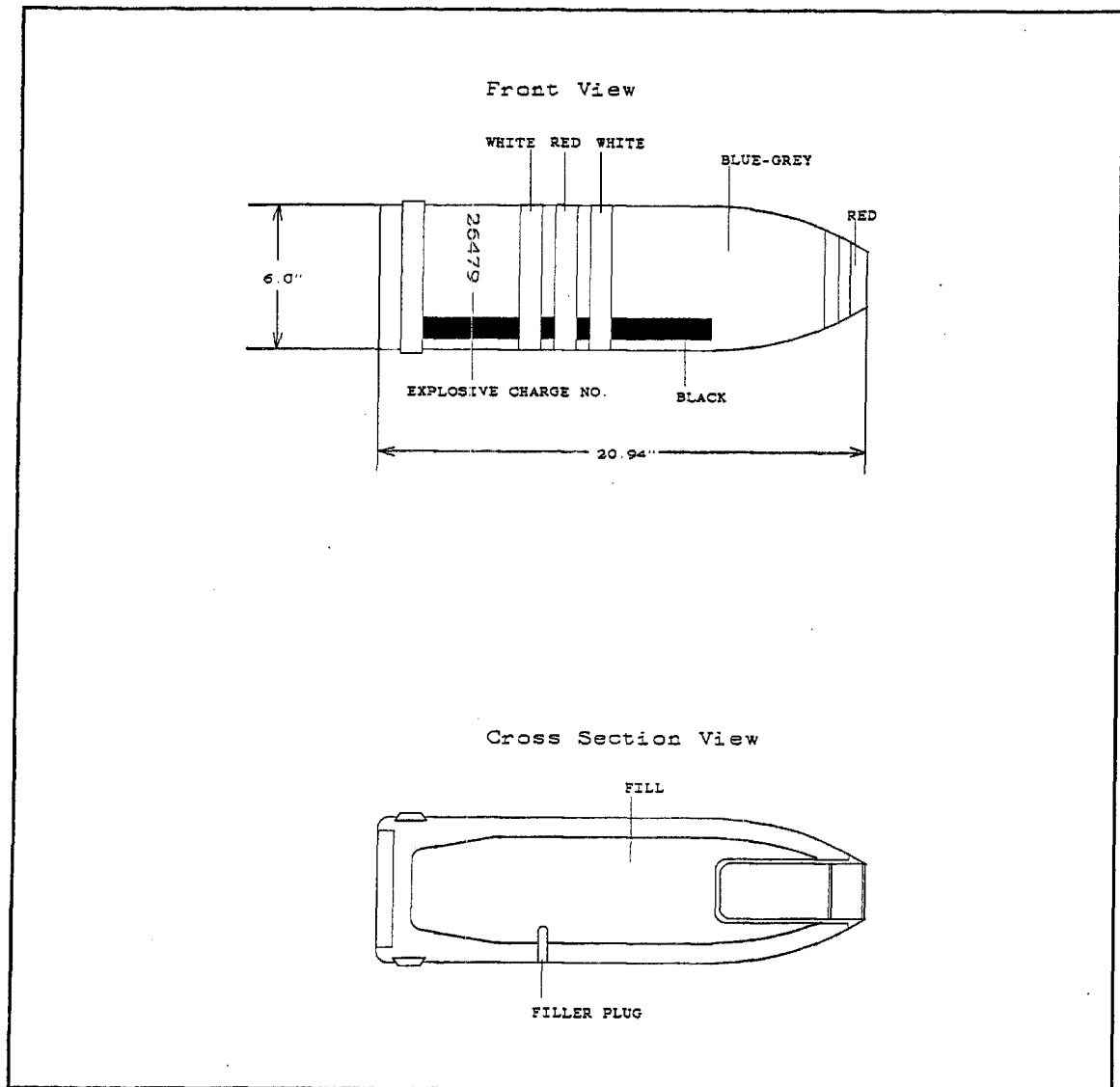
ENGINEERING DATA:

Construction:

Main body: semisteel (cast iron of low carbon content)
Wall thickness: 2.26 centimeters (0.89 inch)

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedures German-Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April 1992) 19d and 19e.



Drawing not to scale

Figure 1.3.8-1. Artillery Chemical Shell, 6-inch Howitzer, Container Type, Mark III (Ref. 1)

1.3.9 NOMENCLATURE: Artillery Chemical Shell, 8-inch Howitzer

TABULATED DATA:

Length: unknown

Diameter: 20.32 centimeters (8 in.)

Type of Fill and Fill Weight:

CG: 11.79 centimeters (26.0 lb)

Total Weight with Fill:

CG: 105.24 kilograms (232 lb)

Markings:

Sketches on this munition could not be drawn because no photographs or illustrations were found in any source documents.

Description:

No description of this shell could be found in sources reviewed.

Explosive Train: unknown

ENGINEERING DATA:

Construction:

Main body: steel

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937).

1.3.10 NOMENCLATURE: 5-inch Chemical Rocket, U (Unrotating)

TABULATED DATA:

Length: 42.5 inches (108 cm) including fuze

Diameter: 5 inches (12.7 cm)

Type of Fill and Fill Weight:

CG: 10.5 pounds (8 kg)

HS: 10.5 pounds (8 kg)

Total Weight with Fill:

CG: 59 pounds (26.8 kg)

HS: 59 pounds (26.8 kg)

Markings:

The rocket was gray with one green band and the code letters G1, which were 1 inch high. The code was painted in black on green bands. In addition to the green band on the rocket, color rings were added, indicating the following:

red ring:	filled
brown ring:	shell made of cast iron
red nose:	shrapnel shell adapted to gas

Description:

The 5-inch chemical rocket, MK 1, is a modification of the 30-pound light case conventional aircraft bomb. It consists of a steel tubular body fitted with a steel plate and a steel nose plug. The bomb body (rocket warhead) bursts on functioning, instead of the tail plate and contents being ejected, as is the case with the MK 1 bomb. Most of the bomb bodies (warheads) have been made from steel plate rolled to shape and lap- or butt- welded longitudinally, and not from solid drawn-steel tube. The nose plug carries the burster container in which the No. 721 fuze is screwed.

When prepared for use, the rocket is fitted with a hemispherical fairing at the forward end, which is retained in position by the fuze. A spigot fitted to the base of the rocket is screw-threaded to engage with the internal thread of the pressure plate plug in the tail and is the means of attachment of the tail and rocket. The rocket is painted light gray, with detector paint at all joints where leakage may occur, when charged with H.

The tail (5-inch MK III) consists of a mild steel tube, containing a propelling charge of Cordite S.C. in the shape of tubes. Ignition is provided by an electric fuze and igniter.

Four fins, to ensure stable flight, and a venturi for propulsion gases, are fitted at the rear end.

The rocket is fired electrically from a stand. The normal stand consists of troughs for six rockets fired together on a light steel frame.

Explosive Train:

Fuze:

Model No.:	No. 721
Total Weight:	unknown
Overall Length:	unknown

Rocket Motor:

Electric fired flash powder igniter
Propellant: Cordite

Burster:

Large burster in nose of warhead. Explosive composition unknown.

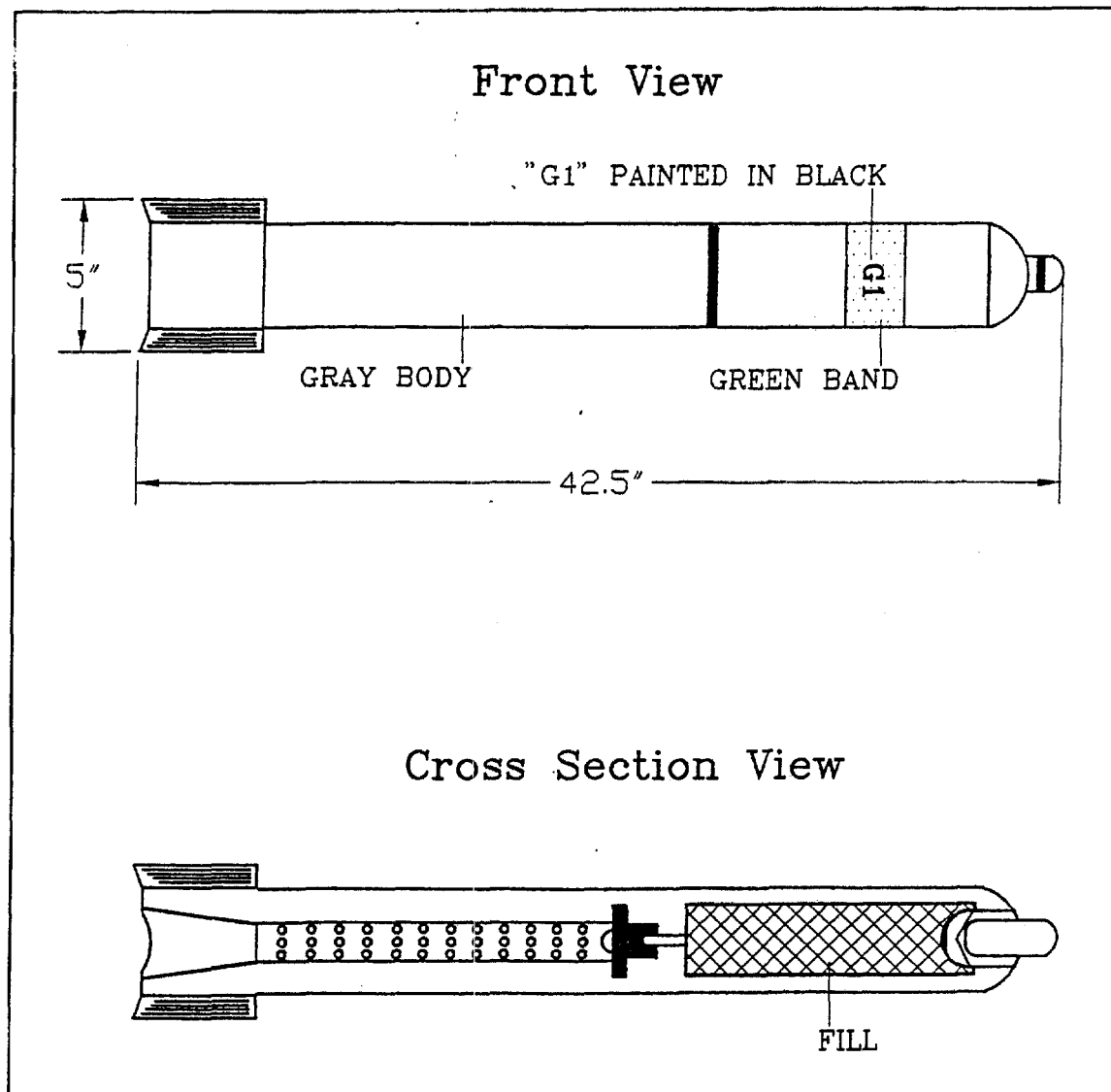
ENGINEERING DATA:

Construction:

Main body: steel tubing or rolled steel

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937).
2. Anonymous, Gas Manual, Part III, Use of Gas by Gas Troops, American Expeditionary Forces No. 1475-3 (N.p.: n.p., March 1919) 17-42.
3. Great Britain, Ministry of Defence, CBDE, MEO's Blue Book, Gas Weapons (Salisbury, Wiltshire: Ministry of Defence, February 1946).



Drawing not to scale

Figure 1.3.10-1. 5-inch Chemical Rocket, U (Unrotating) (Ref. 2)

1.3.11 NOMENCLATURE: Mortar, 4.2 inches, MK Is

TABULATED DATA:

Length: 51.82 centimeters (20.40 in.)

Diameter: 10.64 centimeters (4.19 in.)

Type of Fill and Fill Weight:

CG: 3.63 kilograms (8 lb) approximate

CNS: 3.63 kilograms (8 lb) approximate

WP: 3.63 kilograms (8 lb) approximate

HS or HT: 2.72 kilograms (6 lb)

Note: HS (mustard gas) was prepared by the sulfur dichloride process and contained 15% carbon tetrachloride as a diluent. HT (mustard gas) was prepared by the thiodiglycol process and contained 60% mustard and 40% di-chloroethylthiodiethyl ether.

Total Weight with Fill:

CG: 11.57 kilograms (25.5 lb)

CNS: 11.57 kilograms (25.5 lb)

WP: 11.57 kilograms (25.5 lb)

HS or HT: 10.66 kilograms (23.5 lb)

Markings:

The 4.2-inch streamlined bomb shell was painted gray overall. The HS or HT shell had one yellow color band and code letters Y1 or Y3, which were 2.54 centimeters (1 inch) high. The CG shell had one green colored band and the code letters G1, which were also 2.54 centimeters (1 inch) high. The code letters were painted on a yellow band, and in white on black bands. In addition to the yellow band on the munition, color rings were added, indicating filled rounds (red ring), shell made of cast iron (brown band), or shrapnel shell adapted to gas (red nose). Markings were not available for the WP shell or the CNS shell.

Description:

The complete round consisted of a one-piece steel case projectile⁷⁷ body, a DA nose fuze with an integral burster, and a tail assembly. The agent was sealed into the round with a steel burster well.

Explosive Train:

Fuze:

Model no.:	DA nose fuze 152, 12A or 162
Total weight:	0.64 kilogram (1.4 lb)
Overall length:	41 centimeters (16.138 in.) (fuze and burster together)

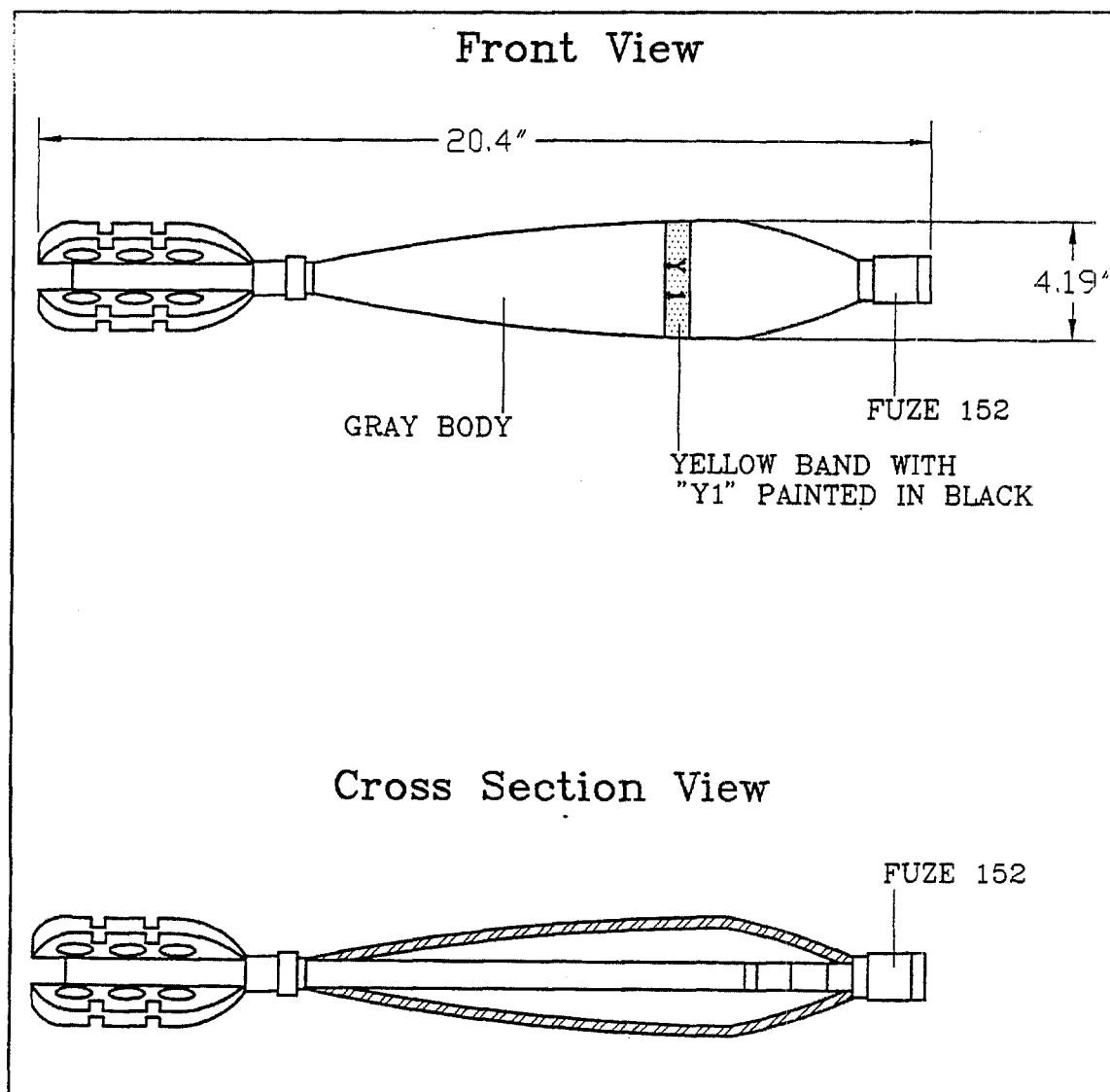
ENGINEERING DATA:

Construction:

Cartridge:	steel
Fuze assembly:	aluminum or steel
Wall thickness:	unknown

REFERENCES:

1. Office, Chief of Staff, Military Intelligence Division, Chemical Warfare Pocket Book (Washington, DC: n.p., 1940) 46-47, 50, 104-105, and 134-135.
2. J. Davidson Pratt, Military Intelligence Division, Key to Code Markings on Chemical Weapons, C. D. Report No. 1094, Great Britain (Washington, DC: n.p., 6 June 1942) 1.
3. Office, Chief Chemical Warfare Service, Report, Combined Chemical Warfare Committee (Washington, DC: n.p., 14 January 1943) 1-2.
4. War Department, Volume I, Gas Warfare, Special Weapons and Type of Warfare (Washington, DC: n.p., 1951) 163 and 286.



Drawing not to scale

Figure 1.3.11-1. Mortar, 4.2 inches (Ref. 4)

1.3.12 NOMENCLATURE: Aerial Spray Tank, SCI; 250, 500 and 1000 pound

TABULATED DATA:

Length: 250 lb: 49.5 in. (125.7 cm)
 500 lb: 68.5 in. (174.0 cm)
 1000 lb: 159.5-160.5 in. (405.1-407.7 cm) depending upon model

Diameter: 250 lb: 11.2 in. (28.5 cm) unlagged, 12.2 in. (30.1 cm) lagged
 500 lb: 13.2 in. (33.5 cm) unlagged, 14.2 in. (36.1 cm) lagged
 1000 lb: 12.5 in. (31.8 cm) unlagged, 13.5 in. (34.3 cm) lagged

Note: The term "lag" in the source documents refers to an insulating material, content unknown.

Type of Fill and Fill Weight:

250-lb model:

H: 176-185 lb (80-84.1 kg)
HT: 170-180 lb (77.3-81.2 kg)
HMF: 173-182 lb (78.6-82.3 kg)

500-lb model:

H: 334-348 lb (151.8-158.2 kg)
HT: 324-338 lb (147.3-153.6 kg)
HMF: 329-343 lb (149.5-155.9 kg)

1000-lb model:

H: 716-742 lb (325.5-337.3 kg)
HT: 694-720 lb (315.5-327.3 kg)
HMF: 705-731 lb (320.5-332.3 kg)

Total Weight with Fill:

250-lb model (with fairings):

246-283 lb (111.8-128.6 kg) depending upon model

500-lb model (excluding fairings, fitted with emission pipe):

443-480 lb (201.4-218.2 kg) depending upon model

1000-lb model:

953-1024 lb (433.2-465.5 kg) depending upon model

Markings:

Markings are only available for the 250-pound MK IV spray tank used for external storage. This tank was painted gray with a yellow band and the code letters Y4, which were 1 inch high and printed on the exterior of the tank. The code Y4 indicates HT filler; it is assumed that Y2 would be stenciled on tanks filled with H, and Y6 on HMV-filled tanks. The code letters were painted black on yellow or green bands. In addition to the yellow band on the spray tank, a red ring was added, which signified that the spray tank was filled.

Description:

Smoke Curtain Installations (SCIs) may be pressure or gravity flow types. If the tank is gravity flow, it is called Type G. If it is of pressure type, it is called Type H (for high pressure) or Type L (for low pressure). When the spray tank is used for chemical purposes, it is called a Type S/G, the S denoting Secret, and the G denoting gravity feed.

The tank generally consists of a tank or body, of cylindrical shape, with either domed or flat ends. On the upper surface of the body is a filling hole plug, an air inlet assembly near the forward end, an externally mounted box containing electrical connections, etc., and a suspension lug. On the underside of the body is the outlet assembly, to which is connected the emission pipe and nozzle.

The body may be streamlined by the addition of nose and tail fairings. A tail fairing is normally fitted on all SCIs when carried externally on an aircraft. Later marks (versions) of SCI, which may be carried externally, have a domed nose and a nose fairing is not essential, although it does improve the aerodynamics of the installation.

The body may be lagged with insulating material to prevent extreme cooling of the charging. This is normally done on externally stowed installations, and on internally stowed ones when use from a great height or in cold weather is envisaged.

The emission pipe is normally 3.5 inches in diameter with a 2.5-inch emission orifice. In the case of normal externally stowed installations (250- and 500-pound versions) the emission pipe is a short pipe turned at a right angle so that the emission orifice points to the rear. In the case of internally stowed SCI, the pipe is longer and is faired. This pipe extends through the belly of the aircraft.

In the air inlet and in the emission assemblies is fitted the operating mechanism. This consists essentially of a Bakelite sealing disk in each assembly, to which is attached an electric detonator. These detonators are connected to the aircraft electric current,

which is used to arm aircraft bombs. The detonators break up the Bakelite disks, and the fill is emptied by gravity flow alone. Earlier marks (versions) used an electric-fired cartridge to break the disk.

The air inlet assembly in early versions was baffled to prevent splash and vapor from coming out after firing, but in later models a spring-loaded valve proved more effective.

Mark numbers were also assigned to each weight category to indicate whether the tank was configured for external or internal use on the aircraft. Mark numbers for each weight class could be MK I, II, III, or IV. The MK number was changed when modifications were made.

Explosive Train:

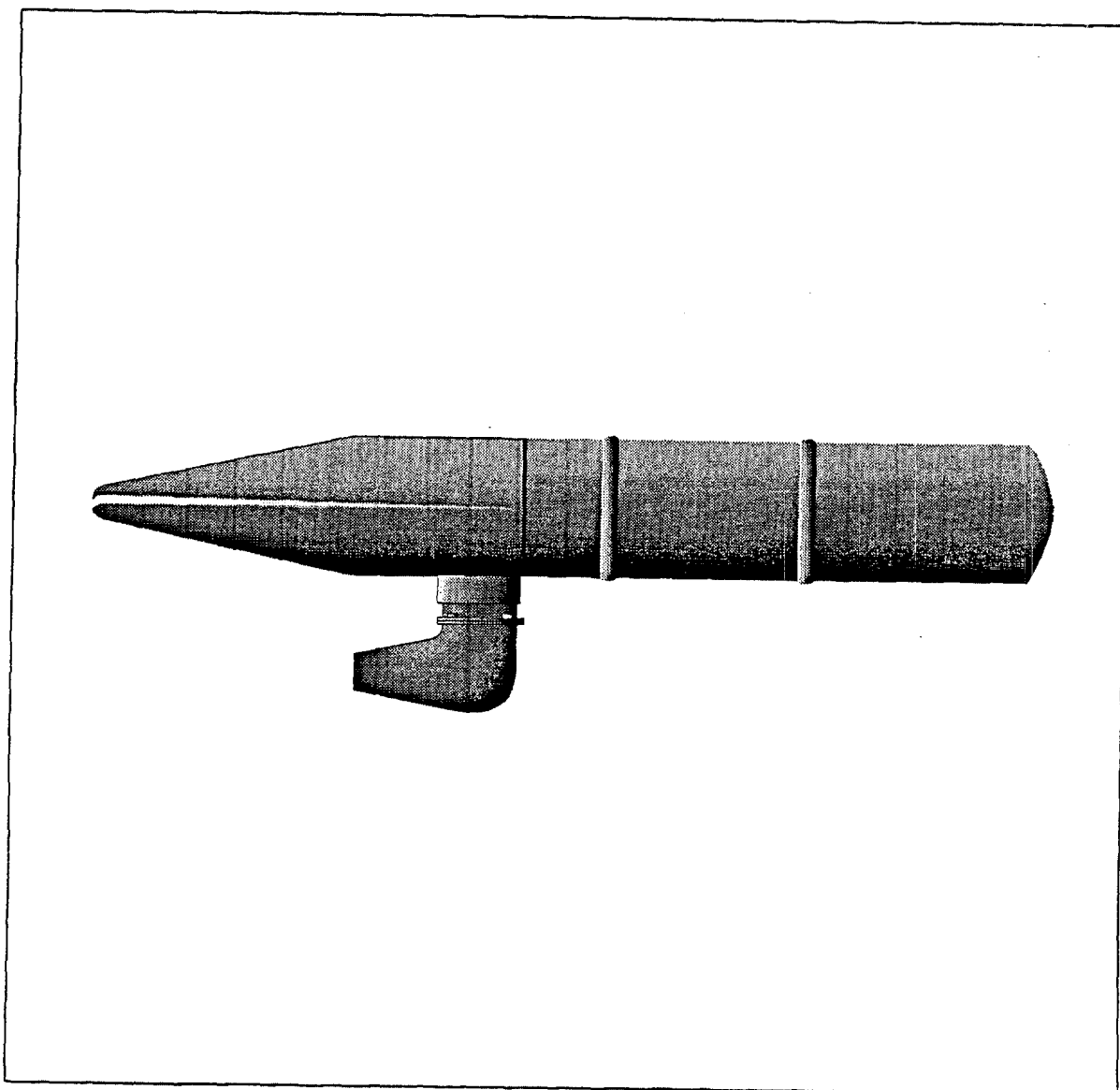
Electric detonator (blasting cap)

ENGINEERING DATA: Unknown

REFERENCES:

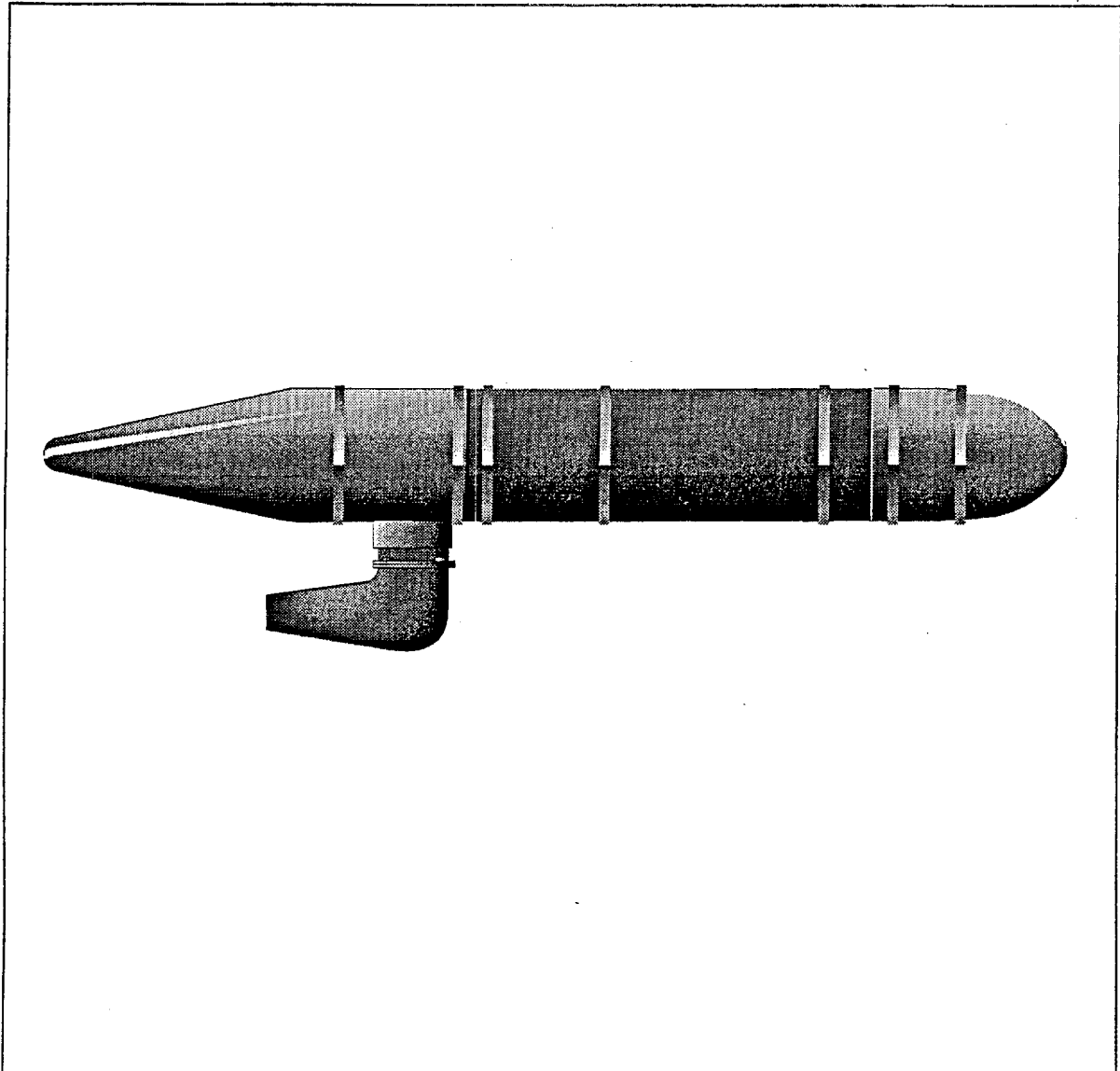
1. Military Intelligence Division, Key to Code Markings on Chemical Weapons, C.D. Report No. 1094, Great Britain (Washington, DC: n.p., 6 June 1942).
2. War Department, Volume I, Gas Warfare, Special Weapons and Type of Warfare (Washington, DC: n.p., 1951).
3. Bombing Committee, Paper No. 46, The Use of Gas from the Air, revised (London: n.p., May 1944).
4. Great Britain, Ministry of Defence, CBDE, MEO's Blue Book, "Gas Weapons" (Salisbury, Wiltshire: n.p., February 1946).

Aerial Spray Tank Mk 4.



Drawing not to scale

Figure 1.3.12-1. Aerial Spray Tank, SCI (Smoke Curtain-Installation) MK IV (Ref. 4)



Drawing not to scale

Figure 1.3.12-2. Aerial Spray Tank, SCI (Smoke Curtain-Installation) MK V (Ref. 4)

1.3.13 NOMENCLATURE: Bomb, Ground, 6-pound

TABULATED DATA:

Length: unknown

Diameter: unknown

Type of Fill and Fill Weight:

HT: 1.47 kilograms (3.25 lb)

Notes: For American readers, the term "bomb, ground" refers to pyrotechnic delay dispersion device similar to a mine.

Mustard gas from the thiodiglycol process contained 60% mustard and 40% di-chloroethylthiodiethyl ether.

Total Weight with Fill:

HT: 2.95 kilograms (6.5 lb)

Markings:

The bomb was gray with one yellow color band and code letters Y3, which were 2.54 centimeters (1 inch) high and printed in black on yellow bands. In addition to the yellow band on the munition, color rings were added indicating the following:

red ring:	filled
brown ring:	shell made of cast iron
red nose:	shrapnel shell adapted to gas

Description:

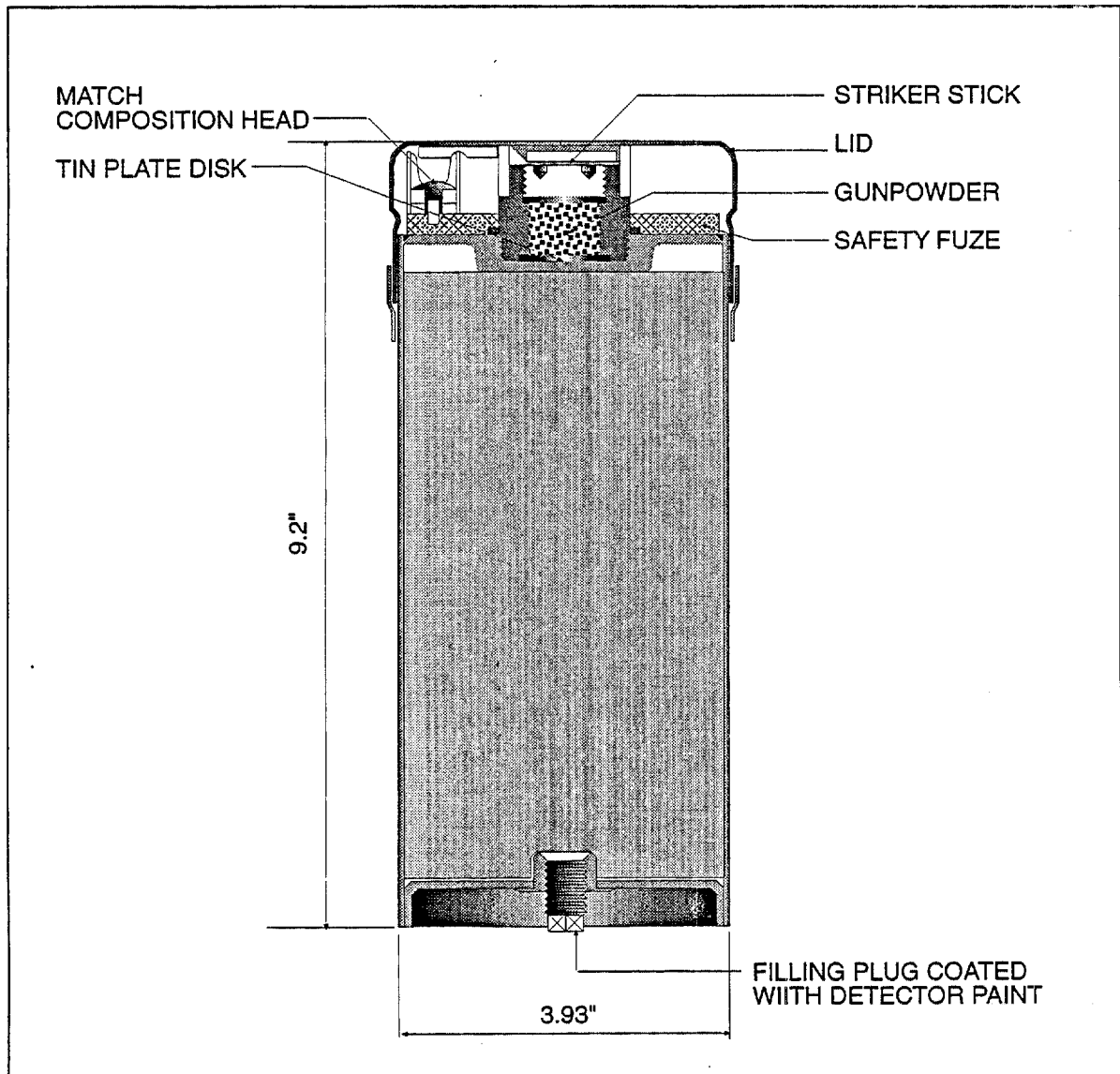
No description of this munition could be found in sources reviewed.

Explosive Train: unknown

ENGINEERING DATA: unknown

REFERENCES:

1. Office, Chief of Staff, Military Intelligence Division, Chemical Warfare Pocket Book (Washington, DC: n.p., 1940) 46-47, 50, 104-105, and 134-135.
2. J. Davidson Pratt, Military Intelligence Division, Key to Code Markings on Chemical Weapons, C. D. Report No. 1094, Great Britain (Washington, DC: n.p., 6 June 1942) 1.
3. Office, Chief Chemical Warfare Service, Report, Combined Chemical Warfare Committee (Washington, DC: n.p., 14 January 1943) 1-2.
4. War Department, Volume I, Gas Warfare, Special Weapons and Types of Warfare (Washington, DC: n.p., 1951) 163 and 286.
5. Office, Chief of Chemical Warfare, Chemical Warfare Intelligence Summary (Washington, DC: n.p., 30 April 30 1941).



Drawing not to scale

Figure 1.3.13-1. Bomb, Ground, 6-pound (Ref. 4)

1.3.14 NOMENCLATURE: Bomb, Aircraft, L.C. 65 Pound

TABULATED DATA:

Length: 18.5 inches (47.0 cm)

Diameter: 9.25 inches square (24.1 cm)

Type of Fill and Fill Weight:

H: 59 pounds (26.8 kg)

Total Weight with Fill:

H: 65 pints (29.5 kg)

Markings:

Markings were not described in the source document. The markings shown on the attached drawing are as shown in the source document. Colors are unknown.

Description:

The 65-pound bomb is a rectangular light sheet metal can with corrugated strengtheners fitted externally to the side of the can. Wire handles are also attached to the upper part of the sides. The MK 2 bomb has a centrally placed charging hole and two domed spacers soldered at diagonal corners of the top of the bomb. There is no fuze in the bomb; the bomb simply breaks up on impact.

This bomb originated as a 5-gallon cylindrical oil drum fitted wire suspension lug and a lead nose weight. This bomb was designated a MK 1 bomb, and there was a large cylindrical "spacer" fitted to the top of the bomb. Diagonally opposite this is a charging hole covered by a screw cap. Between these fittings, and stretching diagonally across the top of the bomb, is a cloth drogue (assumed to be a strip of cloth used to slow the descent). The bomb was unsatisfactory. No drawing was available for the MK 1 version of this bomb.

Explosive Train:

None

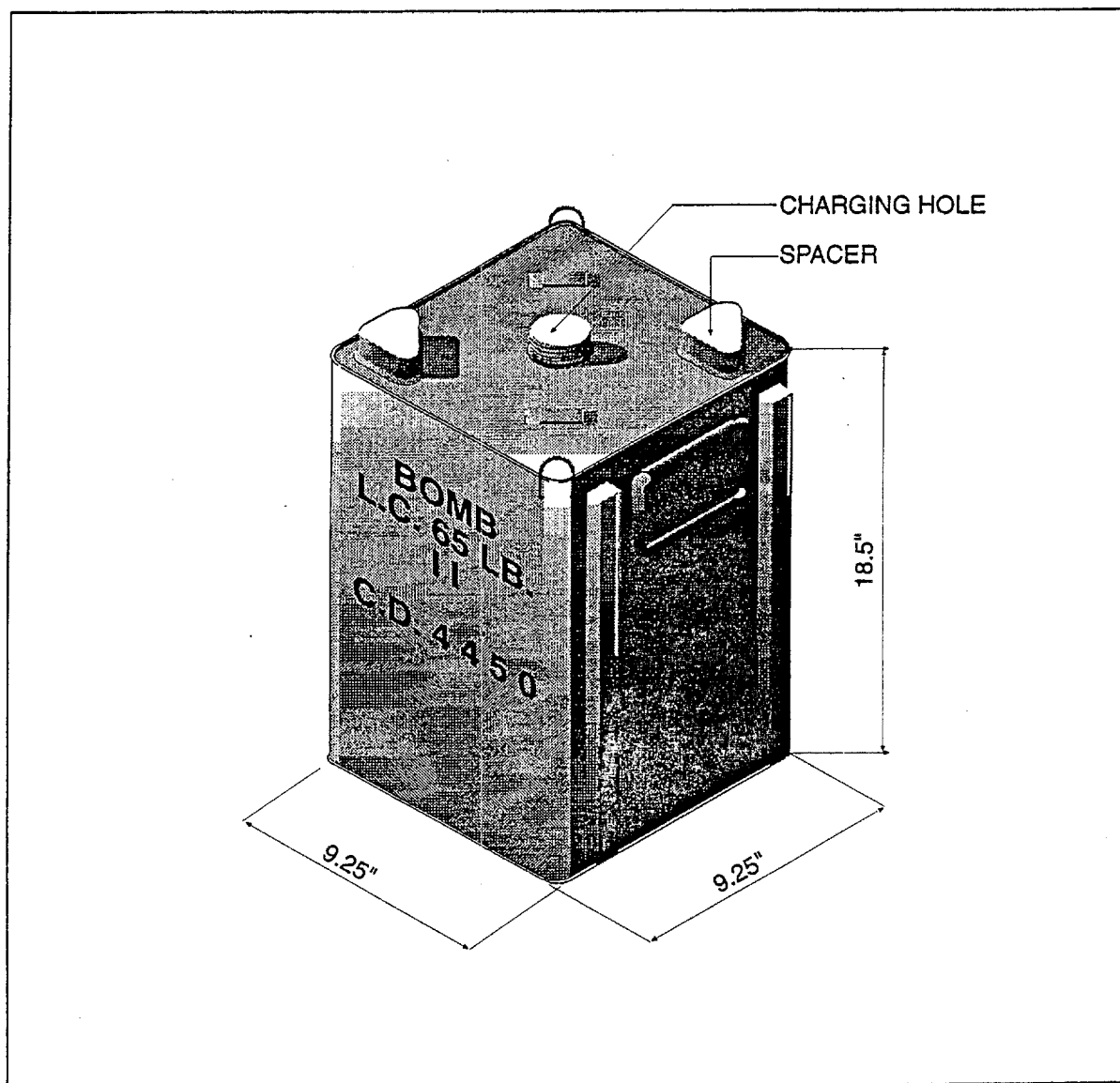
ENGINEERING DATA:

Construction:

Main body: light sheet metal with corrugated strengtheners

REFERENCES:

1. 'Great Britain, Ministry of Defence, CBDE, MEO's Blue Book, "Gas Weapons" (Salisbury, Wiltshire: Ministry of Defence, February 1946).



Drawing not to scale

Figure 1.3.14-1. Bomb, Aircraft, L.C. 65 pound

**1.3.15 NOMENCLATURE: 250-pound L.C. (Light Case) Bomb, MK I
and MK II**

TABULATED DATA:

Length: 163.83 centimeters (64.5 in.)

Diameter: 30.48 centimeters (12 in.)

Type of Fill and Fill Weight:

CG: 58.97 kilograms (130 lb)

H: 56.70 kilograms (125 lb)

BBC: unknown

Total Weight with Fill:

CG: 114.76 kilograms (253 lb)

H: 112.49 kilograms (248 lb)

BBC: unknown

Markings:

The 250-pound air bomb was gray in color and had a yellow band on the body, with the code letters Y1, Y3 or Y5, which were 2.54 centimeters (1 inch) high. [Note: The two most widely used fills were mustard gas (HS, HT, and HM) and phosgene (CG); however, bromo-benzyl-cyanide (BBC-V, a lacrimator) could be used.] The code letters were painted in black on yellow or green bands, and in white on black bands. In addition to these bands, a red ring was added, which indicated that the bomb was filled.

Description:

The 250-pound LC air bombs were fuzed bombs of conventional appearance. (Note: There were two types of 250-pound air bombs, MK I and MK II. The difference lay in the structural modifications, which did not alter the contamination performance of the bomb or affect its method of release.) They functioned on impact by the tail ejector principle, in which a small internal burster blew off a lightly welded tail plate. Limited numbers of 250-pound phosgene-filled bombs were stored. The 250-pound mustard-filled bombs had a high terminal velocity, which was an advantage when roof penetration was required for contaminating the inside of buildings.

Explosive Train:

Fuze

Model no.: British No. 36 and 44 (nose fuze)
Overall length: unknown
Total weight: unknown

Ejection charge:

Model no.: No. 52 detonator (H)

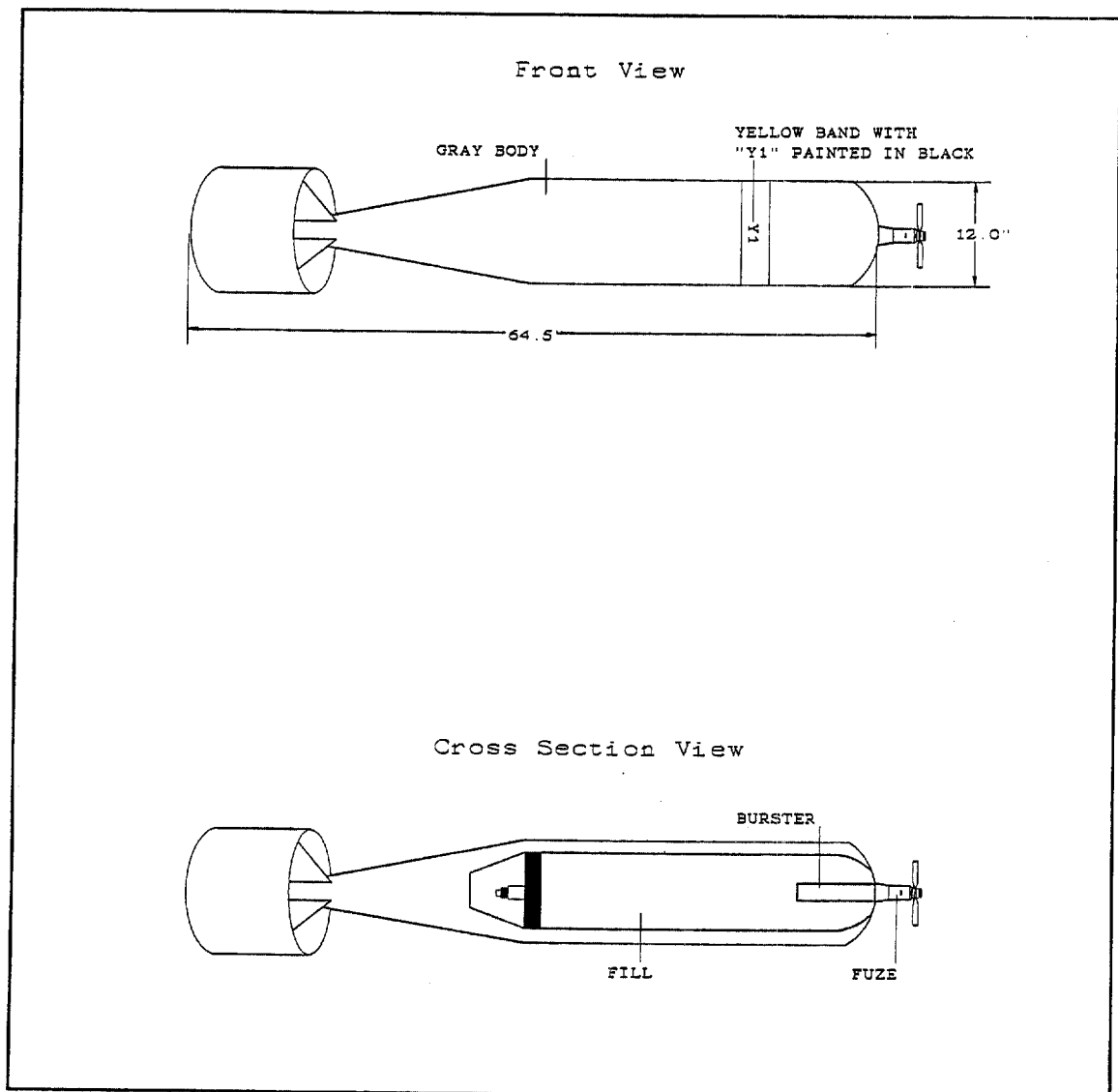
Note: A No. 44 pistol, No. 52 detonator and burster H.E. ejection No.1 were used when this munition was equipped with American fuzeing or carried in American aircraft as a phosgene-charged munition.

Explosive type: G40 powder
Explosive weight: 141.75 grams (5 ounces)

ENGINEERING DATA: unknown

REFERENCES:

1. Office, Chief of Staff, Military Intelligence Division, Chemical Warfare Pocket Book (Washington, DC: n.p., 1940) 46-47, 50, 104-105, and 134-137.
2. Military Intelligence Division, Key to Code Markings on Chemical Weapons, C. D. Report No. 1094, Great Britain (Washington, DC: n.p., 6 June 1942) 1-2.
3. War Department, volume I, Gas Warfare, Special Weapons and Type of Warfare (Washington, DC: n.p., 1951) 175-176 and 286.
4. Bombing Committee, Paper No. 46, The Use of Gas From the Air, revised (London: May 1944) 5 and 8.



Drawing not to scale

Figure 1.3.15-1. 250-pound L.C. (Light Case) Bomb, MK I and MK II (Ref. 3)

1.3.16 NOMENCLATURE: 500-pound L.C. (Light Case) Bomb, MK I and MK II

TABULATED DATA:

Length: 176.53 centimeters (69.5 in.)

Diameter: 33.02 centimeters (13 in.)

Type of Fill and Fill Weight:

Note: The two marks of this bomb varied in the method of fixing the burster container in the body. Both MK I and MK II bombs could be filled with phosgene, but for technical reasons, only the MK I was filled with mustard gas.

CG: 91.63 kilograms (202 lb)

H: 84.37 kilograms (186 lb)

Total Weight with Fill:

CG: 148.33 kilograms (327 lb)

H: 141.07 kilograms (311 lb) (estimated)

Markings:

The overall color of the bomb was gray. Other markings are unknown.

Description:

The 500-pound bomb was of conventional appearance but it was not of the tail ejection type. It had two bursters (one in the nose and one in the tail), which fragmented the case. When filled with mustard gas it was intended to air burst by means of a barometric or M111 clockwork fuze, thereby discharging its contents in the form of a spray.

Explosive Train:

Fuze:

Model no.:	British No. 44 pistol (nose); No. 52 MK II detonator; M111 clockwork or barometric (functions by a change in barometric pressure)
Overall length:	British No. 30 pistol (tail); delay detonator No. 55, MK1 unknown
Total weight:	unknown

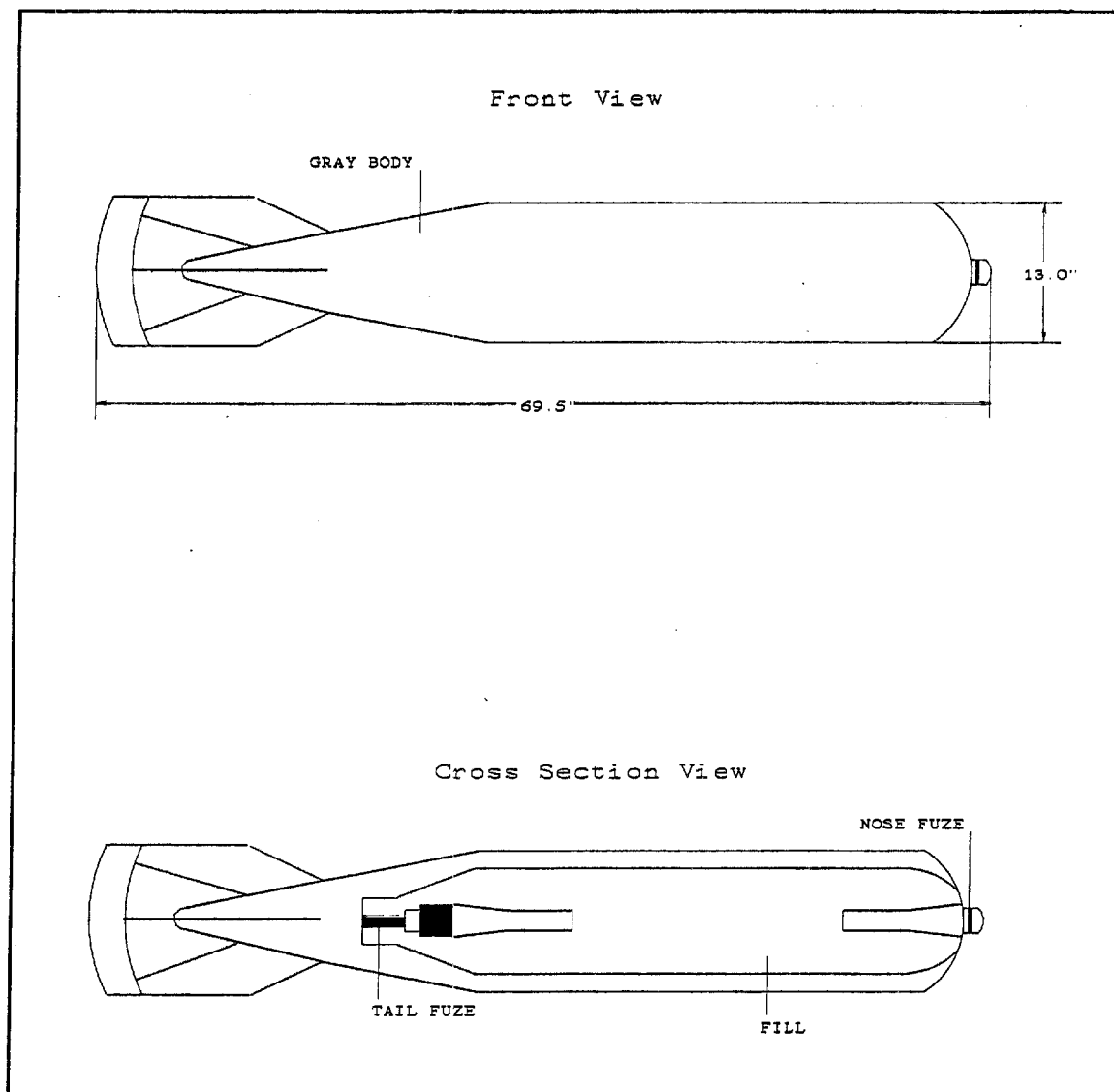
Burster:

Model no.: No. 1; H.E. (nose and tail)
Explosive type: G40 powder
Explosive weight: 141.75 grams (5 ounces)

ENGINEERING DATA: unknown

REFERENCES:

1. War Department, volume I, Gas Warfare, Special Weapons and Type of Warfare (Washington, DC: n.p., 1951) 175-178, 286.
2. Bombing Committee, Paper No. 46, The Use of Gas From the Air, revised (London: n.p., May 1944).



Drawing not to scale

Figure 1.3.16-1. 500-pound L.C. (Light Case) Bomb, MK I and MK II (Ref. 1)

1.3.17 NOMENCLATURE: Mine, Chemical, No.1, MK II

TABULATED DATA:

Height: 50 centimeters (20 in.)

Diameter: 28.58 centimeters (11.25 in.)

Type of Fill and Fill Weight:

HT: 11.34 - 22.68 kilograms (25-50 lb)

Note: There was a second type of chemical mine, which weighed 13.61 kilograms (30 lb) and contained 11.34 kilograms (25 lb) of mustard gas. The mines were designed for electric or pyrotechnic fuze detonation.

Total Weight with Fill:

HT: unknown

Markings:

The mine was painted gray and consisted of a commercial pattern cylindrical can with a yellow color band and the code letters Y3, which were 2.54 centimeters (1 inch) high. The code was painted in black on a yellow band. In addition to the yellow band on the mine, color rings were added. A red ring indicated that the munition was filled.

Description:

The chemical mine was a commercial pattern cylindrical can that was essentially constructed of sheet metal (two sizes). [Note: There was a second type of chemical mine, which weighed 13.61 kilograms (30 pounds) and contained 11.34 kilograms (25 pounds) of mustard gas. The mines were designed for electric or pyrotechnic fuze detonation.] The cylindrical drum was 28.58 centimeters (11.25 inches) in diameter by 49.53 centimeters (19.5 inches) high with connected top and neck, containing 22.68 kilograms (50 pounds) of mustard with match head ignition (6- or 7-minute delay) or a fixed electrical, powder burster.

Explosive Train:

Fuze:

Model no.:	Bickford fuze
Overall length:	unknown
Total weight:	unknown

Burster:

Model no.: unknown
Explosive type: powder
Explosive weight: unknown

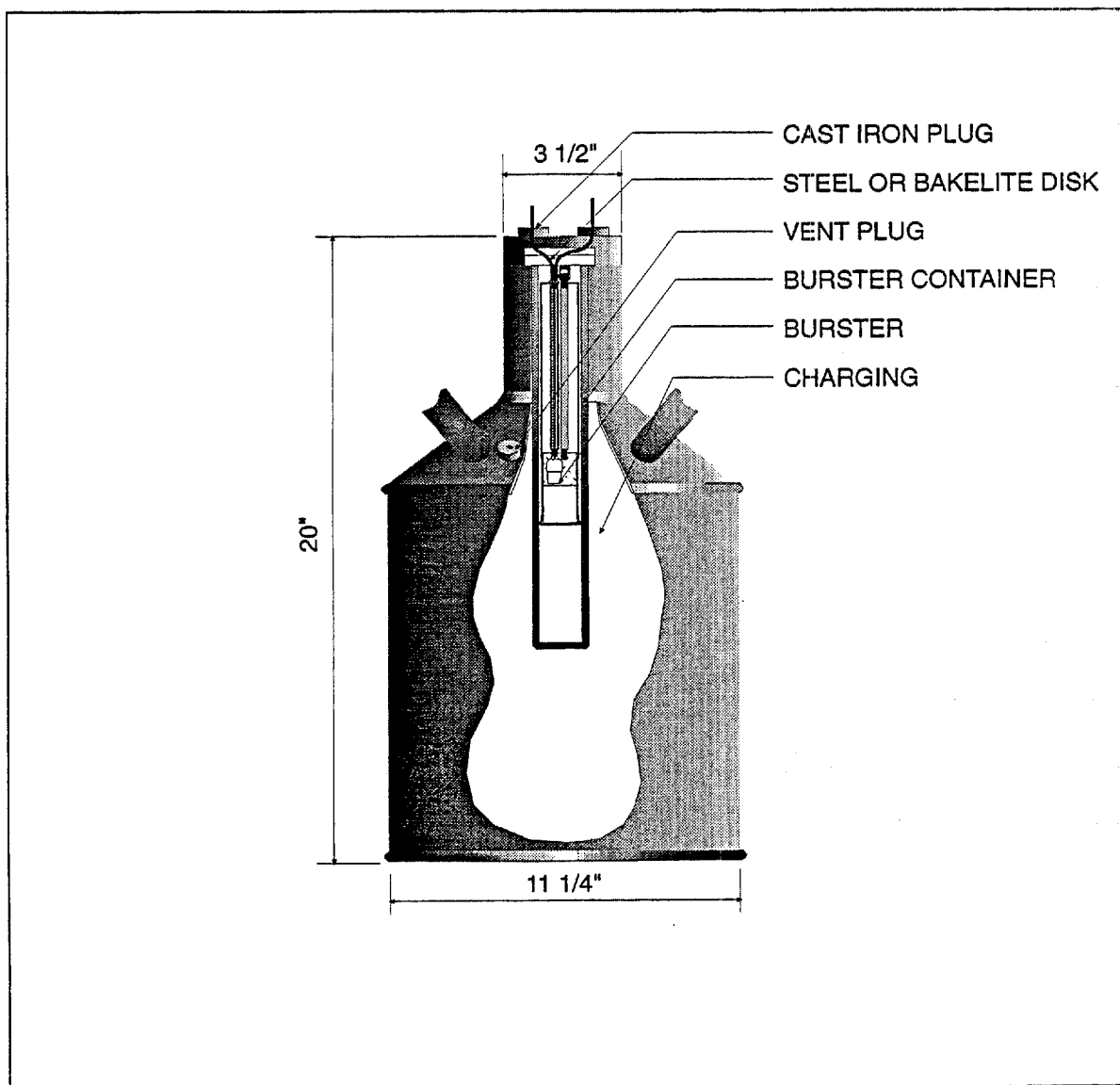
ENGINEERING DATA:

Construction:

Main body: sheet metal

REFERENCES:

1. Office, Chief of Staff, Military Intelligence Division, Chemical Warfare Pocket Book (Washington, DC: n.p., 1940) 46-47, 50, 104-105, and 134-135.
2. Military Intelligence Division, Key to Code Markings on Chemical Weapons, C. D. Report No. 1094, Great Britain (Washington, DC: n.p., 6 June 1942) 1.
3. Office, Chief Chemical Warfare Service, Report, Combined Chemical Warfare Committee (Washington, DC: n.p., 14 January 1943) 2.
4. War Department, volume I, Gas Warfare, Special Weapons and Type of Warfare (Washington, DC: n.p., 1951).
5. Office, Chief of Chemical Warfare, Chemical Warfare Intelligence Summary (Washington, DC: n.p., 30 April 1941).
6. Office, Chief of Chemical Warfare Service, M. A. Report London 12/19/41 No. 45, 996 (Demonstration of CW Weapons) (Washington, DC: n.p., 13 March 1942) 7.
7. Regulation for Army Ordnance, Volume 3, Pamphlet No. 7, Chemical Warfare Ammunitions (N.p.: n.p., n.d.).



Drawing not to scale

Figure 1.3.17-1. Mine, Chemical, No.1, MK II

1.3.18 NOMENCLATURE: 22-centimeter Catapult Mine

TABULATED DATA:

Length: 45.21 centimeters (17.8 in.)

Diameter: 22.0 centimeters (8.66 in.)

Type of Fill and Fill Weight:

50% chlorine/50% CG (1:1): 17.01 kilograms (37.5 lb)

Total Weight with Fill:

50% chlorine/50% CG: 24.36 kilograms (53.7 lb)

Marking:

The mine was painted gray with white letters. The marking for this munition is unknown.

Description:

There was no descriptive information regarding this mine. According to one source, the mine contained a burster located down the center of the munition. The type of explosive and explosive weight are unknown.

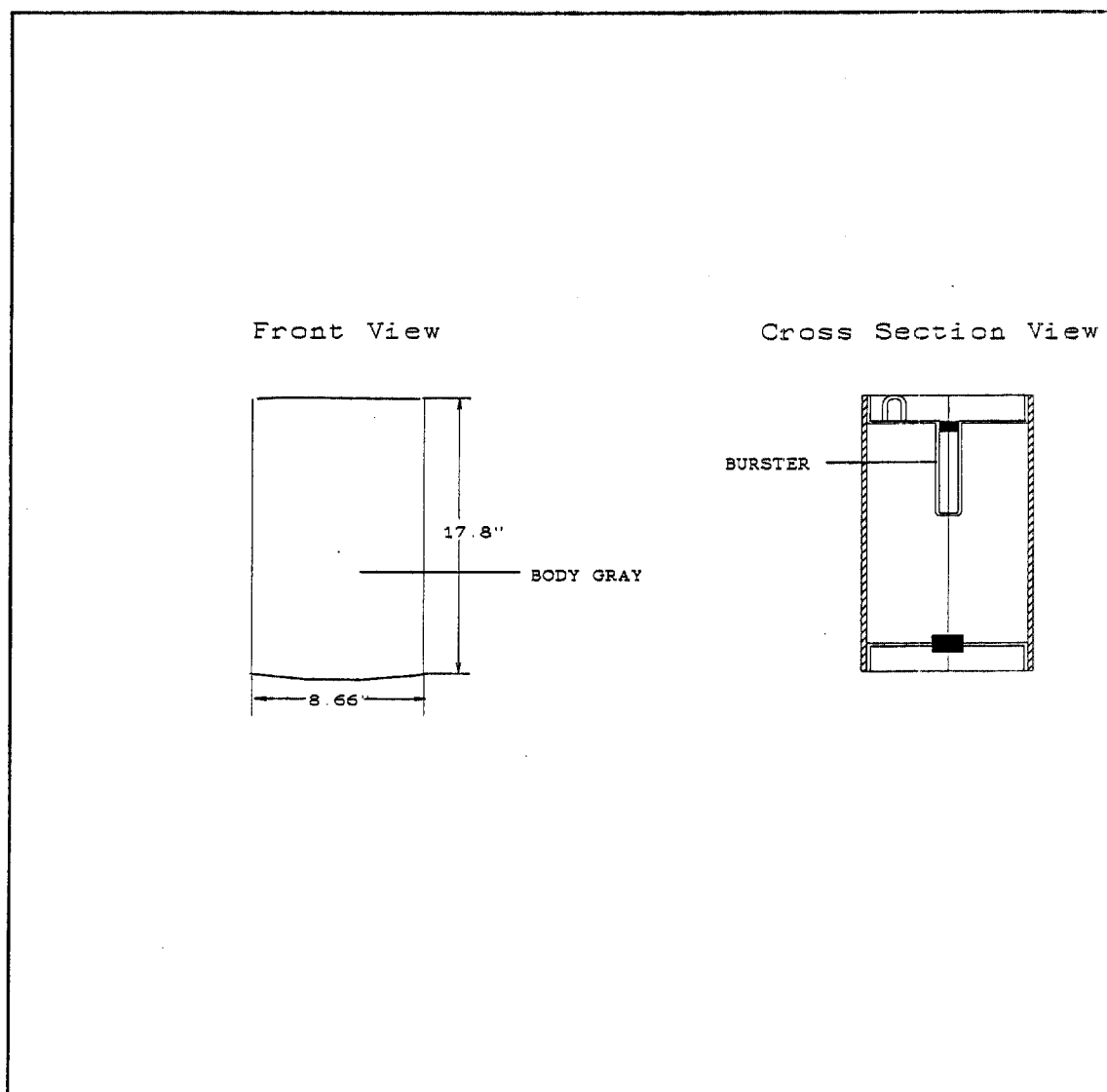
Explosive Train: unknown

ENGINEERING DATA:

Construction: unknown

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedures German-Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April, 1976) (Washington, DC: n.p., April 1992) 7.



Drawing not to scale

Figure 1.3.18-1. 22-centimeter Catapult Mine (Ref. 1)

1.3.19 NOMENCLATURE:

English Gas Hand Grenade (Smoke/Fog)
(German Nomenclature for captured British
munition)

TABULATED DATA:

Length: 84 mm (3.3 in.) without fuse

Diameter: 84 mm (3.3 in.)

Type of Fill and Fill Weight:

Poison gas: 420 gm (14.8 oz) tin tetrachloride (translated from: zinntetrachloride)

Total Weight with Fill:

Poison gas: 635 gm (1.4 lb)

Markings:

The grenade body is painted with black lacquer. The grenade body was marked with a red square. The "closing cover is coated red." It is assumed that this refers to the cover over the grenade fuze being painted red.

Description:

Information for this grenade is limited to that found in German Intelligence Data Sheets on WWI chemical ammunition prepared in 1918. This grenade was known by the Germans to exist since March 1918. It is an iron ball painted with black lacquer. The drawing includes a fuze that appears to function like modern hand grenade fuzes. It is assumed this fuze is armed by pulling the safety pin, the cover being ejected and a cocked striker impacting a pyrotechnic delay element. The burster would detonate after a set time.

This grenade was denoted "poison gas" in the source document. It is assumed that the grenade was used as a riot control or harassing grenade, not as a lethal grenade.

Explosive Train:

Fuze:

Assumed to be pyrotechnic time initiated by a cocked striker.

Burster:

Explosive capsule. Filler nor quantity of explosive is identified.

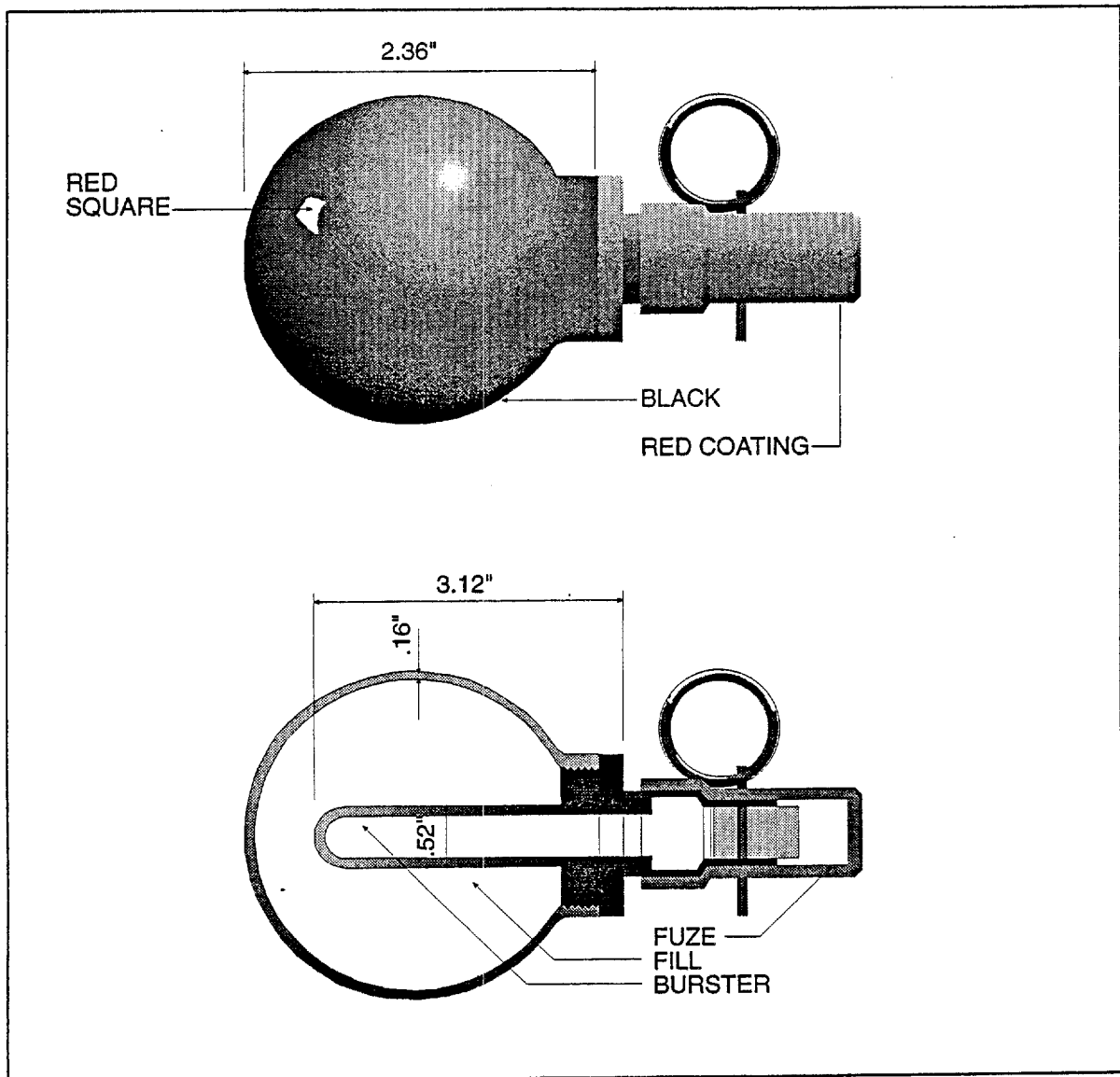
ENGINEERING DATA:

Construction:

Main body: iron (drawing shows dimensions of 4 mm thickness)

REFERENCES:

1. Technical Manual 60A-8-1-2: EODP German Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918 (N.p.: n.p., 1 April 1976).



Drawing not to scale

Figure 1.3.19-1. English Gas Hand Grenade (Smoke/Fog) (Ref. 1)

1.3.20 NOMENCLATURE:

**English Overhand Grenade Type "E"
Pepper Grenade** (German Nomenclature for
captured British munition)

TABULATED DATA:

Length: 87 millimeters (3.4 in.) without lead wires

Diameter: 76 millimeters (3.0 in.)

Type of Fill and Fill Weight:

Poison gas: 22 grams (0.8 oz)
4% sneezing powder (chemical compound unknown)
96% calcium carbonate

Total Weight with Fill:

Poison gas: 112 grams (4.0 oz); volume listed as 205 cm³

Markings:

The grenade body is white. No other markings were available in the source document.

Description:

Information for this grenade is limited to that found in German Intelligence Data Sheets on WWI chemical ammunition prepared in 1918. This grenade was known by the Germans to exist since April 1918. It is a white ball with two copper wires attached to the explosive capsule. It is assumed that the body is metal, because of the crimp shown in the drawings in the source document.

This grenade was denoted "poison gas" in the source document. It is assumed that the grenade was used as a riot control grenade not as a lethal grenade.

Explosive Train:

Fuze:

Assumed to be fired electrically because of lead wires extending from grenade.

Burster:

Explosive capsule. Filler nor quantity of explosive is identified.

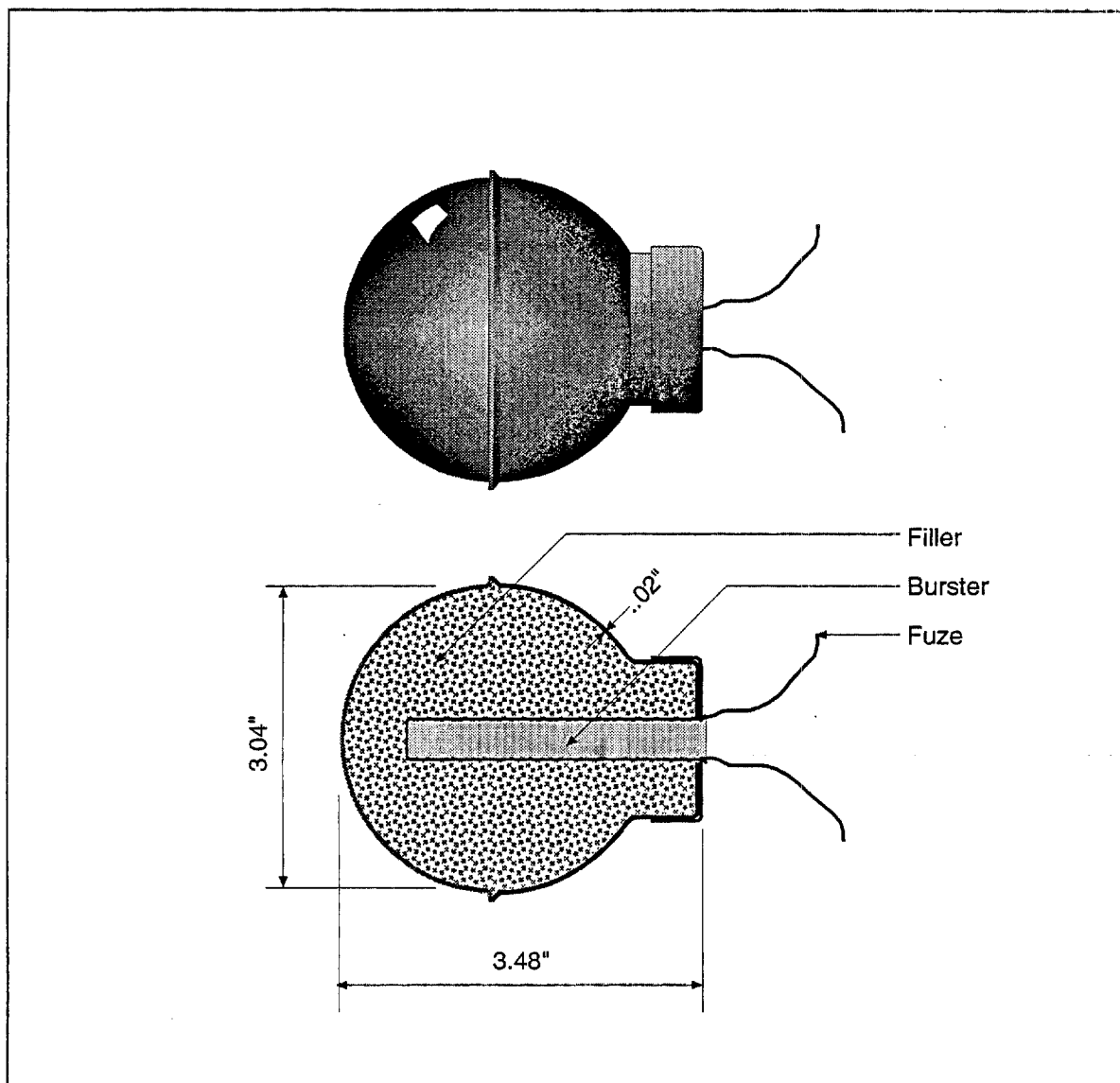
ENGINEERING DATA:

Construction:

Main body: assumed to be sheet metal because of crimp shown on drawing. Case thickness shown as 0.5 mm.
Firing wire: copper

REFERENCES:

1. Technical Manual 60A-8-1-2: EODP German Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918 (N.p.: EODP, 1 April 1976).



Drawing not to scale

Figure 1.3.20-1. English Overhand Grenade Type "E" Pepper Grenade (Ref. 1)

FRENCH
CHEMICAL MUNITIONS

TABLE OF CONTENTS

Section	Title	Page
	LIST OF ILLUSTRATIONS	2-ii
	LIST OF TABLES	2-ii
2	FRENCH CHEMICAL MUNITIONS	
2.1	INTRODUCTION	2-1
2.2	MUNITION MARKINGS	2-2
2.3	TECHNICAL DESCRIPTIONS	2-2
2.3.1	Shell, 75-millimeter, No. 4, 4B, 5, 7, or 20 MK II	2-3
2.3.2	Shell, 105-millimeter, Nos. 5 and 20	2-7
2.3.3	Shell, 120-millimeter, No. 5 (Torpedo Shape)	2-8
2.3.4	Shell, 120-millimeter, No. 4B	2-11
2.3.5	Shell, 120-millimeter, Phosgene/Marsite	2-14
2.3.6	Shell, 145-millimeter, No. 5	2-17
2.3.7	Shell, 155-millimeter Gun, Semisteel, No. 4, 4B, 5, or No. 7 ...	2-20
2.3.8	Shell, 155-millimeter Howitzer, Semisteel, No. 5, 7, and 20 ...	2-23
2.3.9	Shell, 240-millimeter, No. 5	2-26
2.3.10	Projector Bottle, 19.5 centimeters, No. 5 (Livens Projectile)	2-27
2.3.11	French Gas Grenade	2-30
2.3.12	French Hand Grenade	2-31
2.3.13	Mid-Range Gas Mine (Rocket) with Three Fins	2-35
2.3.14	French Projectile (Rocket) with Six Fins	2-36

LIST OF ILLUSTRATIONS

Figure	Title	Page
2.3.1-1	Shell, 75-millimeter, No. 4, 4B, 5, 7, or 20 MK II	2-6
2.3.3-1	Shell, 120-millimeter, No. 5 (Torpedo Shape)	2-10
2.3.4-1	Shell, 120-millimeter, No. 4B	2-13
2.3.5-1	Shell, 120-millimeter, Phosgene/Marsite (arsenic trichloride)	2-16
2.3.6-1	Shell, 145-millimeter, No. 5	2-19
2.3.7-1	Shell, 155-millimeter Gun, Semisteel, No. 4, 4B, 5 or No. 7	2-22
2.3.8-1	Shell, 155-millimeter Howitzer, Semisteel, No. 5, No. 7 and No. 20	2-25
2.3.10-1	Projector Bottle, 19.5 centimeters, No. 5 (Livens Projectile)	2-29
2.3.13-1	Mid-Range Gas Mine (Rocket) with Three Fins	2-35

LIST OF TABLES

Table	Title	Page
2-1	French Chemical Fill Designations	2-1
2-2	French Chemical Weapon Marking Codes	2-2

SECTION 2

FRENCH CHEMICAL MUNITIONS

2.1 INTRODUCTION

Data on French chemical munitions developed during both World Wars and in the interim is scarce. Most chemical weapons were developed during World War I and remained unchanged during the ensuing periods. The inventory primarily consists of artillery shells filled with World War I era agents, such as phosgene, mustard, and arsenical compounds.

The French system of marking is coded by the type of fill and type of munition. In most cases, detailed information concerning the munition's manufacture is also stencilled onto the munition's body. Table 2-1 describes typical chemical fill designations found on French munitions of the World War I era.

Table 2-1. French Chemical Fill Designations

French Designation	American Equivalent or Chemical Name
manganite (No. 4B)	50% hydrocyanic acid 50% arsenic trichloride
vincennite quarternaire (V4) (No. 4)	50% hydrocyanic acid 15% opacite (stannic chloride) 30% arsenic trichloride 5% chloroform
mauguinite	100% cyanogen chloride
vitrite (No. 4B)	cyanogen chloride plus arsenic trichloride
collongite (No. 5)	75% phosgene 25% opacite (stannic chloride) or tin tetrachloride
aquinite (No. 7)	75% chloropicrin 25% opacite (stannic chloride)
sulvanite (No. 13)	75% ethylsulfuryl chloride, 25% opacite (stannic chloride)
lacrimite (No. 15)	75% thiophosgene 25% opacite (stannic chloride)
marsite	arsenic trichloride
ypérite (No. 20)	mustard (H)

2.2 MUNITION MARKINGS

During World War I, the main body of French chemical shells was painted dark green or blue-gray and the ogive was painted black. Chemical fillings were indicated by numbers, sometimes combined with color codes. Although the filling code numbers designated the type of fill, codes were assigned in an inconsistent fashion. It appears that the numbers were assigned sequentially as the filling was approved. Very often, the numbers on the shells became illegible and the types of shells could not be distinguished. Table 2-2 shows summaries of the known codes that appear on French chemical munitions.

Table 2-2. French Chemical Weapon Marking Codes

Shell	Fill	Color	Number
75-millimeter	vincennite quaternaire (V4)	two white rings	4 on top and bottom
75-millimeter	vitrite manganite marsite	white bands	4B on ogive base and shell case
75-millimeter	66% collongite 33% opacite (stannic chloride)	one white ring	5 on top and bottom
75-millimeter	aquinite	two orange-yellow or brown bands	7 on ogive
75-millimeter	yperite with solvent	two orange-yellow or brown bands	20 on ogive
155-millimeter	66% collongite 33% opacite (stannic chloride)	one white ring	5 on top of ogive
155-millimeter	yperite with solvent	two orange-yellow bands	20 on top of ogive

2.3 TECHNICAL DESCRIPTIONS

The following pages present technical information on each French chemical munition.

2.3.1 NOMENCLATURE: Shell, 75-millimeter, No. 4, 4B, 5, 7, or 20 MK II

TABULATED DATA:

Length: 263.90 millimeters (10.39 in.)
350.52 millimeters (13.8 in.) with cartridge case
614.4 millimeters (24.19 in.) with cartridge case

Diameter: 74.68 millimeters (2.93 in.)

Type of Fill and Fill Weight:

vincennite (No. 4): 0.36 to 0.5 kilogram (0.79 to 1.10 lb.)

Note: A percentage of opacite (stannic chloride) is added to vincennite to produce smoke.

vitrite (No. 4B): 0.70 kilogram (1.55 lb.)
collongite (No. 5): 0.67 to 0.76 kilogram (1.48 to 1.68 lb.)
aquinite (No. 7): 0.80 kilogram (1.76 lb.)
yperite (No. 20): 0.82 kilogram (1.81 lb.)
WP: unknown

Total Weight with Fill:

No. 4: 4.86 to 5.0 kilograms (10.72 to 11.03 lb.)
No. 4B: 5.2 kilograms (11.47 lb.)
No. 5: 5.17 to 5.26 kilograms (11.40 to 11.60 lb.)
No. 7: 5.3 kilograms (11.69 lb.)
No. 20: 5.32 kilograms (11.73 lb.)
WP: unknown

Markings:

The overall color is green with the number (alone or with a letter) 4, 4B, or 5 on the ogive for the vincennite, vitrite, and collongite, respectively. On the ogive, immediately below the number, are letters indicating its nature: CO for collongite opacite, or CM for collongite mixture. For the aquinite and yperite fills there are two orange-yellow or brown bands with the number 7 or 20, respectively, on the ogive. Immediately below the numbers are letters indicating its nature: Yt, Yc, or Yp. (Note: Yt indicates yperite dissolved in carbon tetrachloride; Yc indicates yperite dissolved in monochlorobenzene; and Yp indicates a mixture of dichlorodiethyl sulfide and carbon tetrachloride.) Immediately below these letters, the date and place of filling are placed: Aub for Aubervilliers, Vis for Vincennes, and P.Cx for Pont-de-Claix. Weight zones with identification marks are stencilled on the shell on each lot number,

Cartridge cases are stamped and stencilled for identification. Stencilled on the base of the cartridge is the mark number of the shell, one stripe (through the middle), which denotes service charge; Gas or Smoke to denote type of chemical fill; and, when flashless powder is used, FI for flashless. Stamped on the base of the cartridge case is the ammunition lot number, caliber and type of cannon, lot number of the cartridge case, and the initials or symbol of the manufacturer of the cartridge case. Primer stamping includes the initials and lot number of the loader and the year of loading.

Description:

The 75-millimeter chemical shell, MK II, has a rather blunt nose, the radius of which is 1.5 caliber. (Note: Caliber means the diameter of the bore of the gun. An ogive radius of 1.5 caliber is, therefore, a radius of 1.5 times 75 millimeters, or 112.5 millimeters.) The portion in the rear of the rotating band is either cylindrical or straight in shape. This shell does not contain a base cover. The threads in the nose for the adapter and booster are tapered or pipe threads. When the adapter and booster are tightly screwed into place, a gastight joint is formed.

The cartridge case is constructed of drawn brass and is 35.1 centimeters (13.8 inches) long. A cartridge case assembly with a loaded primer weighs about 1.25 kilograms (2.75 pounds). A projecting rim or flange is formed on the head of the cartridge case and the extractor of the gun engages this rim to eject the case from the gun after firing. This rim or flange also acts as a stop for the round when it is loaded into the gun. The primer is fitted in the center of the head of the case and forced into its seat by a press. A projecting rim or flange is formed on the head of the cartridge case and the extractor of the gun engages this rim to eject the case from the gun after firing. This rim or flange also acts as a stop for the round when it is loaded into the gun.

Explosive Train:

Fuze:

Model no.:	MK III, MK III-A, or MK V
Overall length:	unknown
Total weight:	MK III and III-A, 0.44 kilogram (0.97 lb.) MK IV, 0.21 kilogram (0.46 lb.)

Booster Charge:

Model no.:	unknown
Explosive type:	picric acid
Explosive weight:	0.025 kilogram (0.06 lb.)

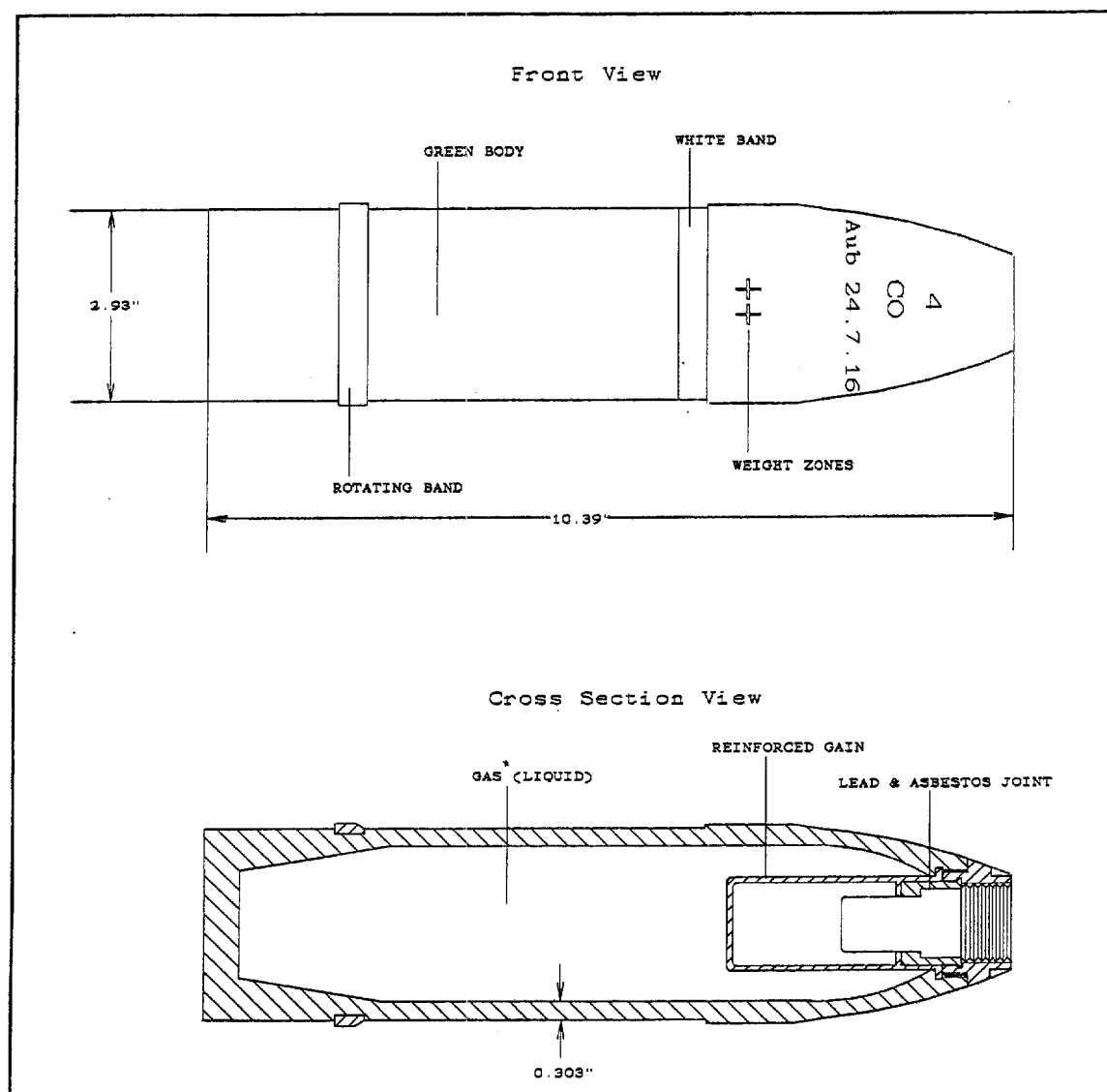
ENGINEERING DATA:

Construction:

Main body: shell steel; thin, comparatively soft metal, easily dented
Cartridge case: drawn brass
Wall thickness: 0.77 centimeter (0.303 in.)

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937) 443-445, 475.
2. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 9, French Chemical Agents and Ammunition (From Captured German Documents) (Washington, DC: n.p., 1 March 1943) 1-3.
3. General Headquarters, American Expeditionary Forces, Gas Manual, Part II, Use of Gas by Artillery (N.p.: n.p., March 1919) 26, 32-45.
4. War Department, Mobile Artillery Ammunition for 75mm Field Gun, M1897 (French); M1916 (American); and M1917 (British) (Washington, DC: n.p., 21 November 1927) 1-26.
5. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedure German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian - 1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April 1992) 2, 3.



Drawing not to scale

Figure 2.3.1-1. Shell, 75-millimeter, No. 4, 4B, 5, 7, or 20 MK II (Ref. 1)

2.3.2 NOMENCLATURE: Shell, 105-millimeter, Nos. 5 and 20

TABULATED DATA:

Length: unknown

Diameter: 105 millimeters (4.13 in.)

Type of Fill and Fill Weight:

collongite (No. 5): fill weight unknown

yperite (No. 20): fill weight unknown

Total Weight with Fill: unknown

Markings:

The shell of the 105-millimeter, no. 5, is stencilled with the number 5 and a white ring around the cylinder. The shell of the 105-millimeter, no. 20, is stencilled with the number 20 and two brown rings around the cylinder. Sketches are not available for this munition.

Description:

Very little information could be found regarding these munitions. It is uncertain whether this shell was specifically designed for use as a gas munition; however, sources indicated that gas no. 5 (collongite) and gas no. 20 (yperite) were used in these shells.

Explosive Train: unknown

ENGINEERING DATA:

Construction:

Main body: shell steel

REFERENCE:

1. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 9, French Chemical Agents and Ammunition (From Captured German Documents) (Washington, DC: n.p., 1 March 1943) 4.

2.3.3 NOMENCLATURE: Shell, 120-millimeter, No. 5 (Torpedo Shape)

TABULATED DATA:

Length: 400 millimeters (15.75 in.) (without fuze or cartridge)

Diameter: 120 millimeters (4.72 in.)

Type of Fill and Fill Weight:

WP: unknown
collongite (No. 5): 1.8 kilograms (3.97 lb.)

Note: The composition of the filling agent is 60% phosgene, 40% tin tetrachloride or opacite.

Total Weight with Fill: 18.7 kilograms (41.23 lb.)

Markings:

The shell is green overall with the number 5 stencilled on the ogive. Below the number, the letters CO for the fill (collongite opacite) are stencilled in white. (Note: The letters CO (collongite opacite) under the gas number means a mix of phosgene and stannic chloride.) Immediately below these letters, the date and place of filling are stencilled; namely, Aub for Aubervilliers, Vis for Vincennes, and P.Cx for Pont-de-Claix. There is one white ring in the center of the round. Above the rotating band appears the designation 18^k8. Weight zones with identification marks are often stencilled on the shell for each particular lot number. These weight markings are +, ++, +++, and +++, depending on the weight of the munitions with the fuze. Sometimes, five white squares are painted on the ogive to represent the weight markings.

Description:

There is no description for this munition. Very little is known of its characteristics or general use.

Explosive Train:

Fuze: unknown

Burster:

Model no.: unknown
Diameter: 18.5 millimeters (0.73 in.)
Length: 130 millimeters (5.12 in.)
Explosive type: picric acid

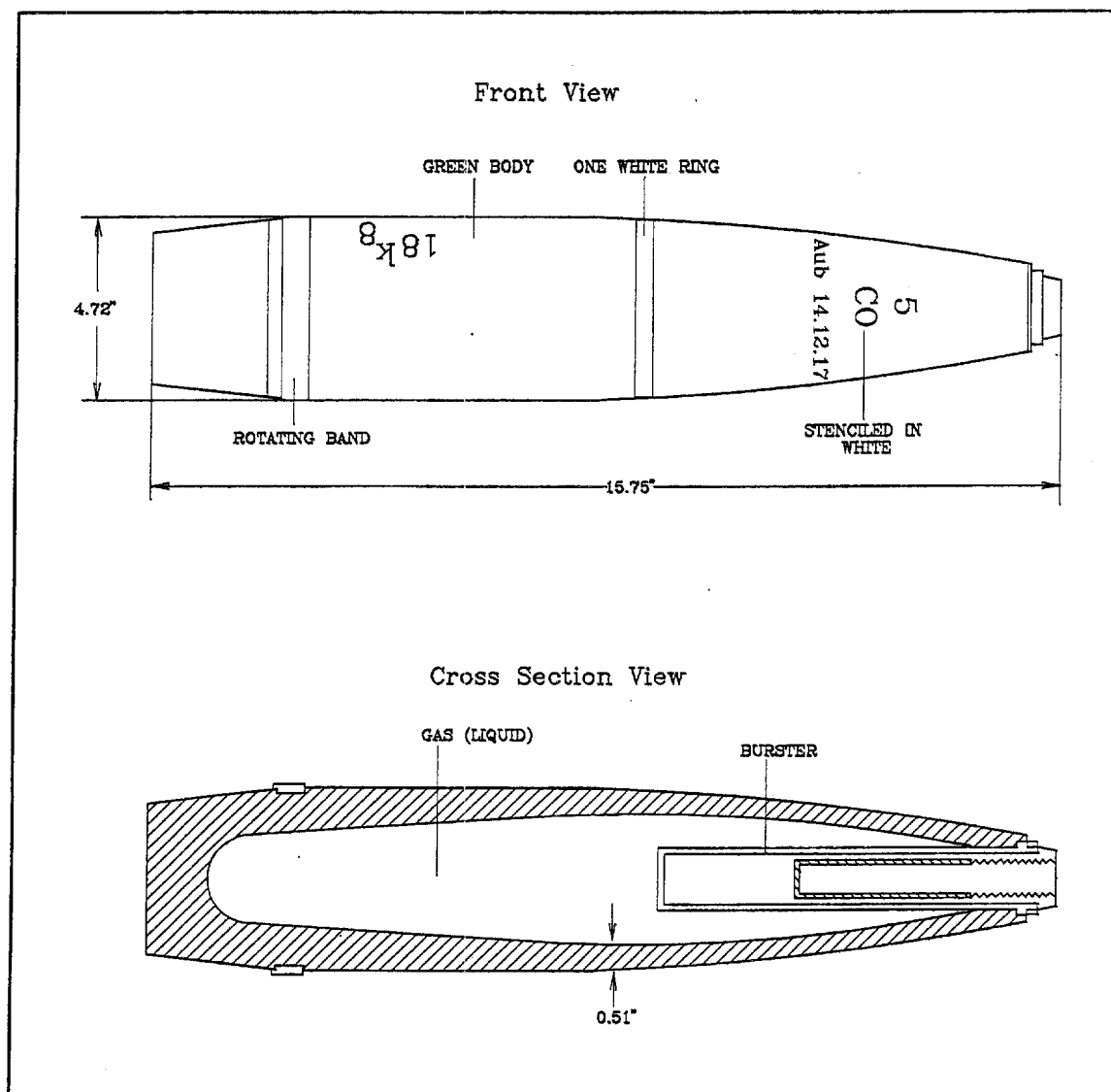
ENGINEERING DATA:

Construction:

Main body: unknown
Wall thickness: 1.3 centimeters (0.51 in.)

REFERENCES:

1. NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedure German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian - 19181 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, April 1976 (Washington, DC: n.p., April 1992) 6.
2. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 9, French Chemical Agents and Ammunition (From Captured German Documents) (Washington, DC: n.p., 1 March 1943) 4.



Drawing not to scale

Figure 2.3.3-1. Shell, 120-millimeter, No. 5 (Torpedo Shape) (Ref. 1)

2.3.4 NOMENCLATURE: Shell, 120-millimeter, No. 4B

TABULATED DATA:

Length: 400 millimeters (15.75 in.) (without cartridge case and fuze)

Diameter: 120 millimeters (4.72 in.)

Type of Fill and Fill Weight:

WP: unknown
manganite (No. 4B): 1.1 kilograms (2.43 lb.)

Total Weight with Fill: 18.3 kilograms (40.35 lb.)

Markings:

The shell is green overall, with $4V_4$ stencilled on the ogive. Immediately below the letters, the date and place of filling are placed; namely, Aub for Aubervilliers, Vis for Vincennes, and P.Cx for Pont-de-Claix. Following the place of filling, there are two white rings around the cylinder.

Description:

There is very little information on this shell and its use.

Explosive Train: unknown

Burster:

Model no.: unknown
Diameter: 18.5 millimeters (0.73 in.)
Length: 130 millimeters (5.12 in.)
Explosive type: unknown
Explosive weight: unknown

ENGINEERING DATA:

Construction:

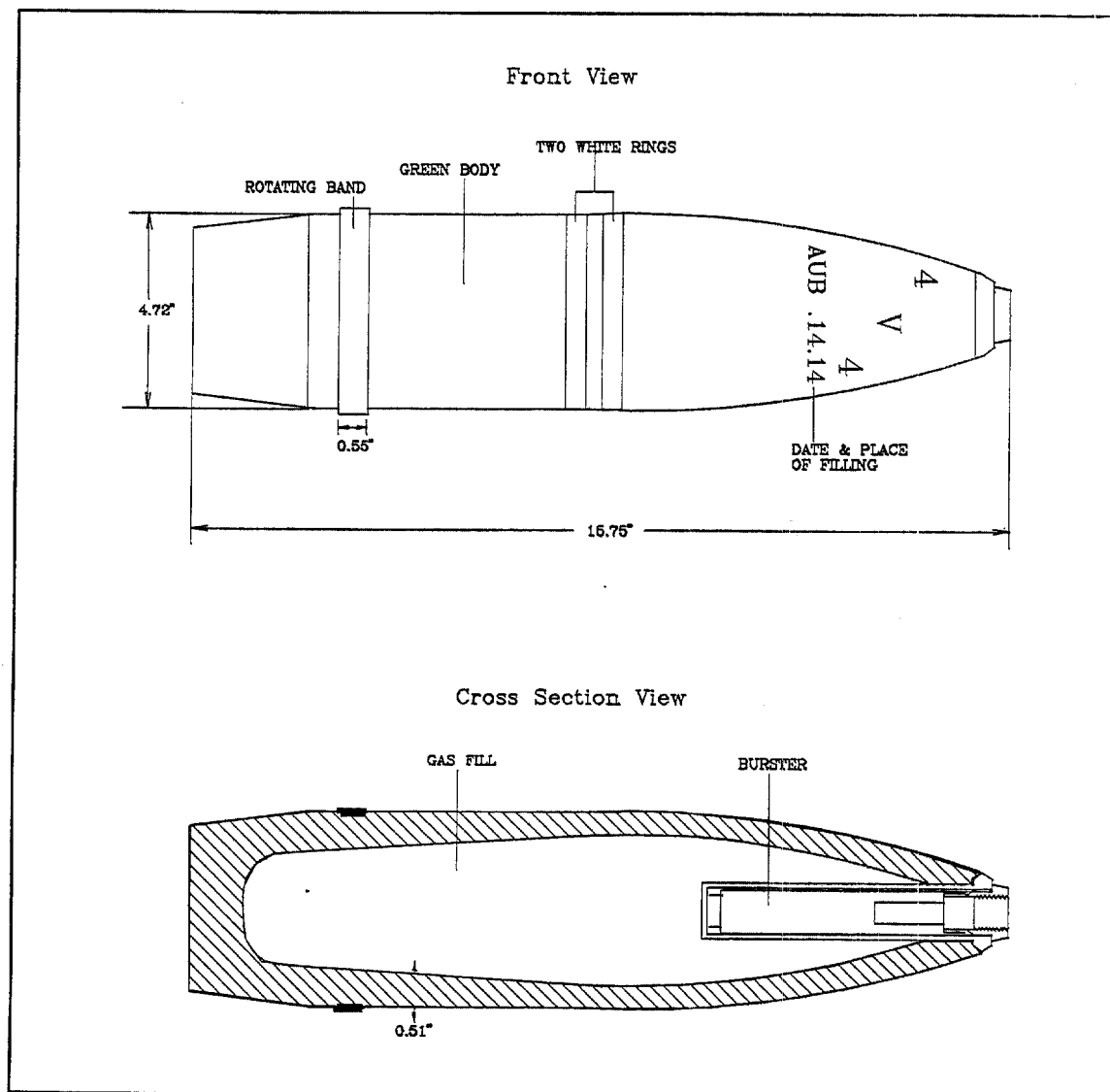
Main body: unknown
Wall thickness: 13 millimeters (0.51 in.)

REFERENCES:

1. NASA TT-21140, Technical Manual: Explosive Ordnance Disposal
Procedure German - Intelligence Data Sheets on World War I Chemical

German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976)
(Washington, DC: n.p., April 1992) 6a.

2. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence
Bulletin No. 9, French Chemical Agents and Ammunition (From Captured
German Documents) (Washington, DC: n.p., 1 March 1943).



Drawing not to scale

Figure 2.3.4-1. Shell, 120-millimeter, No. 4B (Ref. 1)

2.3.5 NOMENCLATURE: Shell, 120-millimeter, Phosgene/Marsite

TABULATED DATA:

Length: 452 millimeters (17.80 in.) (without cartridge case and fuze)

Diameter: 120 millimeters (4.72 in.)

Type of Fill and Fill Weight:

phosgene with marsite: fill weight unknown

Note: Marsite was also known as arsenic trichloride. The French did not use this fill alone in projectiles.

Total Weight with Fill: unknown; however, weight empty is 15.5 kilograms

Markings:

The shell is green with the letters CM painted in white, which denotes the munition fill as collongite mixture. Below these letters there is one white ring painted around the cylinder.

Description:

There is no physical description for this munition and very little is known concerning its general use.

Explosive Train: unknown

ENGINEERING DATA:

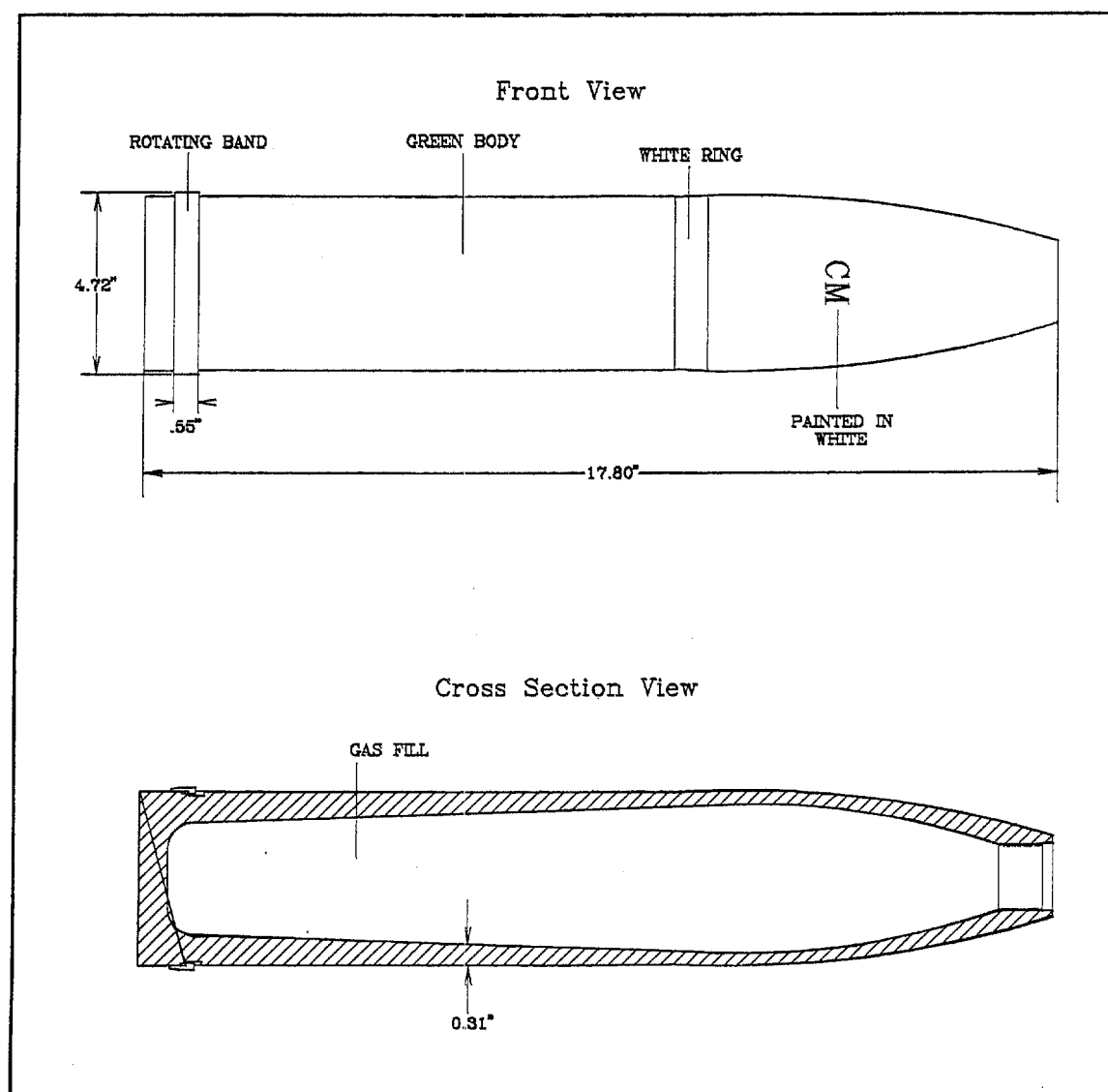
Construction:

Main body: unknown

Wall thickness: 8 millimeters (0.31 in.)

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedure German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian - 1918, Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976 (Washington, DC: n.p., April 1992) 5.
2. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 9, French Chemical Agents and Ammunition (From Captured German Documents) (Washington, DC: n.p., 1 March 1943) 4.



Drawing not to scale

Figure 2.3.5-1. Shell, 120-millimeter, Phosgene/Marsite (arsenic trichloride)

2.3.6 NOMENCLATURE: Shell, 145-millimeter, No. 5

TABULATED DATA:

Length: 531 millimeters (20.91 in.) (without cartridge case and fuze)

Diameter: 145 millimeters (5.7 in.)

Type of Fill and Fill Weight:

collongite (No. 5): 3.2 kilograms (7 lb.)

Note: The composition of this filling is 65% phosgene, 35% tin tetrachloride or opacite (stamie chloride).

Total Weight with Fill: 34.4 kilograms (68.8 lb.)

Markings:

The shell is green overall, with the number 5 stencilled on the ogive. Immediately below this number a two letter code (CO) appears, which indicates the fill as collongite opacite, the code name for phosgene and tin tetrachloride. Immediately below the letters, the date and place of filling are placed; namely, Aub for Aubervilliers, Vis for Vincennes, and P.Cx for Pont-de-Claix. Following the place of filling, there is one white ring around the cylinder and immediately above the rotating band there is a code 36^k3. This munition has two rotating bands.

Description:

Very little is known of its original construction and use.

Explosive Train:

Burster:

Model no.: unknown

Explosive type: picric acid

Explosive weight: 0.095 kilogram (0.21 lb.)

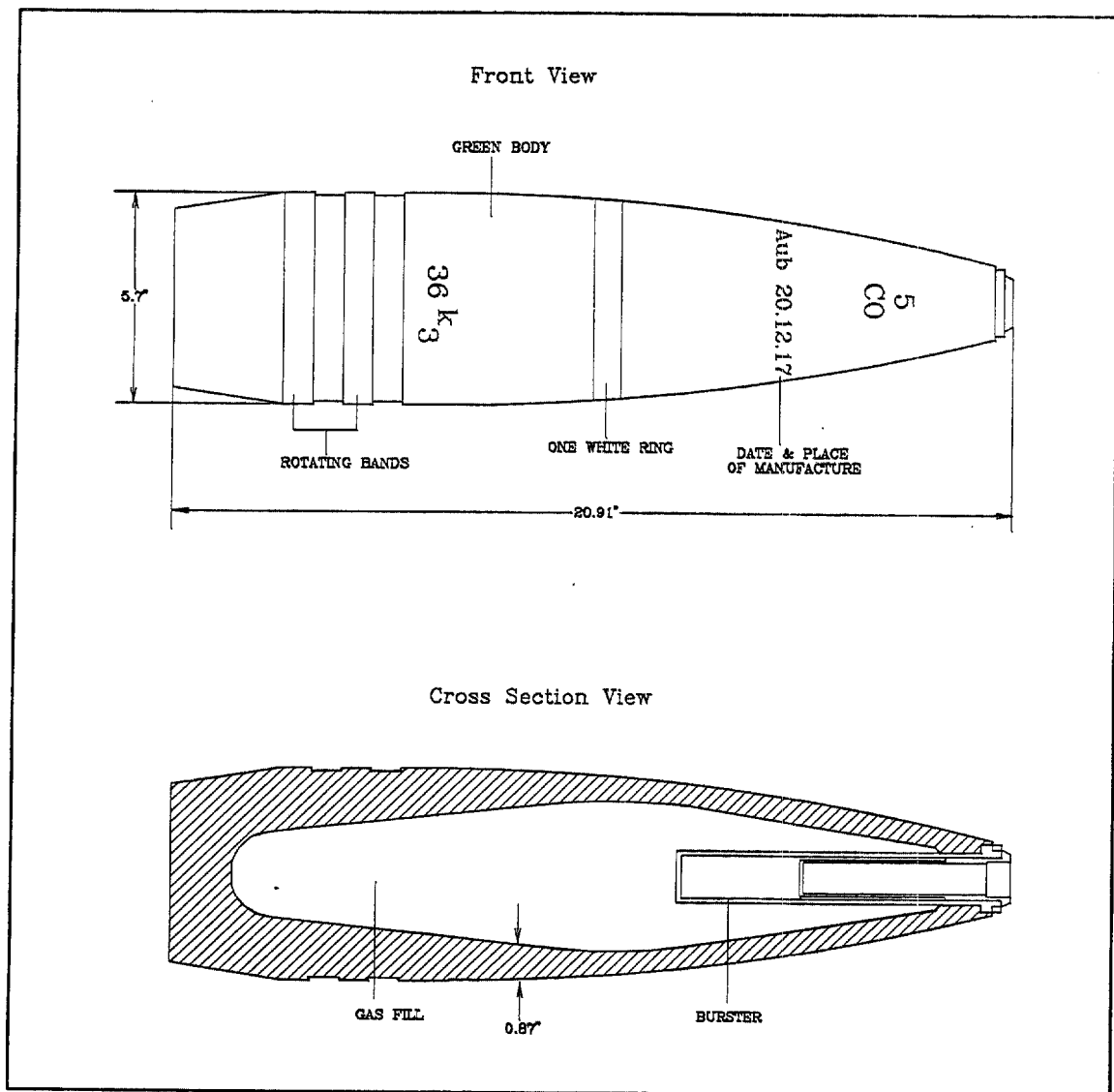
ENGINEERING DATA:

Construction:

Wall thickness: 22 millimeters (0.87 in.)

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedure German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian - 1918, Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April 1992) 6.
2. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 9, French Chemical Agents and Ammunition (From Captured German Documents) (Washington, DC: n.p., 1 March 1943) 4.



Drawing not to scale

Figure 2.3.6-1. Shell, 145-millimeter, No. 5 (Ref. 1)

2.3.7 NOMENCLATURE: Shell, 155-millimeter Gun, Semisteel, No. 4, 4B, 5, or No. 7

TABULATED DATA:

Length: 577.85 millimeters (22.75 in.)

Diameter: 155 millimeters (6.1 in.)

Type of Fill and Fill Weight:

collongite (No. 5): 4.08 kilograms (9.0 lb.)

Note: The mixture contains a percentage of opacite (stannic chloride) added to produce smoke.

aquinite (No. 7):	4.85 kilograms (10.7 lb.)
vincennite (No. 4):	unknown
manganite or vitrite (No. 4B):	unknown
WP:	unknown

Total Weight with Fill:

No. 5:	43.58 kilograms (96.1 lb.)
No. 7:	44.35 kilograms (97.8 lb.)
No. 4:	unknown
No. 4B:	unknown
WP:	unknown

Markings:

The 155-millimeter semisteel shell munition was green overall with the number (alone or with a letter) 5, 4, 4B, or 7 (which indicates the filling) stencilled on the ogive. The collongite (No. 5)-filled round had one white band around the cylinder, the aquinite (No. 7) round had one orange-yellow band around the cylinder, the vincennite (No. 4), manganite or vitrite (No. 4B) round had two white bands around the central portion of the cylinder. Immediately below the number of the filling are the date and place of filling; namely, Aub for Aubervilliers, Vis for Vincennes, and P.Cx for Pont-de-Claix. Weight zone markings were one-half inch-squares and can be 2, 3, 4, 5, or 6 in number. Each square contains a punch mark at the center. Weight markings are stencilled for each particular lot number, depending on the weight of the munitions. On the body are the letters G.P. in white, indicating that the round is a gun shell.

Description:

The extreme front end of the ogive is rather blunt. The threads in the nose for the adapter and booster are either tapered or pipe threads. When the adapter and booster are tightly screwed into place, a gastight joint is formed. This chemical shell does not contain a base cover as does the HE shell. Two rotating bands are a distinguishing feature in comparison with the 155-millimeter howitzer shell.

Explosive Train:

Fuze:

Model no.:	MK III
Overall length:	unknown
Total weight:	0.43 kilogram (0.95 lb.)

Booster Charge: unknown

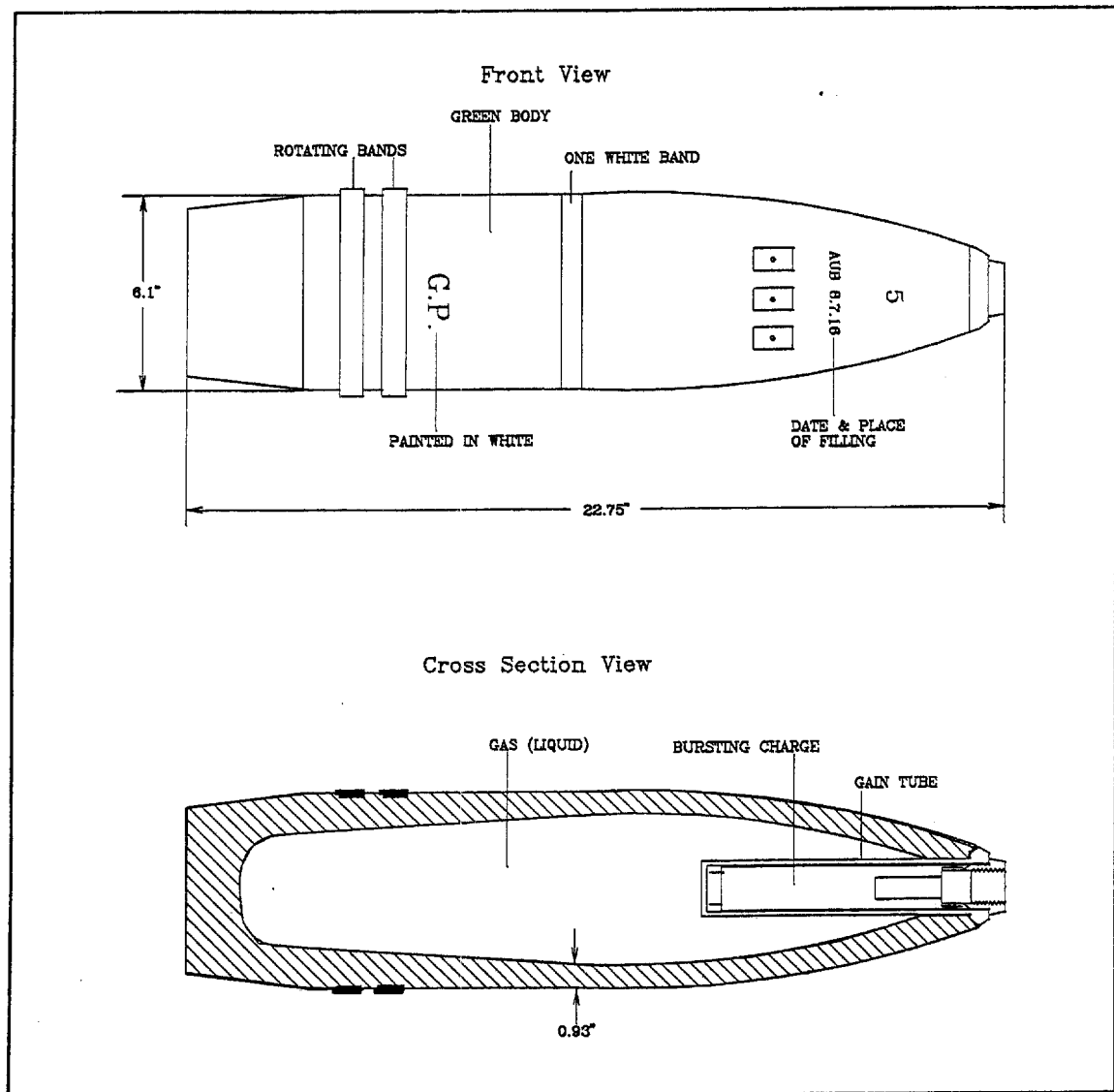
ENGINEERING DATA:

Construction:

Main body:	semisteel (cast iron of low carbon content)
Wall thickness:	2.36 centimeters (0.93 in.)

REFERENCES:

1. General Headquarters, American Expeditionary Forces, Gas Manual, Part II, Use of Gas by Artillery (N.p.: n.p., March 1919) 53-55.
2. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 9, French Chemical Agents and Ammunition (From Captured German Documents) (Washington, DC: n.p., 1 March 1943) 5.
3. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedure German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian - 1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April 1992) 7.



Drawing not to scale

Figure 2.3.7-1. Shell, 155-millimeter Gun, Semisteel, No. 4, 4B, 5 or No. 7 (Ref. 1)

2.3.8 NOMENCLATURE: Shell, 155-millimeter Howitzer, Semisteel, No. 5, 7, and 20

TABULATED DATA:

Length: 577.85 millimeters (22.75 in.)

Diameter: 155 millimeters (6.1 in.)

Type of Fill and Fill Weight:

collongite (No. 5): 4.08 kilograms (9.0 lb.)

Note: The mixture contains a percentage of opacite (stannic chloride) added to produce smoke.

aquinite (No. 7): 4.85 kilograms (10.7 lb.)

yperite (No. 20) 3.45 kilograms (7.6 lb.)

WP: unknown

Total Weight with Fill:

No. 5: 43.58 kilograms (96.1 lb.)

No. 7: 44.35 kilograms (97.79 lb.)

No. 20: 43.0 kilograms (95.0 lb.)

WP: unknown

Markings:

The 155-millimeter semisteel howitzer shell was green overall with the number 5, 7, or 20 (which indicates the filling) stencilled on the ogive. Immediately below the number, there are the two letters CM, which mean a collongite mixture, the code name for phosgene and arsenic. The collongite (No. 5)-filled round had one white band around the body, the aquinite (No. 7) round had one orange-yellow band around the body, and the yperite (No. 20) round had two orange-yellow bands around the central portion of the body. Immediately below the number of the filling are the date and place of filling; namely, Aub for Aubervilliers, Vis for Vincennes, and P.Cx for Pont-de-Claix. Weight zone markings were one-half-inch squares and can be 2, 3, 4, 5, or 6 in number. Each square contains a punch mark at the center. Weight markings are stencilled for each particular lot number, depending on the weight of the munitions.

Description:

The 155-millimeter semisteel howitzer chemical shell has a rather blunt nose, the radius of which is 1.5 calibers. (Note: Caliber means the diameter of the bore of the gun. An ogive radius of 1½ calibers is, therefore, a radius of 1.5 times 155

booster are either tapered or pipe threads. When the adapter and booster are tightly screwed into place, a gastight joint is formed.

Explosive Train:

Fuze:

Model no.: MK III
Overall length: unknown
Total weight: 0.43 kilogram (0.95 lb.)

Burster:

Model no.: MK VI-B
Explosive type: picric acid
Explosive weight: 0.095 kilogram (0.21 lb.)

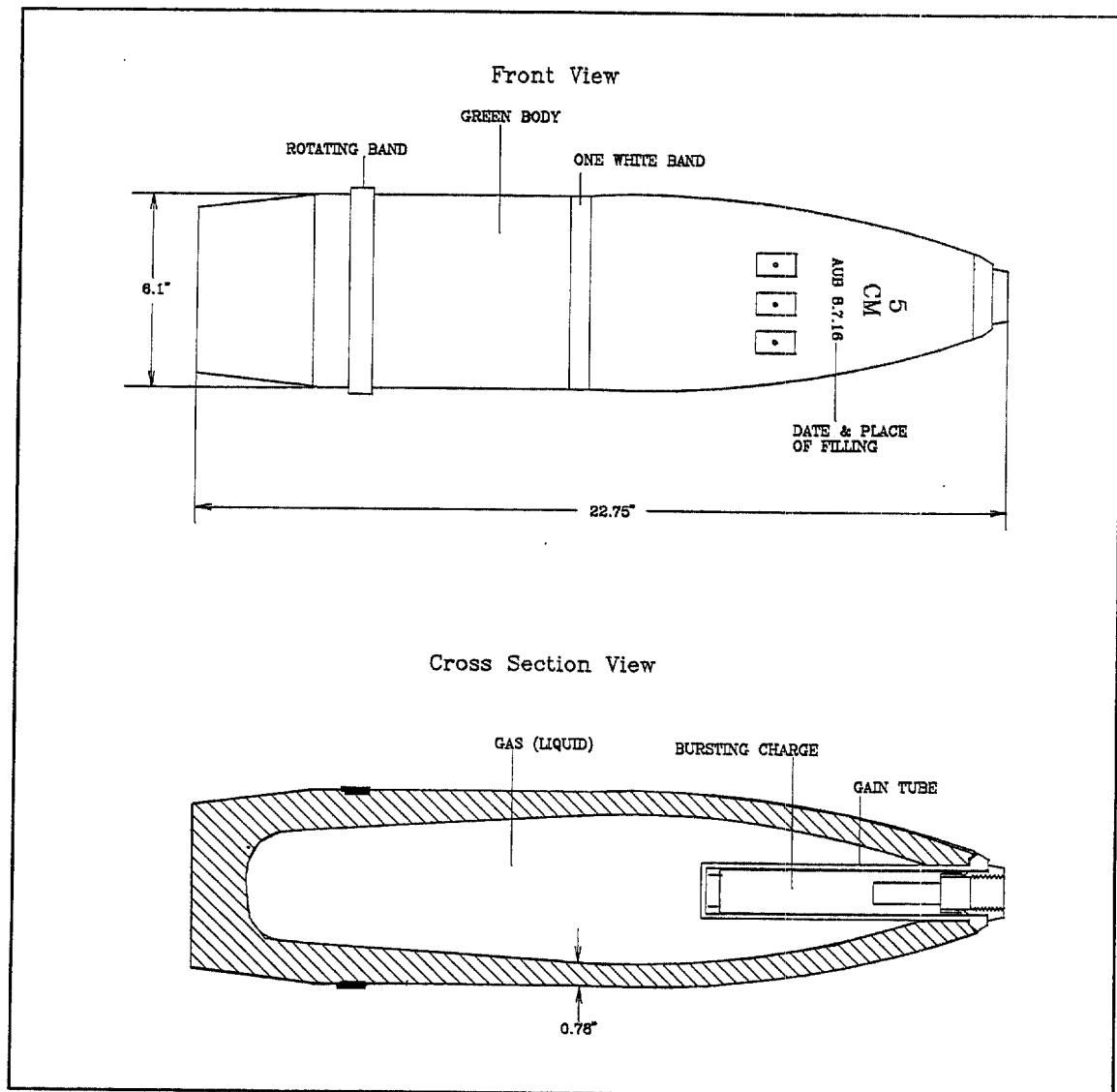
ENGINEERING DATA:

Construction:

Wall thickness: 20 millimeters (0.78 inch)
Main body: semisteel (softer steel, content unknown)

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedure German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian - 1918 (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, DC: n.p., April 1992) 7.
2. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 9, French Chemical Agents and Ammunition (From Captured German Documents) (Washington, DC: n.p., 1 March 1943) 5.
3. General Headquarters, American Expeditionary Forces, Gas Manual, Part II, Use of Gas by Artillery (N.p.: n.p., March 1919) 54-55.
4. War Department, Mobile Artillery Ammunition for 75mm Field Gun, M1897 (French); M1916 (American); and M1917 (British) (Washington, DC: n.p., 25 November 1927) 1-21.



Drawing not to scale

Figure 2.3.8-1. Shell, 155-millimeter Howitzer, Semisteel, No. 5, No. 7 and No. 20 (Ref. 3)

2.3.9 NOMENCLATURE: Shell, 240-millimeter, No. 5

TABULATED DATA:

Length: unknown

Diameter: 240 millimeters (9.45 in.)

Type of Fill and Fill Weight:

collongite (No. 5): fill weight unknown

Total Weight with Fill: unknown

Markings:

The munition has stencilled markings with the number 5, which indicates the type of fill. (Note: All shell cases of more than 105 millimeters have the letters CO stencilled in white paint under the number of the gas.) Very little information is known about the characteristics and use of this munition. Sketches of this munition are not available.

Description:

Very little information could be found on this munition and its purpose. One source indicates that the number 5 is stencilled on this type of munition, which would indicate a phosgene (collongite opacite) fill.

Explosive Train: unknown

ENGINEERING DATA:

Construction: unknown

REFERENCES:

1. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 9, French Chemical Agents and Ammunition (From Captured German Documents) (Washington, DC: n.p., 1 March 1943) 5.

**2.3.10 NOMENCLATURE: Livens Projectile, 19.5 centimeters, No. 5
(Projectile)**

TABULATED DATA:

Length: 59.5 centimeters (23.4 in.)

Diameter: 19.5 centimeters (7.7 in.)

Type of Fill and Fill Weight:

CG pure (No. 5): 13 kilograms (28.7 lb.)

Total Weight with Fill: 28.5 kilograms (62.8 lb.)

Markings:

The body is green with one white ring in the middle of the projectile. Above the ring is the filling date and place; in this case, Aub for Aubervilliers and 26.3.18 for the date of filling. Immediately above this designation there is the letter C, which stands for collongite, the agent fill. (Note: The letter C, for collongite, stencilled in white paint means phosgene.) Above this code letter there is the number 5, which identifies the type of shell, that is, phosgene shell. There is white paint at the top end of the projector bottle (marking the filler opening with a screw plug). There are also the words COTE A AMORCER at the bottom (fuze end) of the projectile.

Description:

The shell body is constructed of seamless drawn-steel tubing 5 millimeters (0.2 inch) thick with forge-welded ends. It can be identified by the projections at each end, which are 28 millimeters (1.1 inches) in diameter and approximately 550 millimeters (21.7 inches) long. The shell has a filling capacity of approximately 11,000 cubic centimeters (671.2 cubic inches). A central tube runs the length of the shell and is welded at both ends. A steel plug is welded into the tube to divide it into the section used to receive the burster tube and the section used for filling the shell. After filling, the shell is sealed by screwing a tapered plug into the filling hole.

Explosive Train:

Fuze: unknown

Booster Charge: unknown

Burster:

Model no.: unknown

Diameter: unknown

Length: 29 centimeters (11.4 in.)

Explosive type: TNT

Explosive weight: 100 grams (3.53 ounces approximately)

ENGINEERING DATA:

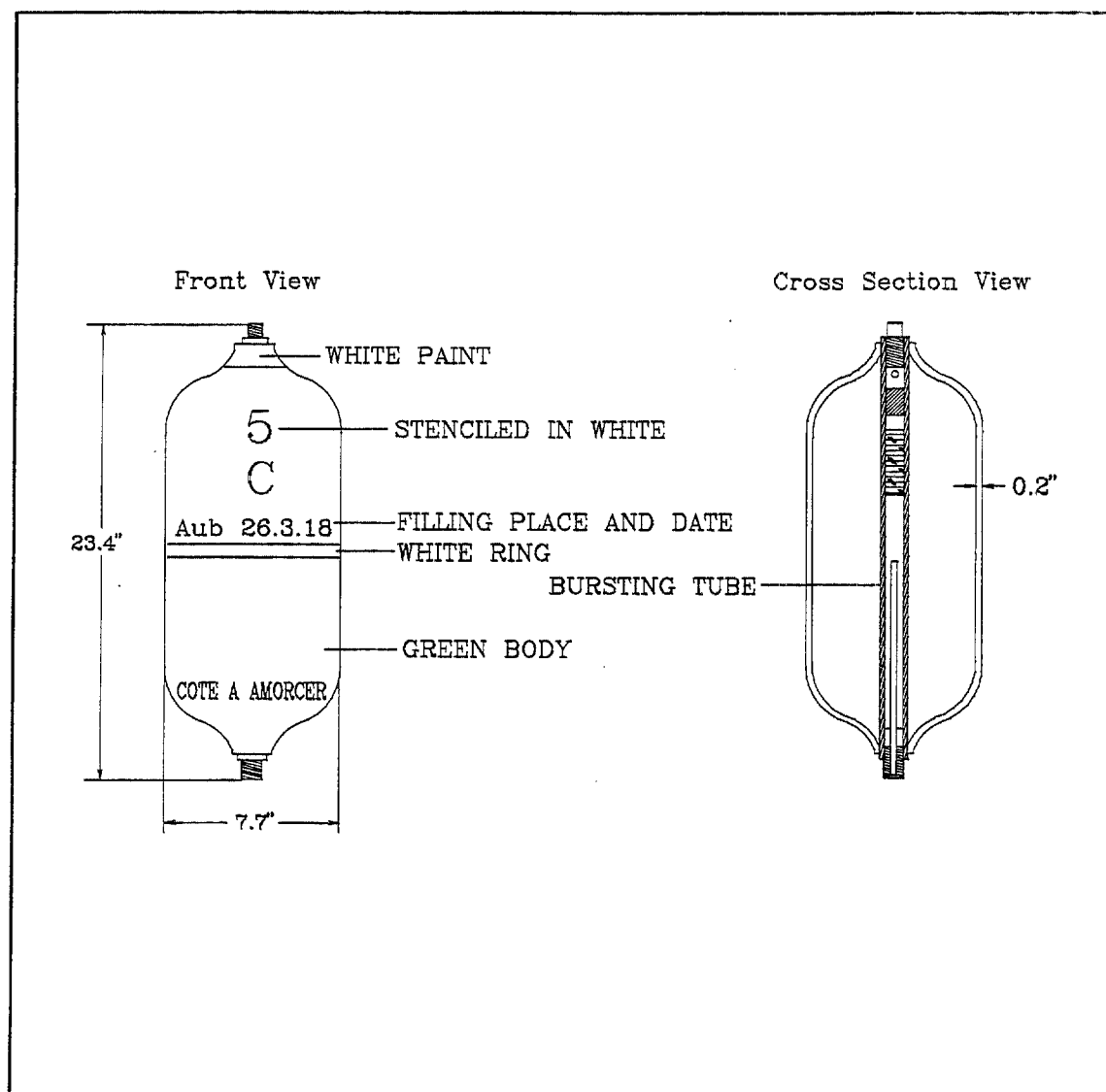
Construction:

Main body: lap-welded or seamless drawn-steel pipe with welded hemispherical ends; central burster well welded to ends

Wall thickness: 0.5 centimeter (0.2 inch)

REFERENCES:

1. Anonymous, NASA TT-21140, Technical Manual: Explosive Ordnance Disposal Procedure German - Intelligence Data Sheets on World War I Chemical Ammunition - British, French, Italian, Russian - 1918) (Translation from German to English. Printed in U.S. Army TM 60A-8-1-2, 1 April 1976) (Washington, D.C.: n.p., April 1992) 2g.
2. NAVY EODB/ARMY TM/AIR FORCE TO 60D-2-2-63, Revision 1, Explosive Ordnance Disposal Procedures U.S. Projectiles, Chemical, MKs I and II, for Livens Projectile) (Indian Head, MD: n.p., 26 February 1986) 3.



Drawing not to scale

Figure 2.3.10-1. Livens Projectile, 19.5 centimeters, No. 5 (Projectile) (Ref. 1)

2.3.11 NOMENCLATURE: French Gas Grenade (German Nomenclature for captured French munition)

TABULATED DATA:

Length: unknown

Diameter: unknown

Type of Fill and Fill Weight:

Poison gas: chloracetone, 90 grams (3.2 oz)

Total Weight with Fill:

Poison gas: 330 grams (11.5 oz); volume listed as 100 cm³

Markings:

The grenade body is glass.

Description:

Information for this grenade is limited to that found in German Intelligence Data Sheets on WWI chemical ammunition prepared in 1918. This grenade was known by the Germans to exist since February, 1917. The body of this grenade is constructed of glass with a clay closure plug.

Explosive Train:

No information is available from the source document. It is assumed this grenade does not have explosive components.

ENGINEERING DATA:

Construction:

Main body: glass

REFERENCES:

1. Technical Manual 60A-8-1-2: EODP German Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918 (N.p.: EODP, 1 April 1976).

2.3.12 NOMENCLATURE: French Hand Grenade (German nomenclature for captured French munition)

TABULATED DATA:

Length: 119 millimeters (4.7 in.) with fuse

Diameter: 64 millimeters (2.6 in.)

Type of Fill and Fill Weight:

Poison gas: chloracetone, acrolein, or "Bromessigester" (may be brommethylethylketone), weight 150-160 grams (5.3-5.6 oz)

Total Weight with Fill:

Poison gas: 320-330 grams (11.2-11.5 oz); volume listed as 170 cm³

Markings:

The grenade body is white. No other markings were available in source document.

Description:

Information for this grenade is limited to that found in German Intelligence Data Sheets on WWI chemical ammunition prepared in 1918. This grenade was known by the Germans to exist since May 1916. The body of this grenade is constructed from sheet metal. It was previously made from brass.

Explosive Train:

Fuze:

Assumed to be pyrotechnic time initiated by pulling of a safety pin. It is not known if the fuse is initiated by a "match head striker" or by impact.

Burster:

Explosive capsule. Filler nor quantity of explosive is identified.

ENGINEERING DATA:

Construction:

Main body: sheet metal

REFERENCES:

1. Technical Manual 60A-8-1-2: EODP German Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918 (N.p.: EODP, 1 April 1976).

2.3.13 NOMENCLATURE: Mid-Range Gas Mine (Rocket) with Three Fins
(German nomenclature for captured French munition)

TABULATED DATA:

Length: 620 millimeters (24.4 in.)

Diameter: 140 millimeters (5.5 in.) (approximate)

Type of Fill and Fill Weight:

Poison gas: 4.65 kilograms (10.23 lb) (suspected sulfur mustard; may be ethylsulfuryl chloride)

Total Weight with Fill:

Poison gas: 9.7 kilograms (21.3 lb)

Markings:

The rocket body was painted green. No other information regarding markings is available.

Description:

Information for this rocket is limited to that found in German Intelligence Data Sheets on WWI chemical ammunition prepared in 1918. This rocket was known by the Germans to exist since July 1916.

Explosive Train:

The only information available is from the drawing. The dimensions are shown for a burster in the nose of the rocket. The fuze is assumed to be an impact fuze.

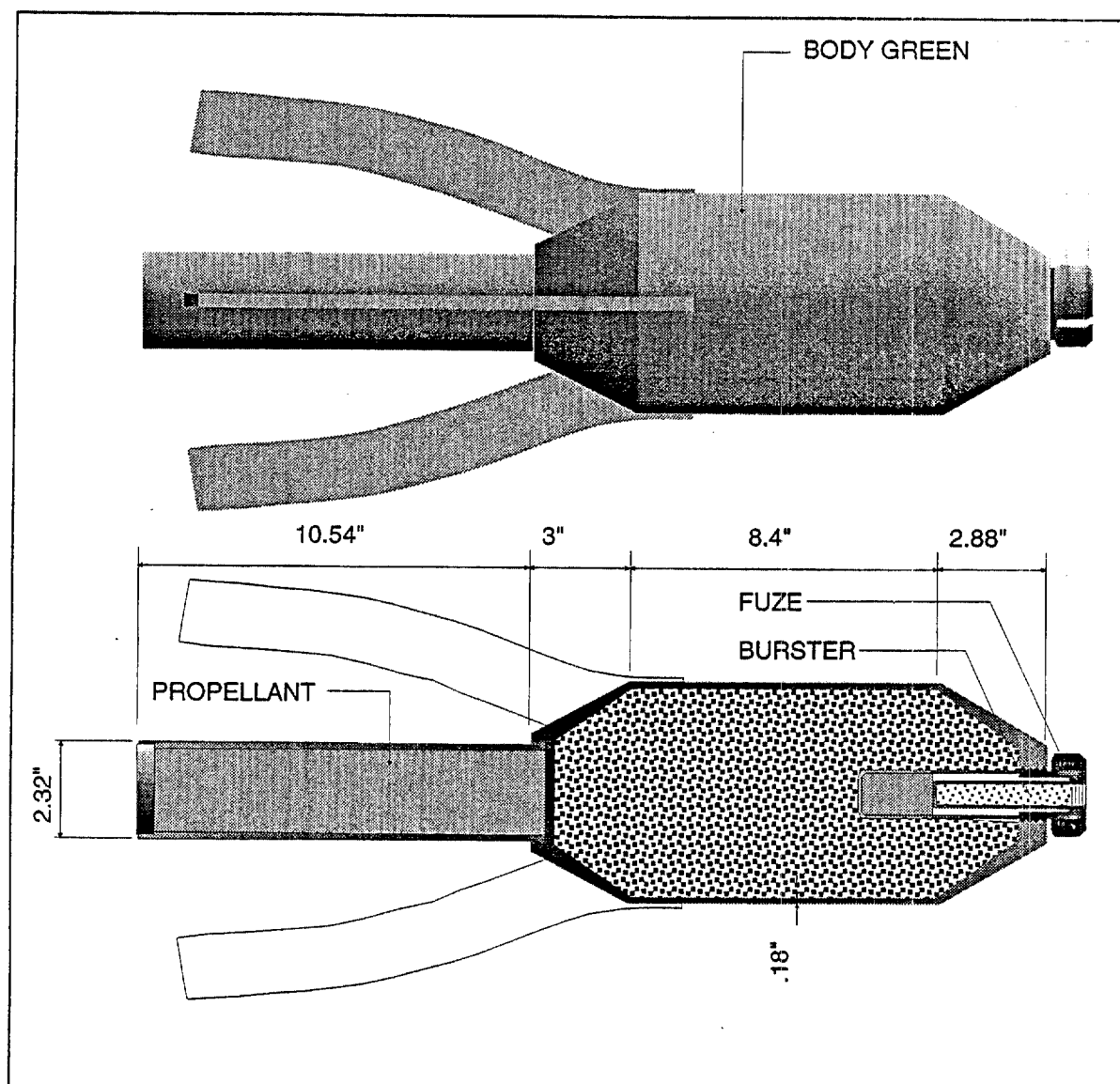
ENGINEERING DATA:

Construction:

Main Body: Wall thickness 4.5 mm at the center. Other dimensions are shown in the drawing.

REFERENCES:

1. Technical Manual 60A-8-1-2: EODP German Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918 (N.p.: EODP, 1 April 1976).



Drawing not to scale

Figure 2.3.13-1. Mid-Range Gas Mine (Rocket) with Three Fins

2.3.14 NOMENCLATURE: French Projectile (Rocket) with Six Fins (German nomenclature for captured French munition)

TABULATED DATA:

Length: 762 millimeters (30 in.) (approximate)

Diameter: 140 millimeters (5.5 in.) (approximate)

Type of Fill and Fill Weight:

phosgene (60%) and tin tetrachloride (40%): 5.36 kilogram (11.8 lb)

Total Weight with Fill:

Estimated 21 kilogram (original text not clear)

Markings:

The rocket body is painted green. There is a white ring above the fins indicating toxic filler. The letters CO and numeral 5 are painted in white. The CO designates colognite opacite. The filling date and plant are stencilled on the main body (18 Dec 1917, Aubervilliers).

Description:

Information for this rocket is limited to that found in German Intelligence Data Sheets on WWI chemical ammunition prepared in 1918. This rocket was known by the Germans to exist since March 1918.

Explosive Train:

Information is not available.

ENGINEERING DATA:

Construction:

Main Body: Wall thickness 7.5 mm at the center.

REFERENCES:

1. Technical Manual 60A-8-1-2: EODP German Intelligence Data Sheets on World War I Chemical Ammunition-British, French, Italian, Russian-1918 (N.p.: EODP, 1 April 1976).

**GERMAN
CHEMICAL MUNITIONS**

TABLE OF CONTENTS

Section	Title	Page
	LIST OF ILLUSTRATIONS	3-ii
	LIST OF TABLES	3-iii
3	GERMAN CHEMICAL MUNITIONS	
3.1	INTRODUCTION	3-1
3.2	GERMAN TOXIC CHEMICAL CODES AND MARKING SYSTEM ...	3-1
3.2.1	World War I	3-1
3.2.2	World War II	3-2
3.3	AERIAL BOMB MARKINGS	3-5
3.4	TECHNICAL DESCRIPTIONS	3-6
3.4.1	7.5-centimeter, Light Trench Mortar Chemical Shell, D Mine ...	3-7
3.4.2	7.6-centimeter Trench Artillery Chemical Shell	3-10
3.4.3	7.7-centimeter Artillery Chemical Shell (7.7-centimeter Gun) ...	3-14
3.4.4	10-centimeter Chemical Mortar, Shell, Type 35 St., One Yellow Ring (Wgr. 35 Nb St. Gelbring)	3-17
3.4.5	10.5-centimeter Artillery Chemical Shell	3-20
3.4.6	15-centimeter Artillery Chemical Shell	3-25
3.4.7	15-centimeter Artillery Chemical Shell, Type 19	3-29
3.4.8	15-centimeter Artillery Chemical Shell, Type 39	3-32
3.4.9	21-centimeter Field Artillery Chemical Shell	3-35
3.4.10	10-liter Chemical Land Mine, Type 37 (10 l. Sp. Bü 37)	3-38
3.4.11	15-centimeter Chemical Rocket, Type 41	3-41
3.4.12	KC 250 Aerial Chemical Bomb	3-45
3.4.13	KC 500 Aerial Chemical Bomb, One or Two Green Rings (KC 500 II Gr)	3-49

LIST OF ILLUSTRATIONS

Figure	Title	Page
3.4.1-1	7.5-centimeter, Light Trench Mortar Chemical Shell, D Mine	3-9
3.4.2-1	7.6-centimeter Trench Artillery Chemical Shell	3-13
3.4.3-1	7.7-centimeter Artillery Chemical Shell (7.7-centimeter Gun)	3-16
3.4.4-1	10-centimeter Chemical Mortar, Type 35 St., One Yellow Ring (Wgr. 35 Nb St. Gelbring)	3-19
3.4.5-1	10.5-centimeter Artillery Chemical Shell, One Green Ring (F.H. Gr. Grünring)	3-22
3.4.5-2	10.5-centimeter Artillery Chemical Shell, Type 39, One Yellow Ring (F.H. Gr. 39 Gelbring)	3-23
3.4.5-3	10.5-centimeter Artillery Chemical Shell, Type 38, One Green Ring (F.H. Gr. 39 Grünring 1)	3-24
3.4.6-1	15-centimeter Artillery Chemical Shell, Green Ring Yellow, Type Jaeger 38 Nb, (Jgr. 38 Nb)	3-27
3.4.6-2	15-centimeter Artillery Chemical Shell, Type 38, Green Ring One (Gr. 38 Grünring 1)	3-28
3.4.7-1	15-centimeter Artillery Shell, Type 19, One Green Ring (Gr. 19, Grünring)	3-31
3.4.8-1	15-centimeter Artillery Chemical Shell, Type 39, One Yellow Ring (Gr. 39, Gelbring)	3-34
3.4.9-1	21-centimeter Field Artillery Chemical Shell	3-37
3.4.10-1	10-liter Chemical Land Mine, Type 37, One Yellow Ring (10 l. Sp. Bü 37 Gelbring) (Ref. 1)	3-40
3.4.11-1	15-centimeter Chemical Rocket Type 41, Green Ring Yellow (Wgr. 41, Grünring-Gelb)	3-44
3.4.12-1	KC 250 Aerial Chemical Bomb, One Yellow Ring	3-48
3.4.13-1	KC 500 Aerial Chemical Bomb, One or Two Green Rings (KC 500 II Gr)	3-51

LIST OF TABLES

Table	Title	Page
3-1	German Munitions Agent Markings	3-1
3-2	World War I Toxic Gas Markings	3-2
3-3	World War II German Marking System	3-3
3-4	Artillery Ammunition Color Codes	3-3
3-5	German Letter Filling Codes (Artillery)	3-4
3-6	Munitions/Burster Combinations and Corresponding Markings (Artillery)	3-5
3-7	Weight Codes for Aerial Bombs	3-6
3-8	Filling Codes for Aerial Bombs	3-6

SECTION 3

GERMAN CHEMICAL MUNITIONS

3.1 INTRODUCTION

German chemical weapons consisted of a full array of mortars, rockets, artillery shells, and aerial bombs developed during World Wars I and II. The Germans developed an elaborate system of marking these munitions to readily identify their content and explosive charge. See Acronyms/Abbreviations for a list of chemical agents and related terms.

3.2 GERMAN TOXIC CHEMICAL CODES AND MARKING SYSTEM

3.2.1 World War I. In World War I, the Germans classified their agents on the *degree* of effect caused by the agent rather than *nature* of the effect. German agents were grouped into four categories. Each group was identified by a colored cross, similar to the Geneva Cross: a yellow cross signified vesicants and persistent fills, a green cross denoted lung irritants and nonpersistent fills, a blue cross signified irritants, and a white cross denoted a lacrimator. There was no uniform base color for gas shells. The earlier shells were gray. The later shells were painted blue with a yellow ogive. Table 3-1 lists World War I agents as they correspond to the cross markings. Note: Spelling is as shown in source documents.

Table 3-1. German Munitions Agent Markings

Marking	Signification	Toxic Gas
yellow cross	vesicants and persistent fills	mustard dimethyl sulfide dichlordimethyl ether*
green cross	lung irritants and nonpersistent fills	chlorine phosgene (D-stoff or Per Stoff) diphosgene (K-stoff)
blue cross	irritants	diphenylchloroarsine (DA) diphenylcyanarsine ethyldichlorarsine
white cross	lacrimator	xylyl bromide (T-stoff) bromacetone (B-stoff) brommethylethylketone (Bn-stoff)

Note:

* This was used to increase the volatility of ethyldichlorarsine, also a lethal agent in itself.

In addition to the colored cross, numbers were sometimes added to distinguish fills with additives or combinations of fillers. Sources list several other markings used by the Germans during World War I. Table 3-2 lists the color, number, and multiple cross combinations.

Table 3-2. World War I Toxic Gas Markings

Marking	Toxic Gas
green cross 1	30-70% diphosgene 70-30% chloropicrin phenylcarbylamine chlorine or brommethylethyl ketone
green cross 2	65% phosgene 20% diphosgene 15% diphenylchlorarsine*
double green cross	67% diphosgene 33% TNT
yellow cross	80-90% mustard 10-20% carbon tetrachloride or 10-20% chlorobenzene
yellow cross 1 (later called green cross 3)	48% ethyldichlorarsine 52% dichlormethylether or 37% ethyldichlorarsine and 40-45% ethyldibromarsine 17-18% dichloromethyl ether
double yellow cross	67% mustard 33% high explosive

Note:

*Percentage of mixture could vary +/- 2-3 percent.

3.2.2 World War II. Some usage of the colored cross marking system continued during World War II; however, early in the war, the Germans changed to a system of colored bands or rings encircling the munitions for identification. Table 3-3 lists of German markings and associated lethal chemical agents.

Table 3-3. World War II German Marking System

Marking	Toxic Gas
none	arsine
1 green band *	chlorine
2 green bands	diphosgene
3 green bands	dichloromethylarsine (ED)
1 green band	AC (HCN)
none	winterlost (HL)
1 yellow band	dichloromethylarsine
2 yellow bands	mustard
1 yellow band	nitrogen mustard
1 white band	phenyldichlorarsine
1 green band *	CG

Note:

* According to the complexity of German markings and the resources reviewed, the one green band was used to identify more than one type of toxic gas fills.

Artillery munitions examined after World War II do not entirely agree with the above markings. The numbers 1, 2, or 3 were used with the colored bands or may have been absent. In one case, two colored bands were used on the same munitions with the yellow ring half the width of the green ring. In some instances, the colors indicated the type of burster in the munitions. The color codes with the associated lethal agents in artillery ammunition are given in table 3-4.

Table 3-4. Artillery Ammunition Color Codes

Marking	Agent/Burster
1 yellow ring	mustard (small burster)
1 green ring	mustard (medium burster)
green ring yellow	mustard (large burster)
green ring 1	nitrogen mustard (HN)
green ring 3	tabun (GA)

Note:

The nomenclature of rings and bands is interchangeable.

In combination with the colored bands, a letter or pair of letters may have been stenciled on the munitions, which indicated the exact filling. The letters and associated fillings are shown in table 3-5.

Table 3-5. German Letter Filling Codes (Artillery)

Letter	Filling
B	thiodiglycol mustard and arsenöl (1:1) (winterlost)
C	thiodiglycol mustard and chlorobenzol (4:1) (winterlost)
D	thickened mustard
E	thickened mustard
F	phosgene
G	tabun
GA	tabun and 20% chlorobenzol
H	diphosgene
K	nitrogen mustard (HN-3)
L	thiodigylcol mustard-anthracenol (2:1) (winterlost)
O	thiodiglycol mustard (summerlost)
P	hydrogen cyanide

Shells filled with B or O fillings were distinguished by a code stenciled in the same color as the ogive ring color. The mustard-filled shell with a small burster had Gb and G/B stenciled in yellow, while the medium burster had Gb and L/O stenciled in green.

The letters FES or KPS may have been stenciled or stamped near the rotating band, indicating the material composition of the rotating band. The large Roman numerals I, II, III, and IV indicate the weight class.

Pink, yellow, green, or brown paint was used in the vicinity of the ogive and the filling plug. (The paint was known as "detector paint".) Codes for bursters were stenciled, usually in black, and stamped between the bourrelet and the rotating band. The code, burster type, burster composition, and corresponding munitions are shown in table 3-6.

Table 3-6. Munitions/Burster Combinations and Corresponding Markings (Artillery)

Code	Type	Burster Composition	Munitions
32	medium	PETN/Wax	10.5-centimeter shell 15-centimeter green ring shell 15-centimeter green ring yellow green ring 1 rocket
36/38	small	PETN/Wax (60:40)	10.5-centimeter shell 15-centimeter 1 yellow ring 10-centimeter 1 yellow ring mortar projectile
37	head	PETN/Wax (60:40)	10.5-centimeter shell 15-centimeter 1 yellow ring type 39 shell
91	large	RDX/Wax (95:5)	10.5-centimeter green ring yellow 10.5-centimeter green ring 1 15-centimeter green ring 1 type 38 shell
95	large	RDX/TNT	10.5-centimeter F.H.Gr. shell 15-centimeter green ring 3 type 39 shell

Note:

The code 38 or Wkh (Weite Kammerhulse) indicated a large burster. The code 39 (Znischenboden) indicated a head burster.

3.3 AERIAL BOMB MARKINGS

Aerial bombs were either field gray or tan. Like artillery munitions, the nose of the bomb had a colored ring that indicated the class. The bombs had up to three colored rings and no numerals. Stenciled in black was a number and weight (14-3.2 kg) that indicated the type of burster and the weight of the explosive in the burster. The filling plug was painted with "detector paint." The code for the filling was stenciled in black, followed by a design number. In a contrasting color within a broken circle was the type of fuze used with the bomb. The nomenclature, which included the type (KC) and the weight class (250 or 500) of the bomb and the abbreviation of the color coding, was stenciled in a contrasting color behind the second color ring. The abbreviations are shown in table 3-7.

Table 3-7. Weight Codes for Aerial Bombs

Abbreviation	Meaning
Gb	1 yellow ring
II Gb	2 yellow rings
Gr	green and yellow rings
II Gr	1 green ring (or 2 green rings)
III Gr	3 green rings

The code letters on German bombs (C, D, etc.) are the same as those found on artillery ammunition. Table 3-8 indicates the color codes and toxic chemical fills of German aerial bombs.

Table 3-8. Filling Codes for Aerial Bombs

Color Codes	Filling
1 yellow ring	mustard/arsenöl (1:1) (winterlost)
2 yellow rings	thickened winterlost
yellow and green ring	mustard/arsenöl (1:1) (winterlost)
1 green ring or 2 green rings	phosgene
3 green rings	tabun (GA)

The markings on German chemical mines are the same as those found on artillery shells and aerial bombs. The mines had one or two concentric yellow circles on top, with the filling date and filling code. The nomenclature was stenciled in white.

3.4 TECHNICAL DESCRIPTIONS

The following pages present technical information on each German chemical munition.

3.4.1 NOMENCLATURE: 7.5-centimeter, Light Trench Mortar Chemical Shell, D Mine

TABULATED DATA:

Length: 27.4 centimeters (10.79 in.) (without fuze)

Diameter: 7.5 centimeters (2.95 in.)

Type of Fill and Fill Weight:

CG: 0.65 kilogram (1.43 lb)

Total Weight with Fill:

CG: 4.54 kilograms (10 lb)

Markings:

The main body color is unknown; however, three rings were painted on the upper third of the projectile, approximately 1.7 centimeters below the fuze. There was also a large letter D on the aft third of the projectile.

Description:

The series of lethal trench-mortar (minenwerfer) shells, called D Mines, was filled with pure phosgene (D-Stoff) and differed from the earlier C Mines mainly in that there was no separate container for the liquid gas. The complete D Mine weighed 4.54 kilograms (10 pounds) and held 0.65 kilogram (1.43 pounds) of phosgene.

Explosive Train:

Fuze:

Model no.:	L.W.M.Z
Overall length:	unknown
Total weight:	unknown

Burster:

Model no.:	unknown
Explosive type:	picric acid
Explosive weight:	0.014 kilogram (0.3 oz)

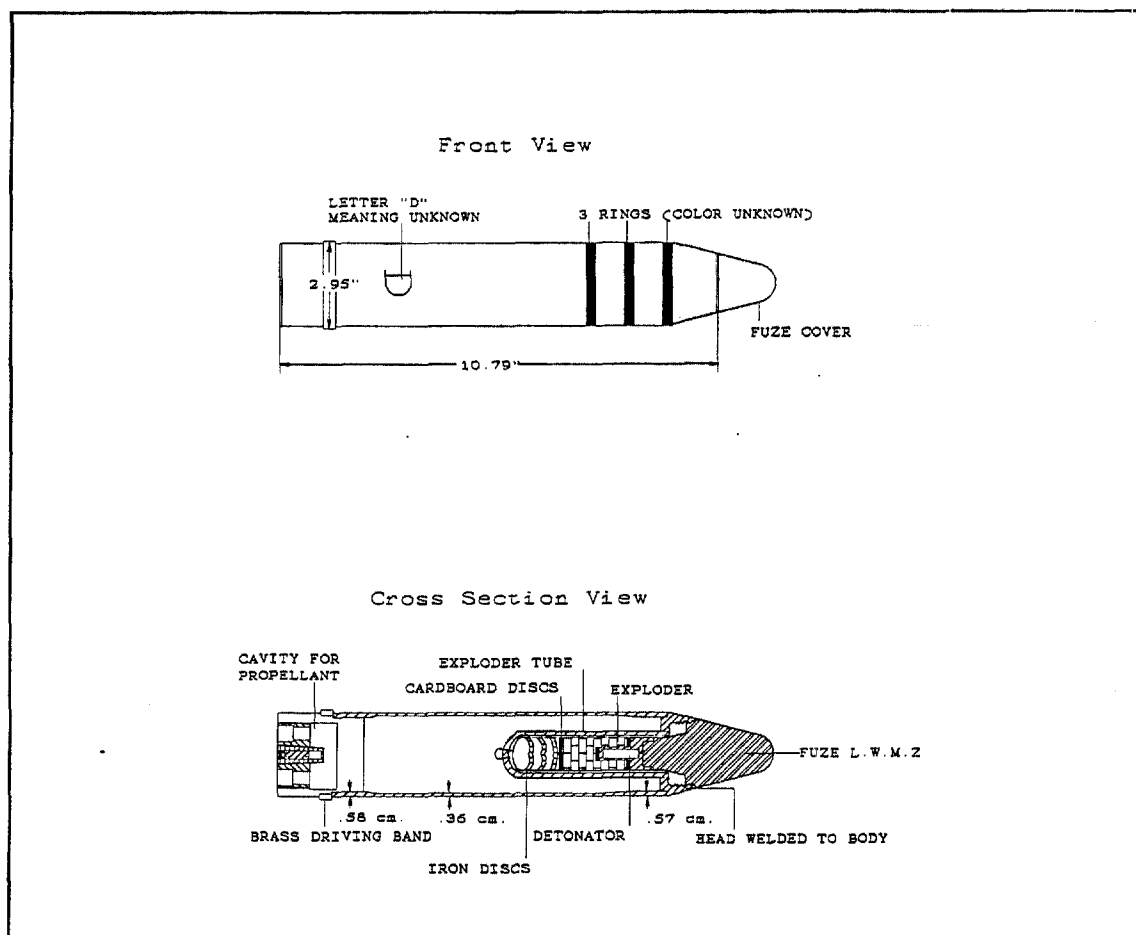
ENGINEERING DATA:

Construction:

Wall thickness: upper third of round 0.57 centimeter (0.224 in.);
 middle of round 0.36 centimeter (0.14 in.);
 lower third of round (above driving band) 0.58 centimeter (0.23 in.)

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare (New York and London: McGraw-Hill Book Company, Inc., 1937) 449.
2. General Staff (Intelligence), General Headquarters, Notes on German Fuzes and Typical French and Belgian Fuzes (London: Harrison and Sons, 1918) 180-181.



Drawing not to scale

Figure 3.4.1-1. 7.5-centimeter, Light Trench Mortar Chemical Shell,
D Mine (Ref. 1)

3.4.2 NOMENCLATURE: 7.6-centimeter Trench Artillery Chemical Shell

TABULATED DATA:

Length: 27.4 centimeters (10.79 in.) (C-Shell and D-Shell) old pattern

24.8 centimeters (9.76 in.) (Type 3, short ogival head)

Diameter: 7.6 centimeters (2.99 in.)

Type of Fill and Fill Weight:

CG (D-stoff): 0.663 kilogram (1.46 lb)

DP (K-stoff): unknown

Note: D-stoff, known as phosgene, was also called Per Stoff.

Total Weight with Fill:

CG: 4.39 kilograms (9.68 lb)

DP (K-stoff): unknown

Markings:

The main body of the shells was gray with two white bands near the head. When the shell was filled with K-stoff, the letter C in white was painted on the body. If the shell was filled with diphosgene (DP), the letter C was painted in red on the body.

In an older style of marking, three white bands about 8 millimeters (0.31 inch) wide, with the letter D were stenciled in black on the body. Stamped on the wall above the driving band was the nomenclature: II M E 16 GGF 30 k.

In the Type 2, ogival head munitions, the color of the round-headed gas shell was a darker gray than that of the cone-headed shell. At the head there were three white bands of the same width and spacing as in the older cone-headed type. The letter D was either stenciled in black or omitted.

Description:

This munition was developed in several versions: the older C and D shells and newer versions with ogival heads. In the older models, the head was welded to the body. The edge of the tube was flanged toward the end, and the flange was welded to a thick steel disk with a central hole, apparently for filling. It would appear that the shell was sealed after filling by pressing a disk of lead surmounted by an iron disk in such a way that the lead disk was forced partly through the filling hole. At the periphery and

around the edges of the filling hole, the iron disk came into contact with the steel bottom disk.

A second pair of disks was pressed against the iron disk, followed by a third pair. One source surmises that the iron disks were probably concavo-convex when inserted, and were placed concave side downwards. When pressed from above they tended to flatten out, and their edges pressed against the walls of the exploder tube. Above the top disk was a cardboard disk upon which rested the picric acid exploder.

The Type 2 (ogival head) differed from the above version in the shape of the head and in the method of closing the filling hole. The head and the exploder tube were in one piece, which was welded to the shell wall. The thickness of the base of the exploder tube was augmented by the addition of a plate welded around the edge. After it was filled, the shell was sealed by screwing the closing screw down to a lead washer surmounted by an iron washer. A cardboard disk was placed above the screw head where the picric acid exploder was placed.

A Type 3 (Short Ogival Head) shell was 24.8 centimeters (9.76 inches) in length. It had the ogival head, a new type of fuze, and a larger agent-fill capacity than the previous versions. The tendency with each succeeding type of this shell was to increase the amount of phosgene fill. The short shell was filled through a hole in the shell wall. This hole was closed by an iron screw plug.

Explosive Train:

Fuze:

Model no.:	L.W.M.Zdr. 16
Overall length:	unknown
Total weight:	unknown

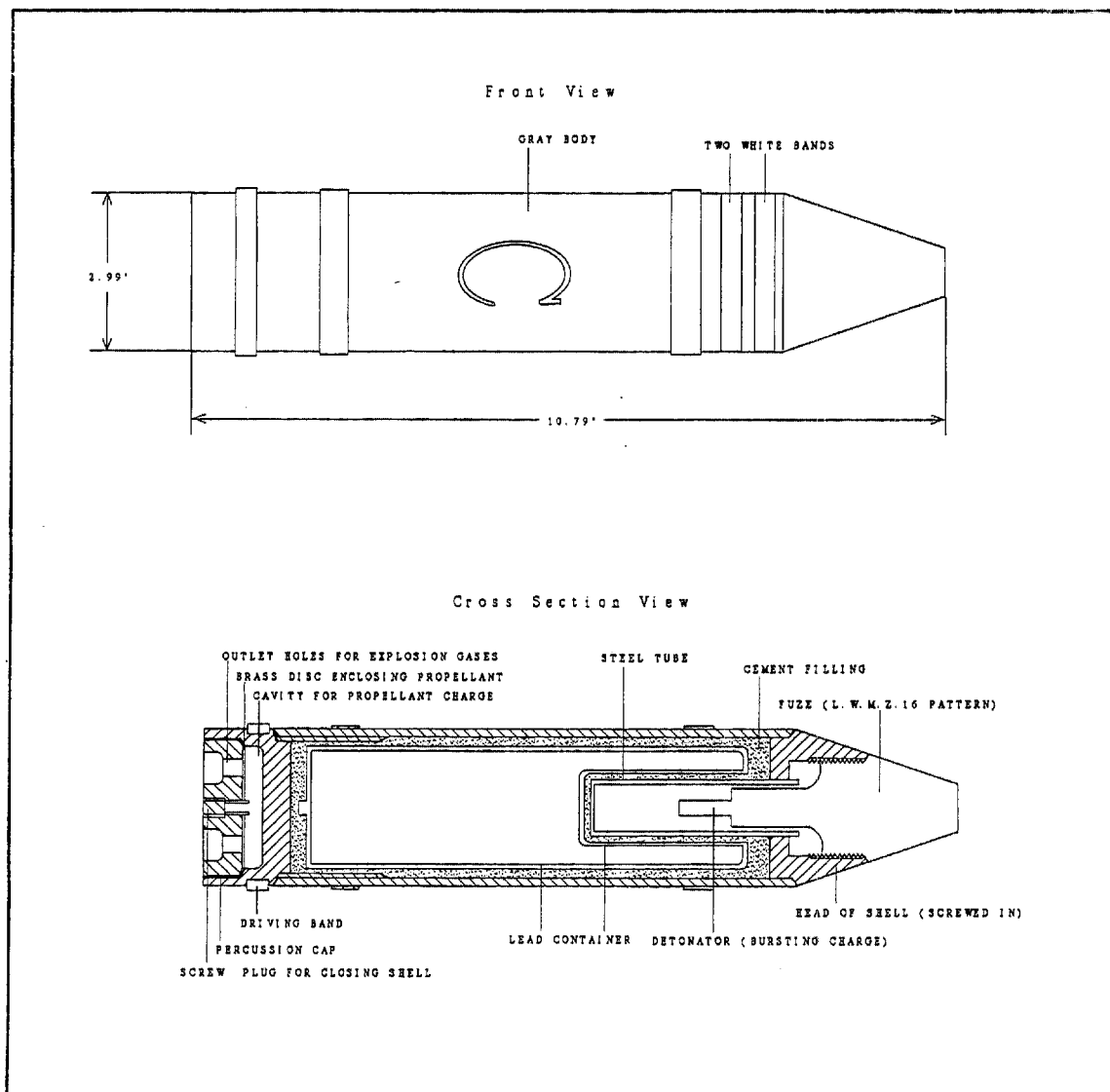
ENGINEERING DATA:

Construction:

Main body:	drawn steel
Wall thickness:	0.36 centimeter (0.14 in.) (C and D shells)

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare (New York and London: McGraw-Hill Book Company, Inc., 1937) 439-440, 437.
2. Anonymous, German Trench Mortar Minenwerfer. Document located at ARDEC Museum, Bldg 45, Book; Foreign, German, 17.4, Picatinny Arsenal, NJ (N.p.: n.p., n.d.) 70-77, 180-181, 352-357.



Drawing not to scale

Figure 3.4.2-1. 7.6-centimeter Trench Artillery Chemical Shell (Ref. 1)

**3.4.3 NOMENCLATURE: 7.7-centimeter Artillery Chemical Shell
(7.7-centimeter Gun)**

TABULATED DATA:

Length:

1915 Pattern: 24.3 centimeters (9.57 in.) (base of shell to base of fuze)

Modern Pattern: 31.3 centimeters (12.32 in.) (base of shell to base of fuze)

Diameter: 7.7 centimeters (3.03 in.) (both types)

Type of Fill and Fill Weight:

Note: Fill is based on common German descriptions of green and yellow cross and yellow cross. Other potential fills may be present. Fill for weight indicated is unknown.

chlorine: unknown
CG: unknown
DP: unknown
H: unknown

1915 Pattern: 0.49 kilogram (1.09 lb)

New Pattern: 1.0 kilogram (2.2 lb)

Total Weight with Fill:

1915 Pattern: 7.12 kilograms (15.7 lb)

New Pattern: 7.26 kilograms (16.0 lb) (long)

Markings:

The main body color is unknown. The letters and number K.Z. 14 were stenciled on the fuze.

Description:

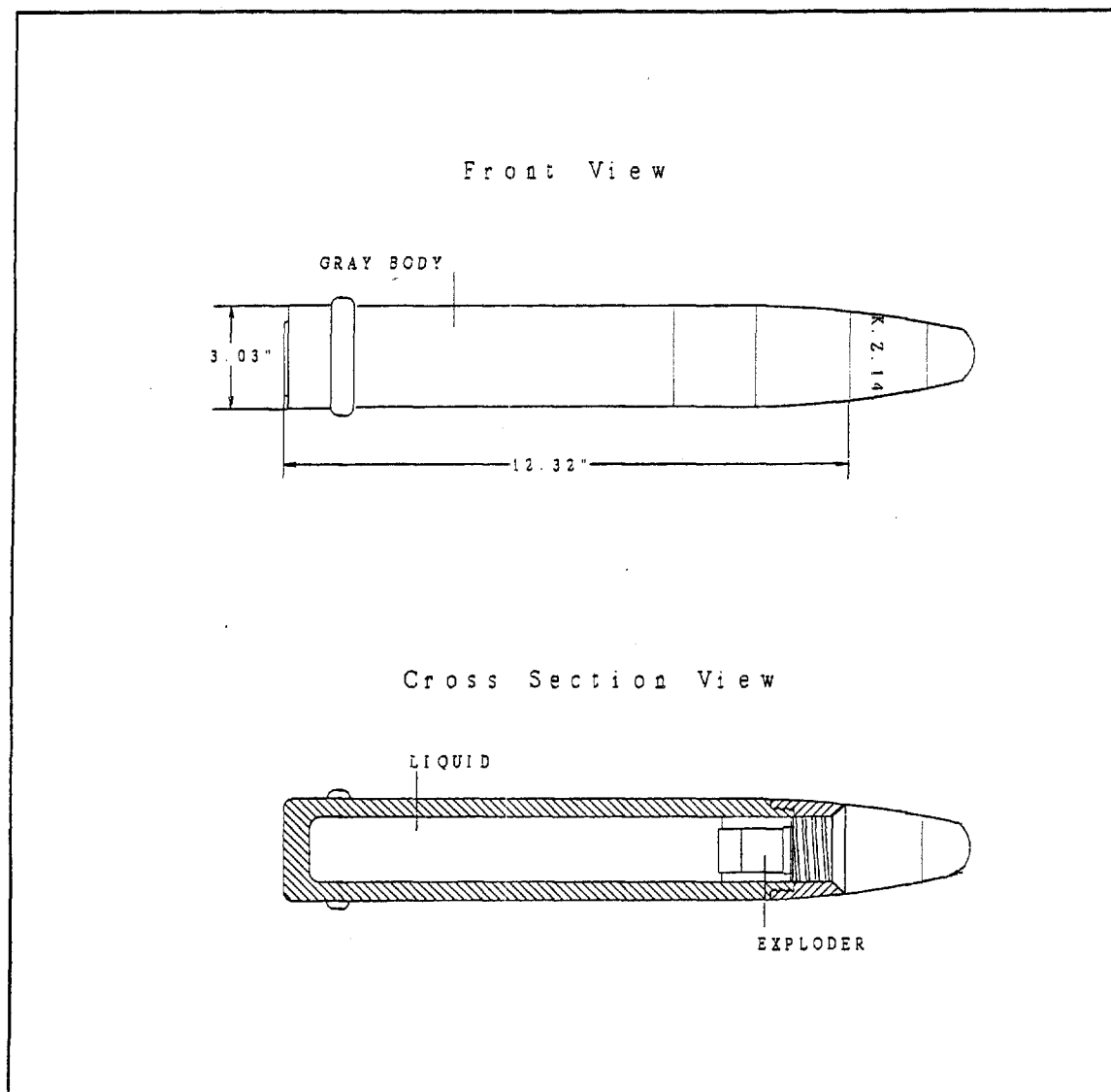
The sources reviewed contained little data regarding this projectile. There appear to be two patterns, which differ in the amount of agent fill and the overall length of the munitions. Other differences may be present but are unknown.

Explosive Train: unknown

ENGINEERING DATA: unknown

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare
(New York and London: McGraw-Hill Book Company, Inc., 1937)
446-447.



Drawing not to scale

Figure 3.4.3-1. 7.7-centimeter Artillery Chemical Shell
(7.7-centimeter Gun) (Ref. 1)

3.4.4 NOMENCLATURE: 10-centimeter Chemical Mortar, Type 35 St., One Yellow Ring (Wgr. 35 Nb St. Gelbring)

TABULATED DATA:

Length: 43.43 centimeters (17.1 in.)

Diameter: 10 centimeters (3.94 in.)

Type Fill and Fill Weight:

H/PD 15.0 kilograms (3.3 lb)

Note: PD is phenyldichlorarsine, a vesicant and lung irritant. The chemical filling is a mixture of a choking and a blood agent.)

Total Weight with Fill:

H/PD: 7.0 kilograms (15.4 lb)

Markings:

The main body color was olive green with characters Wgr. Z. 38 stamped on the fuze. G/B was stenciled in yellow on the body of the projectile. A series of letters and numbers, Gb. G/B 36/38, also was stamped on the body. One yellow ring was stenciled on the body, and the base had one yellow circle.

Description:

The projectile body is the standard German 10 centimeters (Wgr. 35 Nb. St. steel body, booster, burster, and burster well). The carrier consists of a cylindrical cardboard container with a hinged metal lid and a metal base cover, the latter containing a recess to protect the projectile fuze.

Explosive Train:

Fuze:

Model no.:	Wgr. Z. 38 or Wgr.238
Overall length:	6.5 centimeters (2.56 in.)
Total weight:	unknown

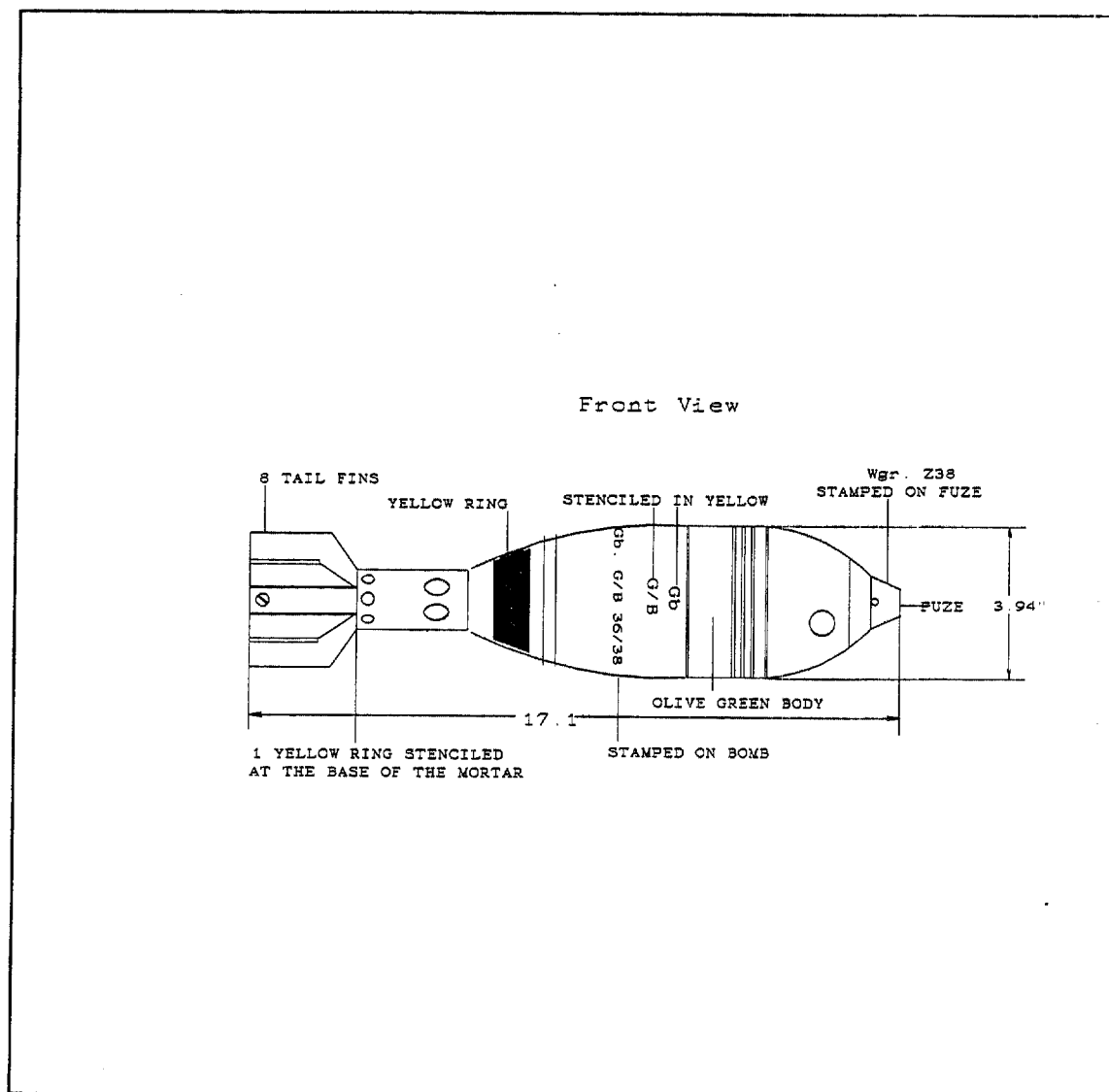
ENGINEERING DATA:

Construction:

Main body: steel
 8 tail fins on the base

REFERENCES:

1. U.S. Army Ordnance Bomb Disposal Center, German Projectiles and Fuzes, Aberdeen Proving Ground, MD: U.S. Army, 1 October, 1944) 270-271, 334-335.
2. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operations (N.p.: U.S. Army, n.d.) I-C-1.



Drawing not to scale

Figure 3.4.4-1. 10-centimeter Chemical Mortar, Type 35 St.,
One Yellow Ring (Wgr. 35 Nb St. Gelbring) (Ref. 2)

3.4.5 NOMENCLATURE: 10.5-centimeter Artillery Chemical Shell

TABULATED DATA:

Length: 48.76 centimeters (19.2 in.) (fuze included)

Diameter: 10.5 centimeters (4.13 in.)

Markings:

The main body color was olive green, with the notation K1 A.Z.23 Nb stamped on the base of fuze. Other markings are as shown in the following table.

German 10.5-centimeter Artillery Chemical Shell Markings				
Filler	Fill Weight	Total Weight	Burster	Markings
mustard (H)	1250 cc	13.98 kg (30.8lb)	central PETN/wax 90/10 125 gm	one green ring (F.H. Gr. Grünring)
winterlost (H/PD)	1250 cc	14.52 kg (32 lb)	central Cyclonite/wax 95/5 125 g	Type 38 green ring yellow (F.H. 38, Grünring-Gelb)
winterlost (H/PD)	1160 cc	14.52 kg (32 lb)	head burster PETN/wax 50/50 208 gm	Type 39 one yellow ring (F.H. 39, Gelbring)
nitrogen mustard (HN-3)	0.9 kg	14.2 kg (31.25 lb)	central Cyclonite/wax 95/5 0.6 kg	Type 38 green ring one (F.H. Gr. 38, Grünring 1)
tabun with 20% chlorobenzene (GA)	1200 cc	13.61 kg (30 lb)	head burster Cyclonite/TNT 50/50 215 gm	Type 39 green ring three (F.H. Gr. 39, Grünring 3)
DM with TNT	550 gm DM 900 gm TNT	14.8 kg (32.5 lb)	TNT surrounds DM fill	blue ring one (F.H. Gr. Blauring 1)
DM with nitrocellulose	837 gm 50/50 mix	14.1 kg (33.75 lb)	ejection charge 84 gm gunpowder	blue ring three (F.H. Gr. 40 Blauring 3)
CAP, PETN, wax 50/35/15 (no explanation of CAP; called CW/HE mixture)	1219 gm	14.5 kg (31.9 lb)	explosive filler	white ring (F.H. Gr. Weissring)

Description:

The length of the projectile was 48.76 centimeters (19.2 inches) with the fuze and 43.94 centimeters (17.3 inches) without the fuze. It had one rotating band, which was 1.50 centimeter (0.59 inch) wide. The cartridge case may have been brass-coated steel, unpainted steel, or black steel spirally bound and marked with the characters 6342/65C.

Explosive Train:

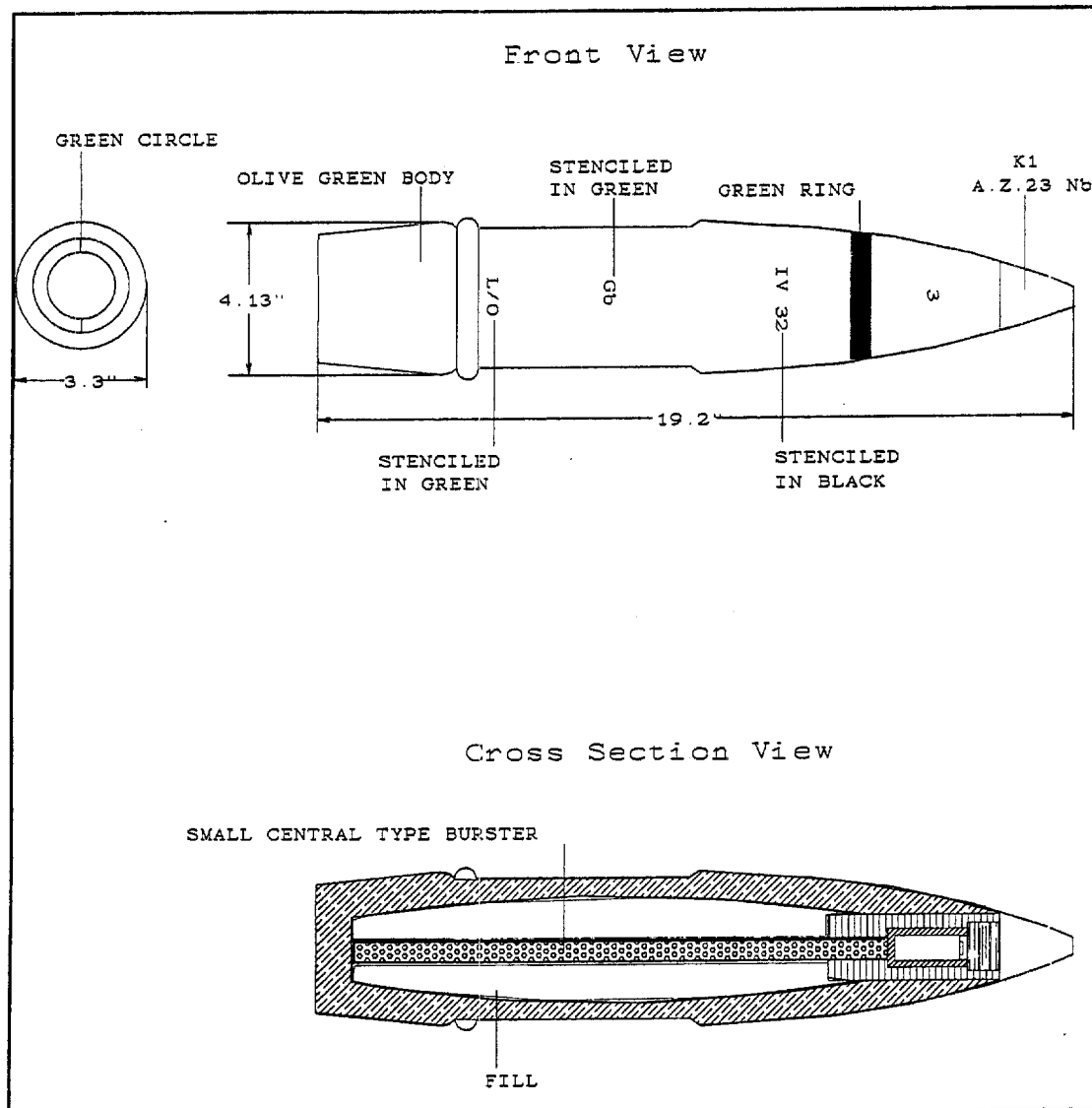
Fuze:

Model no.:	nose percussion fuze K1 A.Z. 23 Nb
Overall length:	6.82 centimeters (2.68 in.)
Total weight:	unknown

Burster: as listed in table 3-9

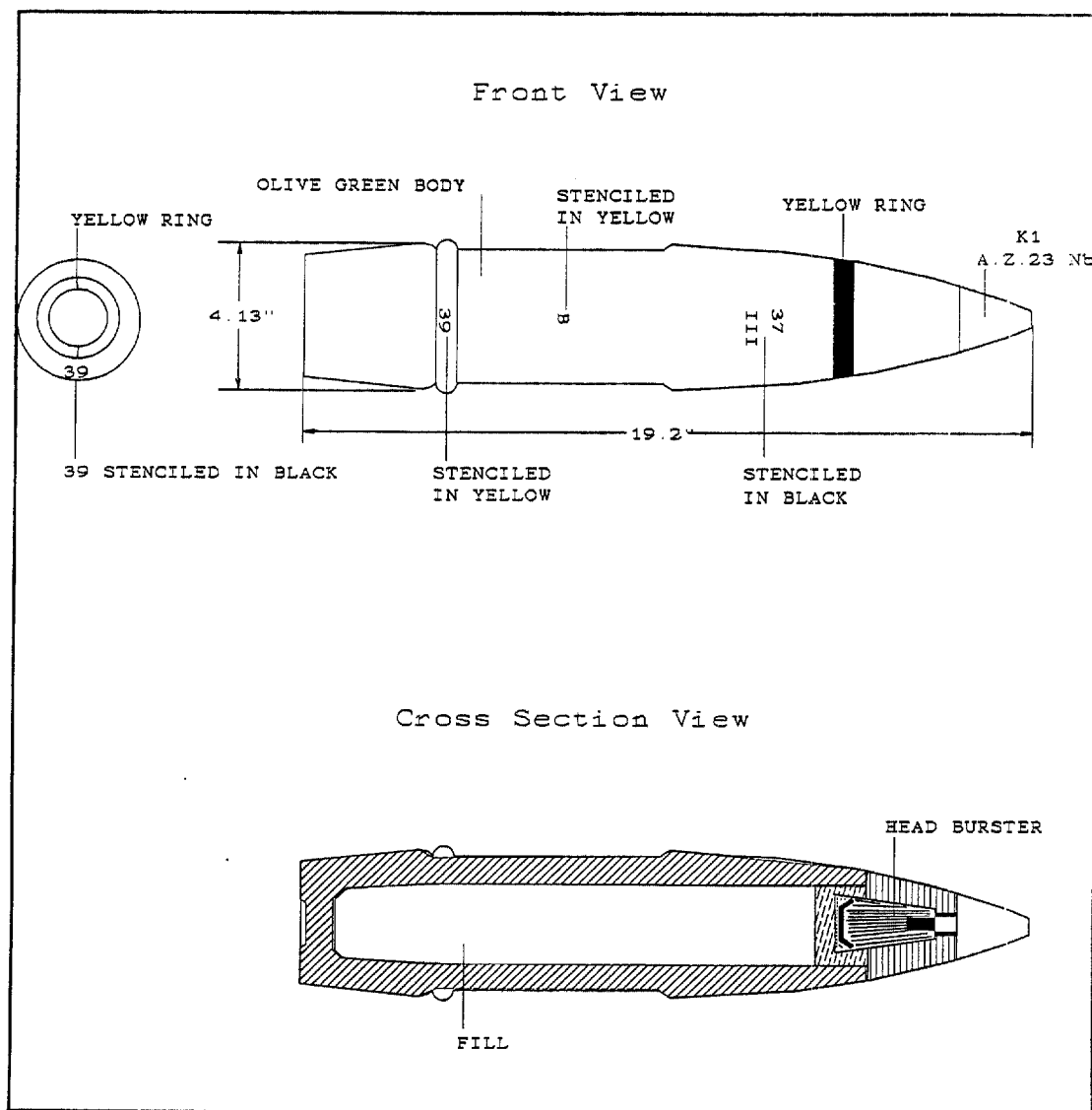
REFERENCES:

1. U.S. Army Ordnance Bomb Disposal Center, German Projectiles and Fuzes (Aberdeen Proving Ground, MD: Department of the Army, 1 October, 1944) 150-151.
2. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operations (N.p.: U.S. Army, n.d.) I-B-13.
3. Chemical Warfare Service, Headquarters, Theater of Service Force, Chemical Warfare in World War II, European Theater (N.p.: U.S. Army, September, 1945) 126.



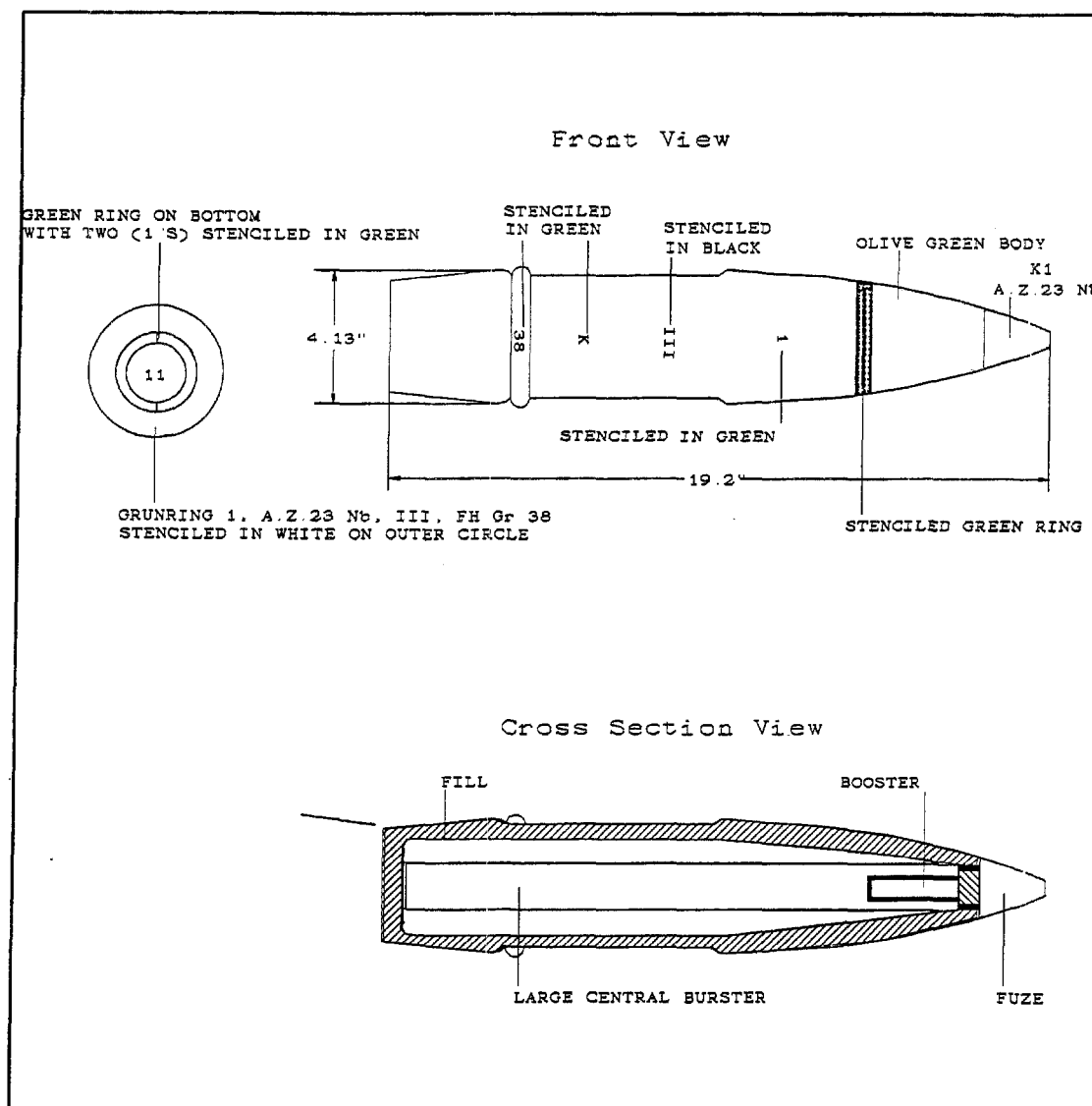
Drawing not to scale

Figure 3.4.5-1. 10.5-centimeter Artillery Chemical Shell, One Green Ring
(F.H. Gr. Grünring) (Ref. 2)



Drawing not to scale

Figure 3.4.5-2. 10.5-centimeter Artillery Chemical Shell, Type 39, One Yellow Ring (F.H. Gr. 39 Gelbring) (Ref. 2)



Drawing not to scale

Figure 3.4.5-3. 10.5-centimeter Artillery Chemical Shell, Type 38, One Green Ring (F.H. Gr. 39 Grünring 1) (Ref. 2)

3.4.6 NOMENCLATURE: 15-centimeter Artillery Chemical Shell

TABULATED DATA:

Length: 67.94 centimeters (26.75 in.) (fuze included)
67.82 centimeters (26.7 in.) (fuze included)

Diameter: 15 centimeters (5.91 in. at base)

Type of Fill and Fill Weight:

HN3: unknown
HE/HN-3: unknown

Note: The chemical filling HE/HN-3 is a blister agent with a high explosive.

Total Weight with Fill:

HN3: 38.10 kilograms (84 lb)
HE/HN-3: 37.78 kilograms (83.8 lb)

Markings:

Green Ring Yellow:

The main body of the shell was olive green with characters K1.A.Z. 40Nb stamped on the base of the fuze. On the upper third of the projectile, one yellow and one green ring were stenciled. Immediately below the green ring, the Roman numeral I was stenciled in green. Below the Roman numeral and above the bourrelet, the Roman numeral II was stenciled in black. Above the driving band, the letter K was stenciled in green. No information is available for the markings at the base of the projectile.

Green Ring One:

The main body color was olive green, with characters K1.A.Z. 40 Nb stamped on the base of the fuze. On the upper third of the projectile, there were two rings, one yellow and one green. Below the green ring was the Roman numeral I stenciled in green. Below the Roman numeral, midway along the body of the projectile was the Roman numeral II was stenciled in black. Below the two driving bands, the letter K was stenciled in green. There is no information on the base plate of the projectile.

Description:

Little information describing this projectile was found, other than the extensive markings found on the outer shell body. The markings were stenciled in green, yellow and black, with alphanumeric characters and the characteristic green and yellow rings.

Explosive Train:

Fuze:

Model no.:	Nose percussion fuze K1.A.Z. 40 Nb
Overall length:	6.82 centimeters (2.687 in.)
Total weight:	unknown

Booster charge:

Model no.:	Zdlg C/98 or Adlg C/98
Explosive type:	unknown
Explosive weight:	unknown

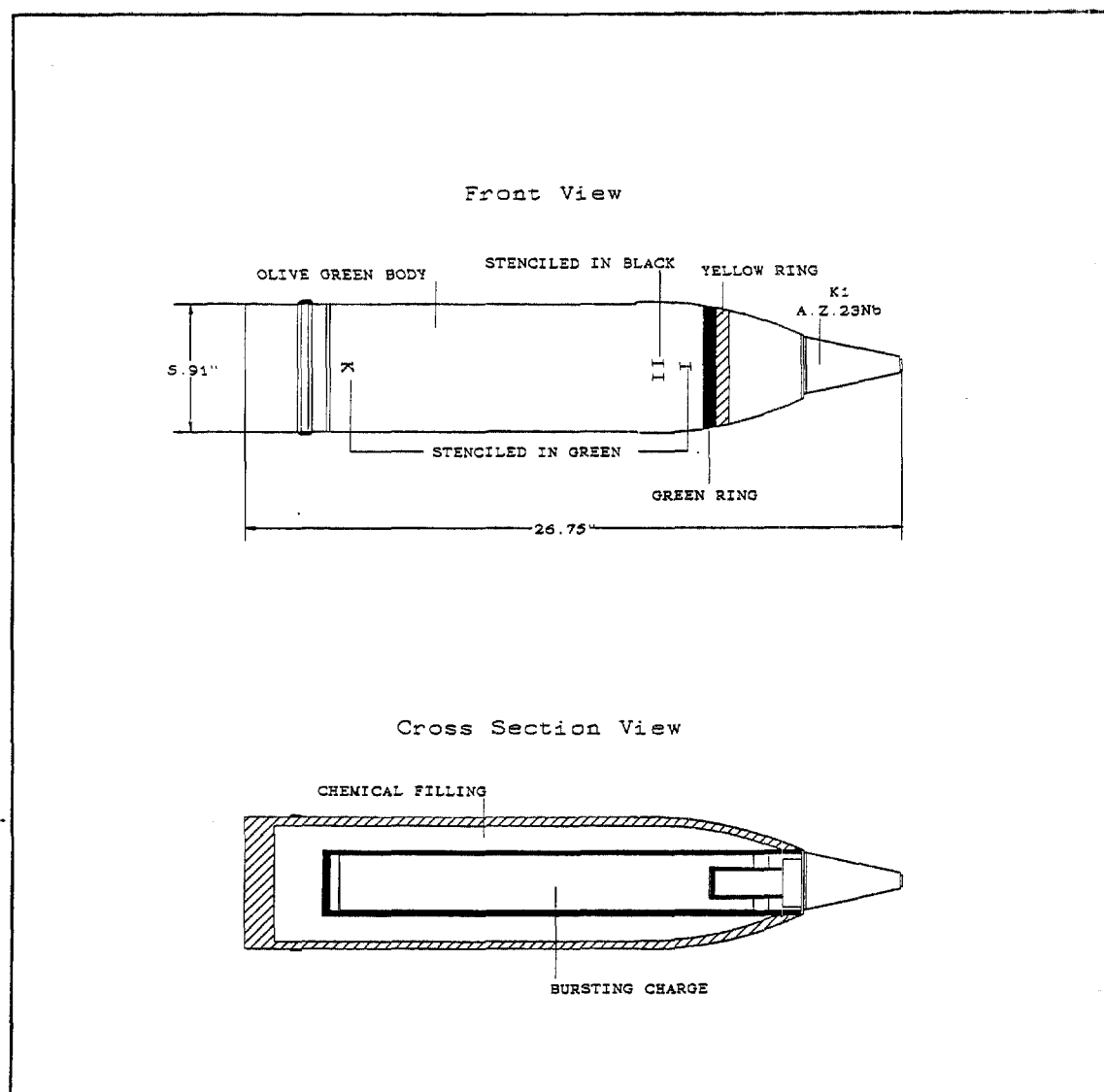
Burster:

Model no.:	unknown
Explosive type:	Cyclonite/wax (95/5)
Explosive weight:	unknown

ENGINEERING DATA: unknown

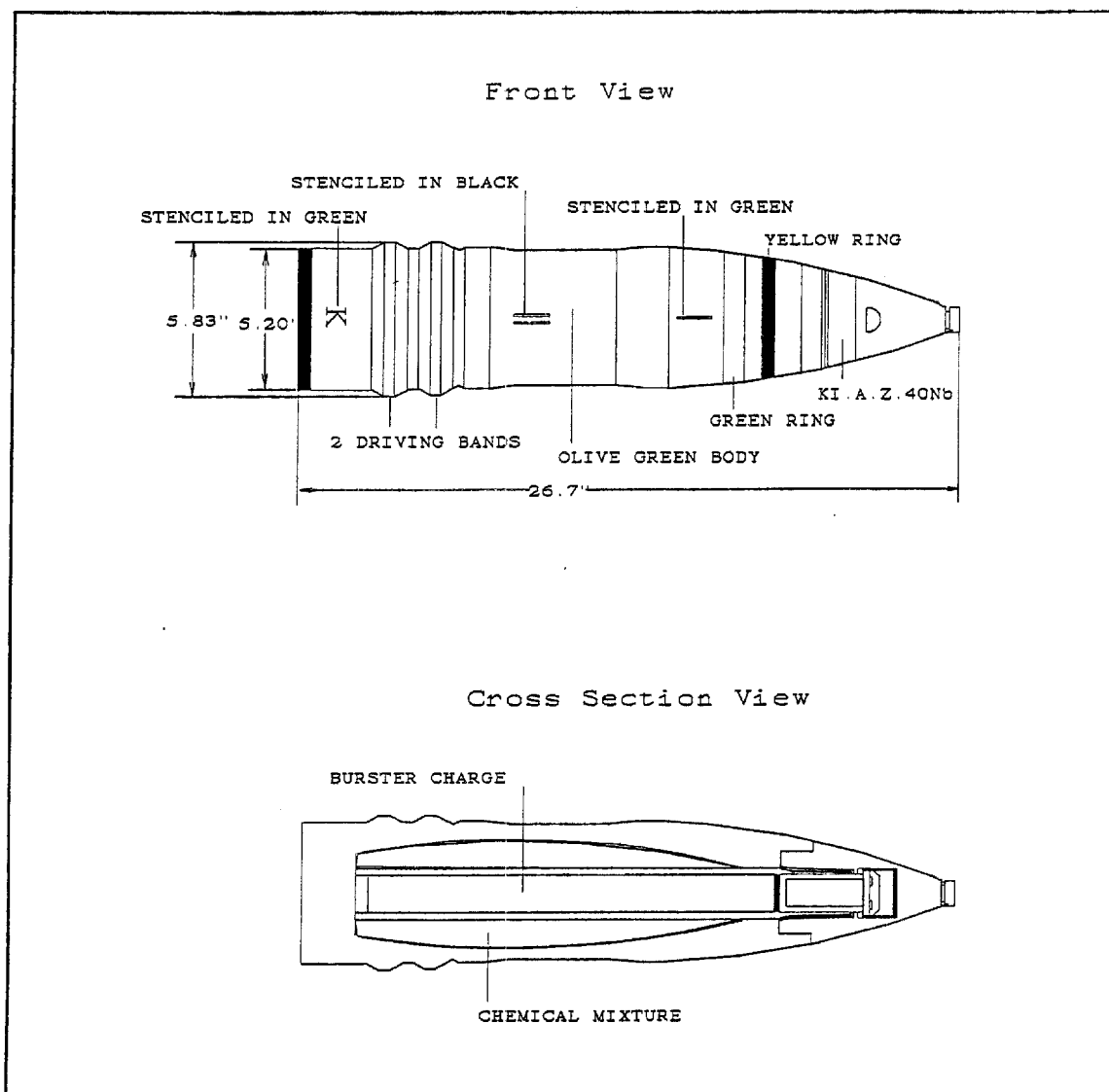
REFERENCES:

1. U.S. Army Ordnance Bomb Disposal Center, German Projectiles and Fuzes (Aberdeen Proving Ground, MD: U.S. Army, 1 October, 1944) 192-193.
2. Chemical Warfare Service, Headquarters, Theater of Service Force, Chemical Warfare in World War II, European Theater (N.p.: U.S. Army, September, 1945) 126.
3. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operation (N.p.: U.S. Army, n.d.) I-B-31.



Drawing not to scale

Figure 3.4.6-1. 15-centimeter Artillery Chemical Shell, Green Ring Yellow, Type Jaeger 38 Nb, (Jgr. 38 Nb) (Ref. 1)



Drawing not to scale

Figure 3.4.6-2. 15-centimeter Artillery Chemical Shell, Type 38, Green Ring One (Gr. 38 Grünring 1) (Ref. 3)

3.4.7 NOMENCLATURE: 15-centimeter Artillery Chemical Shell,
Type 19

TABULATED DATA:

Length:

Projectile: 61.47 centimeters (24.21 in.) with AZ fuze
68 centimeters (26.77 in.) with Dopp. Z fuze

Diameter: 15 centimeters (5.83 in.) at bourrelet
13.21 centimeters (5.2 in.) at base

Type of Fill and Fill Weight:

H: weight unknown
H/PD: 4.81 kilograms (10.6 lb)

*Note: The chemical filling H/PD is a mixture of a choking and a blister agent.
PD is phenyldichlorarsine, a vesicant and lung irritant.*

Total Weight with Fill:

H: 36.74 kilograms (81 lb)
H/PD: 37.33 kilograms (82.3 lb)

Markings:

The main body color was olive green with characters A.Z.23Nb stamped on the base of the fuze. One green ring or one yellow ring was stenciled on the upper third of the projectile. Below the ring, the Roman numeral II was stenciled in black. Below the Roman numeral and above the bourrelet, the letters Gb were stenciled in green. Immediately above the two driving bands, the code L/O was stenciled in green. The bottom of the base of the projectile had one green ring stenciled on it.

Description:

Little information describing this projectile was found other than the extensive markings on the outer shell body. The markings were stenciled in green, yellow, and black, with alphanumeric characters and the characteristic green ring.

Explosive Train:

Fuze:

Model no.: A.Z. 23 (0.8) μ mg;
A.Z. 23 (0.2) μ mg;
A.Z. 23m.2V μ mg;
or Time and Percussion fuzes Dopp. Z. s/60s;
Dopp. Z./60 lm

Overall length: unknown
Total weight: unknown

Booster charge:

Model no.: Gr.Zdlg C/98 Nb or Zdlg C/98
Explosive type: unknown
Explosive weight: unknown

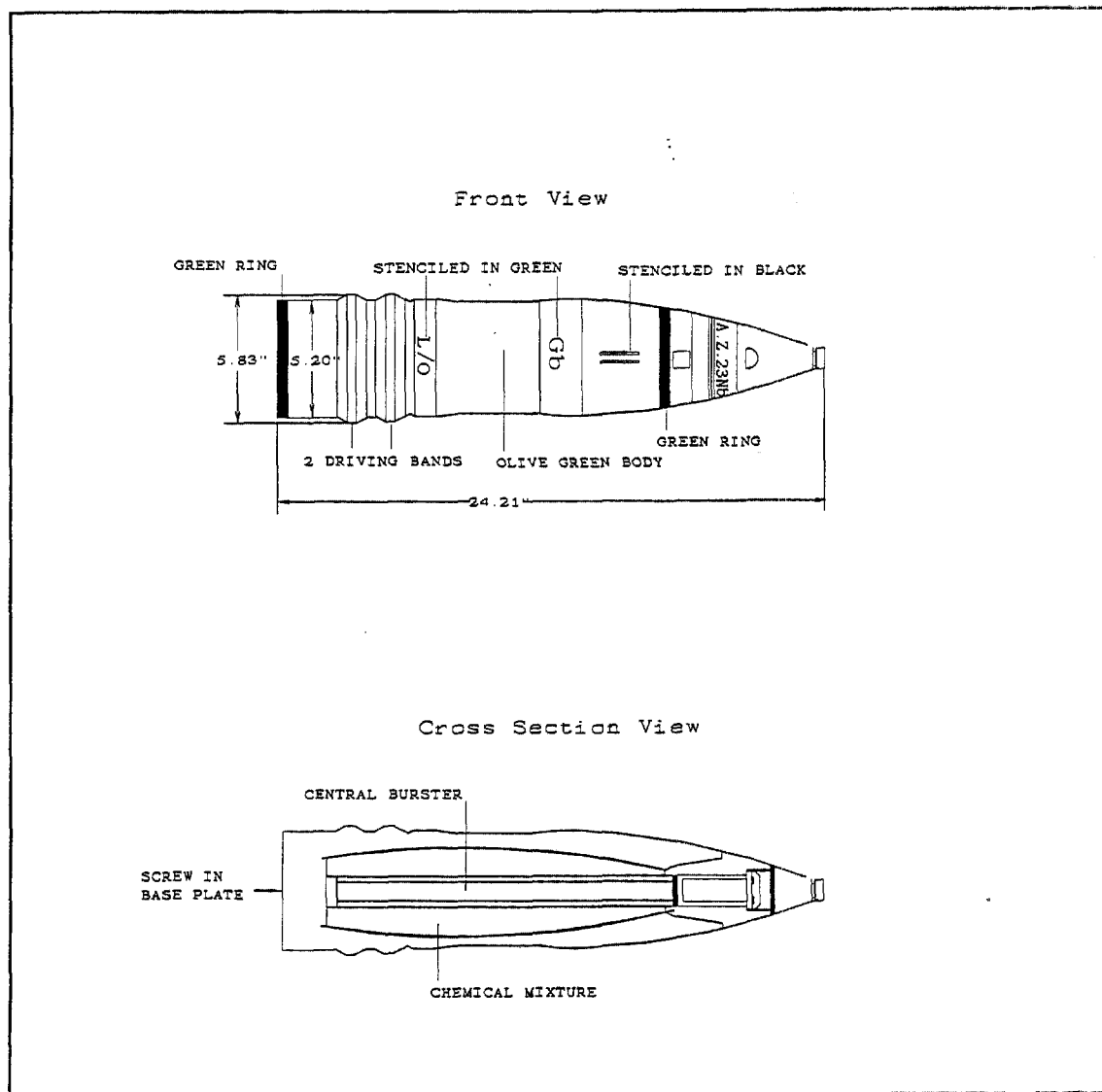
Burster:

Model no.: unknown
Explosive type: smoke or PETN/Wax (95/5)
Explosive weight: unknown

ENGINEERING DATA: unknown

REFERENCES:

1. U.S. Army Ordnance Bomb Disposal Center, German Projectiles and Fuzes (Aberdeen Proving Ground, MD: U.S. Army, 1 October, 1944) 200-201.
2. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operations (N.p.: U.S. Army, n.d.) I-B-35.
3. Chemical Warfare Service, Headquarters, Theater of Service Force, Chemical Warfare in World War II, European Theater (N.p.: U.S. Army, September, 1945) 126.



Drawing not to scale

Figure 3.4.7-1. 15-centimeter Artillery Shell, Type 19,
One Green Ring (Gr. 19, Grünring) (Ref. 1)

**3.4.8 NOMENCLATURE: 15-centimeter Artillery Chemical Shell,
Type 39**

TABULATED DATA:

Length: 66.04 centimeters (26 in.) (fuze included)

Diameter: 15 centimeters (5.9 in.)

Type of Fill and Fill Weight:

H/PD: 4.81 kilograms (10.6 lb)

Note: The chemical filling is a mixture of a choking and a blister agent. PD is phenyldichlorarsine, a vesicant and lung irritant.

GA: estimated 3 kilograms (6.6 lb)

Total Weight with Fill:

H: 36.29 kilograms (80 lb)

GA: 34.47 kilograms (75.8 lb)

Markings:

Gr. 39, Gelbring (one yellow ring):

The main body color was olive green, with characters K1.A.Z. 40 Nb stamped on the base of the fuze. On the upper third of the projectile, there was one yellow ring. Below the yellow ring was the Roman numeral II stenciled in black. Below the Roman numeral, midway along the body of the projectile, was the letter B stenciled in yellow. Immediately above the two driving bands was the number 39 stenciled in yellow. The base plate of the projectile had a yellow circle stenciled on it.

Gr. 39, Grunring 3 (green ring three):

The main body color was olive green, with the characters K1.A.Z. 40 Nb stamped on the base of the fuze. One green ring was stenciled on the upper third of the projectile, with the number 3 immediately below it. Below the number, the Roman numeral II was stenciled in black. Below the Roman numeral and midway down on the projectile body, the letters GA were stenciled in green. Above the two driving bands, the number 39 was stenciled in green. On the base plate of the projectile, one green circle was stenciled with the number 3.

Description:

Little information describing this projectile was found, other than the extensive markings on the outer shell body. The markings were stenciled in green, yellow and black, with alphanumeric characters and the characteristic yellow ring.

Explosive Train (projectile):

Fuze:

Model no.:	K1. A.Z. 40 Nb
Overall length:	6.82 centimeters (2.687 in.)
Total weight:	unknown

Booster charge:

Model no.:	Gr. Zdltg C/98 Nb or Zdlg C/98
Explosive type:	unknown
Explosive weight:	unknown

Burster:

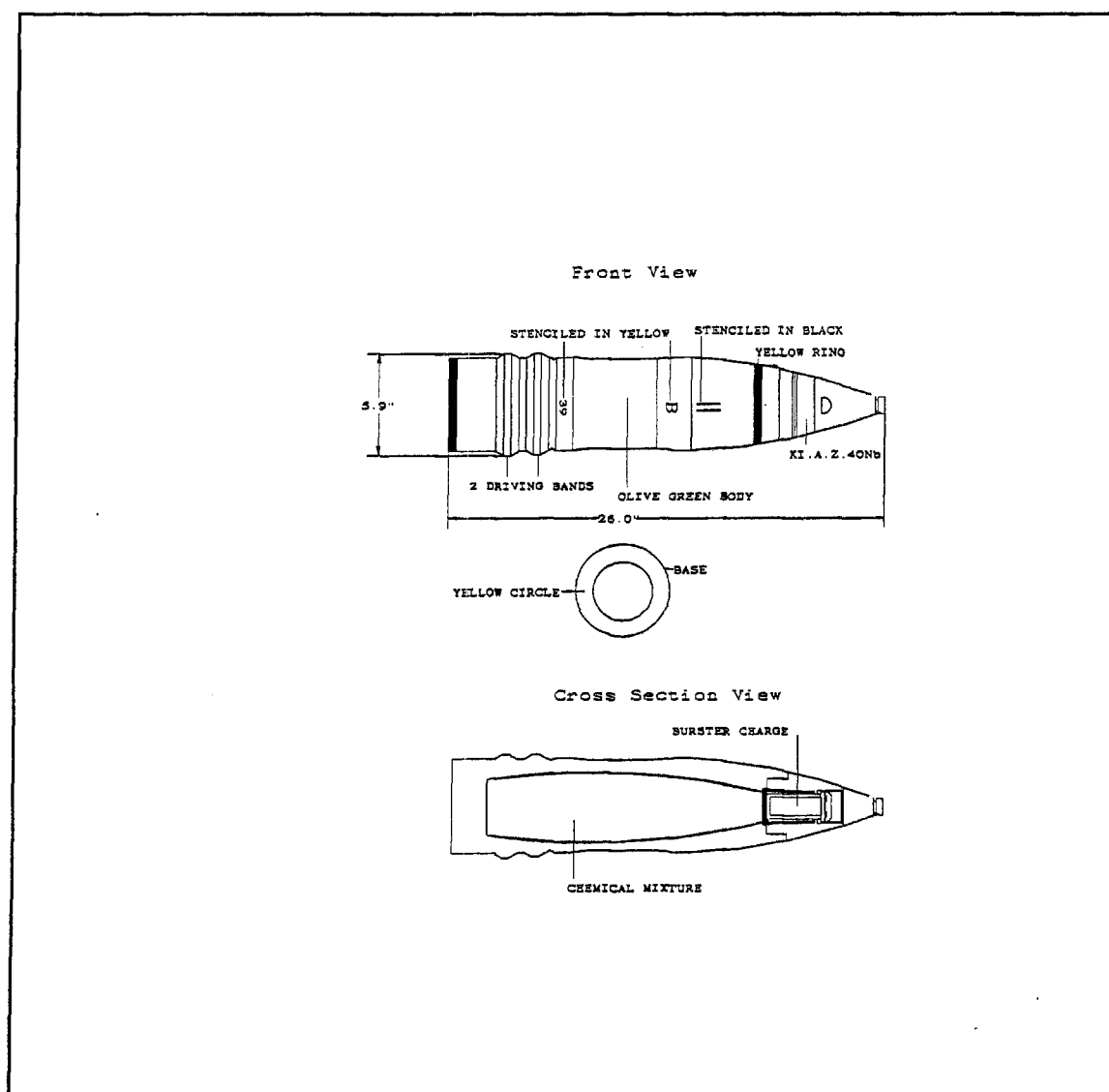
Note: This shell differs from the other Gelbring round (15-centimeter, Type 19, one yellow ring) in that it had the burster in the ogive only.

Model no.:	unknown
Explosive type:	PETN (60/40) (head burster) for H/PD fill RDX (central burster) for GA fill
Explosive weight:	unknown

ENGINEERING DATA: unknown

REFERENCES:

1. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operations (N.p.: U.S. Army, n.d) I-B-34.
2. Chemical Warfare Service, Headquarter, Theater of Service Force, Chemical Warfare in World War II, European Theater (N.p.: U.S. Army, September, 1945) 125-126.
3. U.S. Army Ordnance Bomb Disposal Center, German Projectiles and Fuzes (Aberdeen Proving Ground, MD: U.S. Army, 1 October, 1944) 200-201



Drawing not to scale

Figure 3.4.8-1. 15-centimeter Artillery Chemical Shell, Type 39,
One Yellow Ring (Gr. 39, Gelbring)(Ref. 3)

3.4.9 NOMENCLATURE: 21-centimeter Field Artillery Chemical Shell

TABULATED DATA:

Length: unknown

Diameter: 21 centimeters (8.27 in.)

Type of Fill and Fill Weight:

CG: unknown

DP: unknown

DC: unknown

HS: unknown

Total Weight with Fill: unknown

Markings:

The overall color of the projectile was gray with a large black band on the middle of the cylindrical body. Note: The markings on this projectile have not been confirmed.

Description:

The 21-centimeter shell had the letters G-Z and a letter on the base of the fuze that was unrecognizable. There was a booster that contained 18 grams of picric acid. Following the booster was a long central burster made of steel that contained TNT. This projectile had a cement seal below the booster and another one at the base of the burster tube. This projectile had one driving band. The drawing shows the rotating band engraved; however, it could not be verified whether the engraving on the rotating band was pre-engraved, or if it was caused by the firing of the munition.

Explosive Train:

Fuze: unknown

Booster:

Model no.: unknown

Explosive type: picric acid

Explosive weight: 18 grams

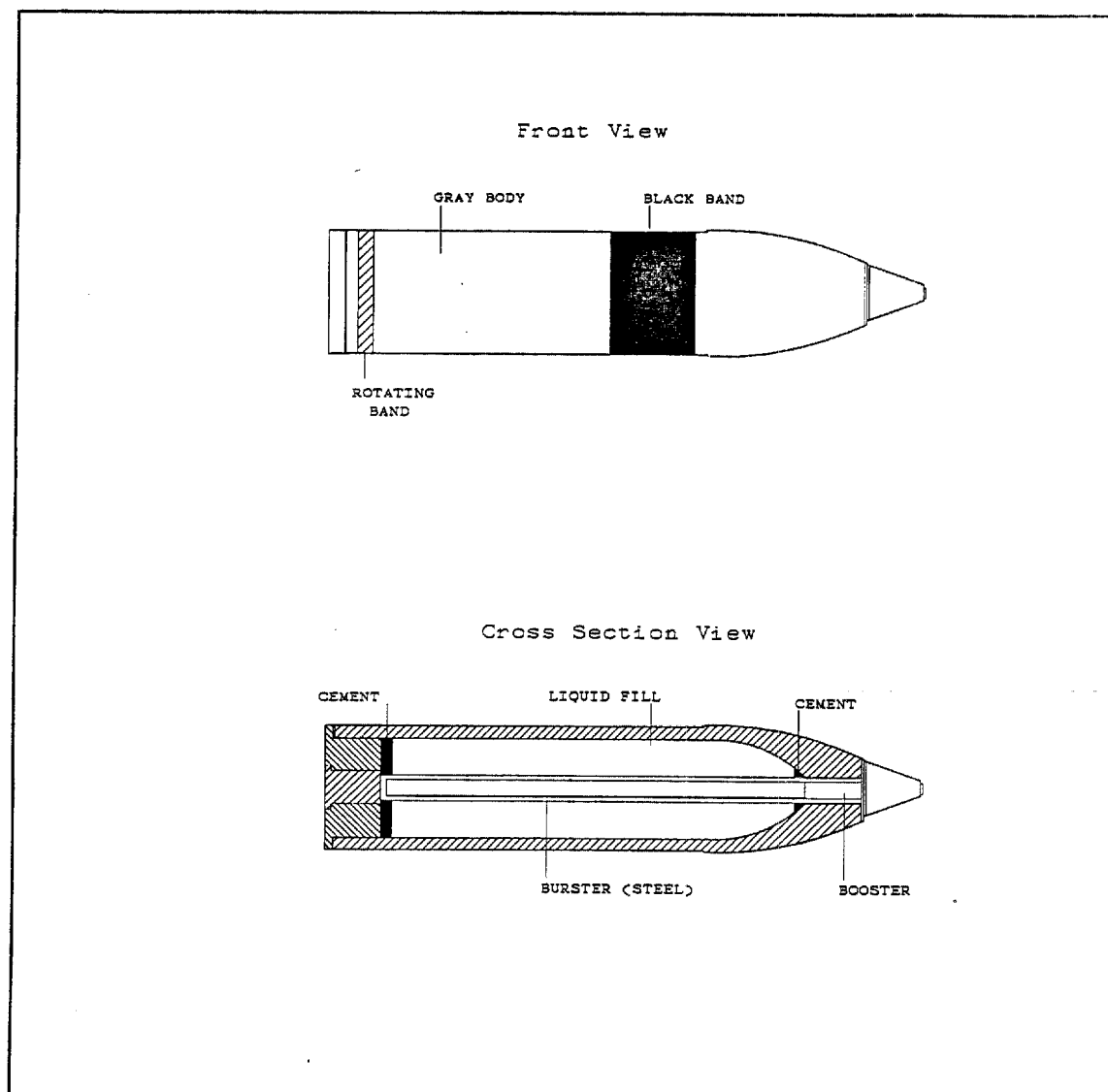
Burster:

Model no.:	unknown
Explosive type:	TNT
Explosive weight:	unknown

ENGINEERING DATA: unknown

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare (New York and London: McGraw-Hill Book Company, Inc., 1937) 473.
2. Anonymous, Figures 31 and 31a., U.S. Army Chemical Corps Museum, Ft. McClellan, AL (N.p.: n.p., n.d.).



Drawing not to scale

Figure 3.4.9-1. 21-centimeter Field Artillery Chemical Shell (Ref. 2)

3.4.10 NOMENCLATURE: 10-liter Chemical Land Mine, Type 37,
(10 l. Sp. Bü 37)

TABULATED DATA:

Length: 41.91 centimeters (16.5 in.)

Diameter: 20.32 centimeters (8 in.)

Type of Fill and Fill Weight:

H: 10.38 kilograms (22.9 lb)

H/PD: 12.88 kilograms (28.4 lb)

Note: The chemical filling H/PD is a mixture of a blister agent and PD (phenyldichlorarsine), a vesicant and lung irritant.

Total Weight with Fill:

H: 19.05 kilograms (42 lb)

H/PD: 19.95 kilograms (44 lb)

Markings:

One Yellow Ring:

The main body color was field gray overall with one yellow ring stenciled on the top of the cylinder. The letters and numbers Mr. 9. 39/B also were stenciled in yellow. The codes Mr. 18. 41, were stenciled on the side of the cylinder in red and 101 Sp. Bü. 37 was stenciled in white.

Two Yellow Rings:

The main body color was field gray overall, with the top of the cylinder having two yellow rings. The letters and numbers Mr. 22. 4. 40/E were also stenciled in yellow. The code 101 Sp. Bü. 37 was stenciled on the side of the cylinder in white.

Explosive Train (projectile):

Fuze:

Model no.: clockwork time fuze

Overall length: unknown

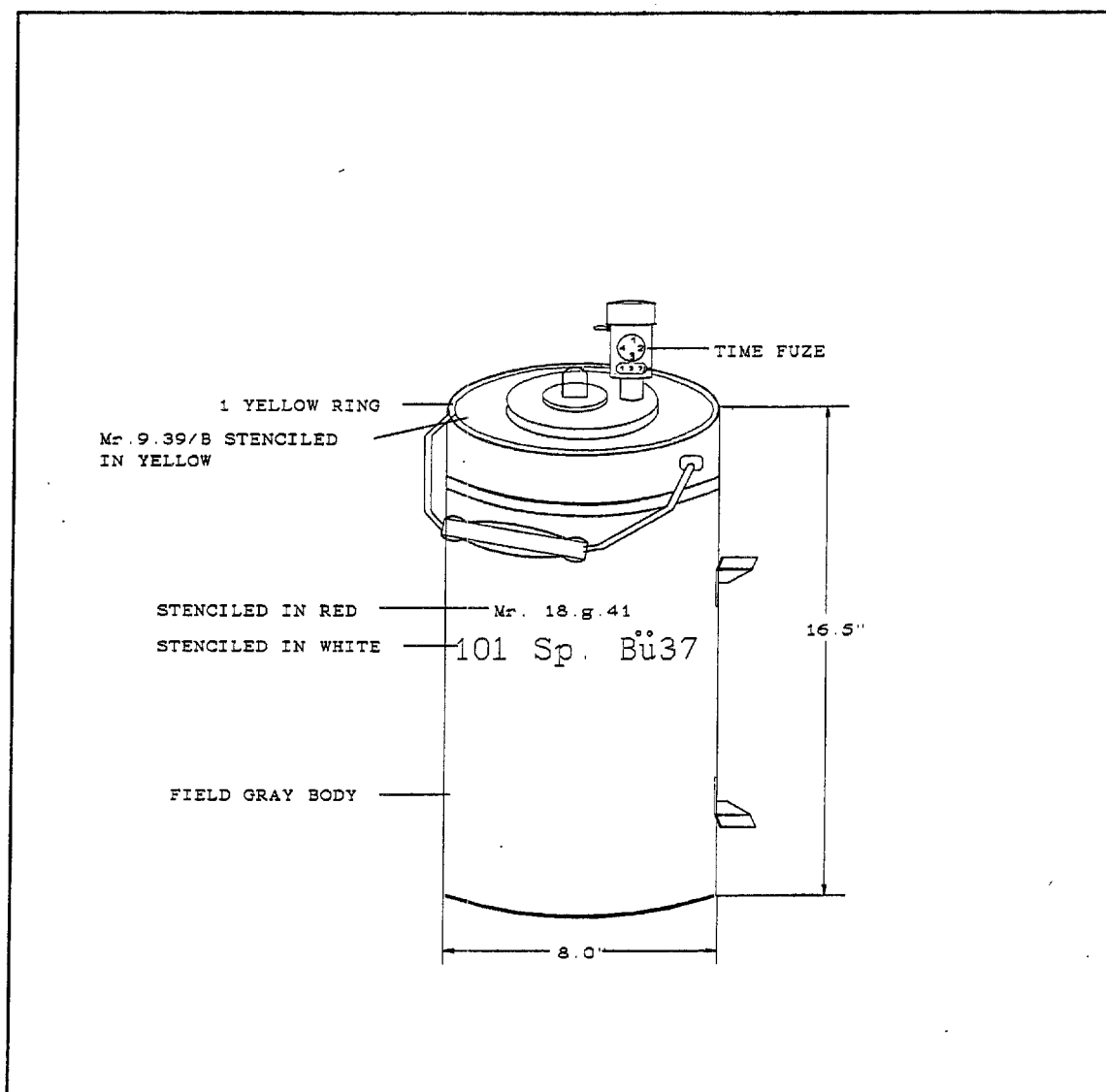
Total weight: unknown

ENGINEERING DATA:

Construction: pressed steel, with an inner container capable of holding 10 liters (2.6 gallons) of agent

REFERENCES:

1. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operations (N.p.: U.S. Army, n.d.) I-N-1, 1-N-2, and I-N-3.



Drawing not to scale

Figure 3.4.10-1. 10-liter Chemical Land Mine, Type 37,
One Yellow Ring (10 l. Sp. Bü 37 Gelbring) (Ref. 1)

**3.4.11 NOMENCLATURE: 15-centimeter Chemical Rocket, Type 41
(Tractor Rocket)**

TABULATED DATA:

Length: 101.6 centimeters (40 in.)

Diameter: 15.75 centimeters (6.2 in.)

Type of Fill and Fill Weight:

Filler	Filler Weight	Total Weight
H mustard	3.18 kg (7lb)	33.93 kg (74.8 lb)
H/PD (PD is phenyldichlorarsine, a vesicant and lung irritant)	4.67 kg (10.3 lb)	(35.38 kg (78 lb)
HN-3 (nitrogen mustard)	3.08 kg (6.8 lb)	33.84 (74.6 lb)
GA (tabun) with 20% chlorobenzene	3.18 kg (7 lb)	34.02 kg (75 lb)

Markings:

For Rockets Containing H:

The main body color was olive green, with one green and one yellow ring stenciled on the nose. The letters W.kh.Digl.n. were stenciled on the midsection of the body in white, with the code bls 22/1944 also stenciled in white. Immediately below the nozzle (forward end of aft section) the letter O was stenciled in green. On the aft end of the midsection the code Wkh was stenciled in green with one green ring and one yellow ring. (This rocket may have had the number 38 stenciled in green in the aft end of the midsection in place of the letters Wkh.)

For Rockets Containing H/PD:

The main body color was olive green, with one yellow ring stenciled on the nose. No information was available on the markings on the midsection. Immediately below the nozzle (forward end of aft section) the letter B stenciled in yellow. One yellow ring was stenciled on the aft section of the rocket.

For Rockets Containing HN-3:

The main body color was olive green, with one green ring and the number 1 stenciled on the nose. The letters W.kh.Digl.n. were stenciled in white, with the code biz 22/1944 also stenciled in white. Immediately below the nozzle (forward end of aft section) the letter K was stenciled in green. On the aft end of the midsection, the code Wkh was stenciled in green with one green ring and the number 1. The code designation Bd.Z. DOV Wg3 was stamped on the base of the fuze. (This rocket may have the number 38 stenciled in green in the aft end of the midsection in place of the letters Wkh. Pink bands were painted beneath the skirt and on the base of the projectile. Some projectiles have the number 38 stenciled in green above the green ring on the nose and just above the green ring on the projectile tail.)

For Rockets Containing GA:

The main body color was olive green with one green ring and the number 3 stenciled on the nose. The letters W.kh.Digl.n. were stenciled on the midsection of the body in white. Immediately below the nozzle (forward end of aft section) the letters GA were stenciled in green. On the aft end of the midsection the code Wkh or 38 was stenciled in green along with one green ring marked with the number 3. The code designation Bd.Z. DOV was stamped on the base of the fuze.

Description:

The 15-centimeter chemical rocket was used as either a chemical or a smoke munition. The rocket motor was at the head of the projectile. The rear or filling section was threaded to the motor section. With proper tools the motor and fill sections could easily be separated. All German chemical rockets were identical except for the markings and agent fill, which would alter the overall weight of the rocket. The Wgr.41 Grünring-Gelb shell consisted of a thin-wall steel cylinder with a long burster charge threaded to the aft end. The container that held the agent was threaded to receive a base fuze and a short exploder. This rocket is commonly known as the German "tractor rocket."

Explosive Train:

Fuze:

Model no.:	Bd. Z. DOV
Overall length:	3.49 centimeters (1.375 in.)
Total weight:	unknown

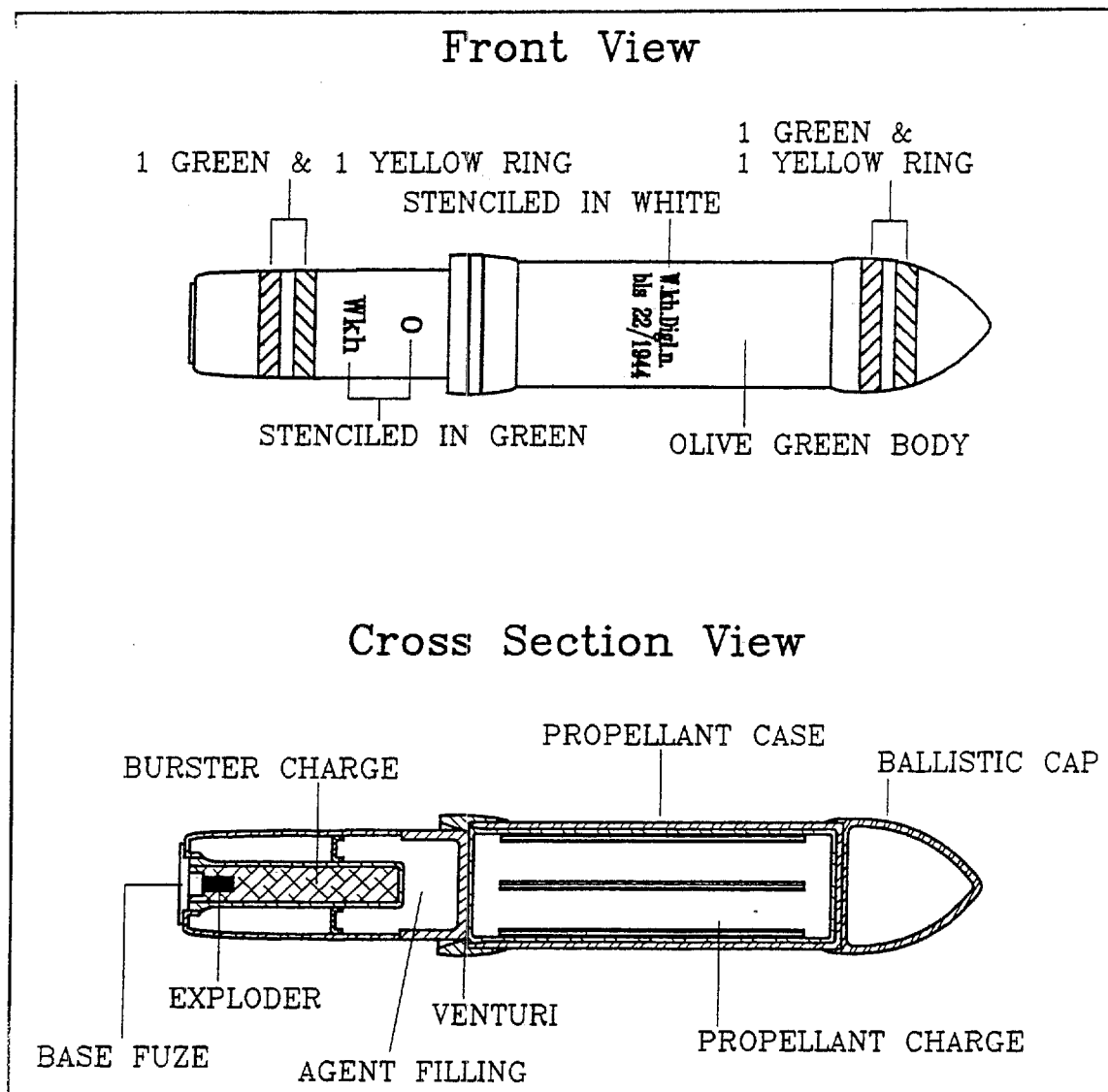
Burster:

Model no.: unknown
Explosive type: PETN/Wax (95/5)
Explosive weight: unknown

ENGINEERING DATA: thin-walled, steel cylinder

REFERENCES:

1. U.S. Army Ordnance Bomb Disposal Center, German Projectiles and Fuzes (Aberdeen Proving Ground, MD: U.S. Army, 1 October, 1944) 420-421.
2. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operations (N.p.: U.S. Army, n.d.) I-D-1 and I-D-2.
3. Chemical Warfare Service, Headquarters, Theater of Service Force (Chemical Warfare in World War II, European Theater (N.p.: U.S. Army, September, 1945) 127.



Drawing not to scale

Figure 3.4.11-1. 15-centimeter Chemical Rocket Type 41, Green Ring Yellow (Wgr. 41, Grünring-Gelb) (Ref. 2)

3.4.12 NOMENCLATURE: KC 250 Aerial Chemical Bomb

TABULATED DATA:

Length: 163.83 centimeters (64.5 in.)

Diameter: 36.83 centimeters (14.5 in.)

Type of Fill and Fill Weight:

Agent	Weight of Filler	Total Weight
H mustard or winterlost	99.79 kg (220 lb)	156.49 kg (345 lb) to 165.56 kg (365 lb)*
H thickened mustard or thickened winterlost	106.6 kg (235 lb)	139.71 kb (308 lb)
tabun (GA)	93.44 kg (206 lb)	151.96 k (335 lb)
phosgene (CG)	108.86 kg (240 lb)	158.76 kg (350 lb)

Note:

*Total weight varies depending on if Green Ring or Yellow Ring model. No explanation of weight change is offered.

Markings:

KC 250 Gb filled with H:

The main body color was tan or field gray with one yellow band and the number 6183 stenciled on the nose. On the forward end of the midsection of the body, an alphanumeric code, Ba-6182, was stenciled in black along with the designation 14-3.2 Kilogram. (This bomb may have been filled with mustard or winterlost; if filled with mustard the code letter O was stenciled in place of Ba. Since the bomb had a fuze-operating rod extending from the nose to the fuze pocket, it should have used a 26 impact fuze.) On the aft end of the midsection, the number 26 (circled), and 157 Kilogram were stenciled in black. On the aft section, one yellow band was stenciled in black with an alphanumeric code, KC 250 Gb.

KC 250 II Gb filled with thickened H:

The main body color was tan or field gray overall, with two yellow rings stenciled on the nose. The number 9 (circled) and the alphanumeric code D-6183 were stenciled in black on the forward end of the midsection. On the aft end of the midsection, 2-0.1 Kilogram and 140 Kilogram were stenciled in black. Two yellow rings with an alphanumeric code KC 250 Gb were stenciled in black on the aft section.

KC 250 Gr filled with H:

The main body color was tan or field gray overall with one green and one yellow ring stenciled on the nose. The number 26 (circled); alphanumeric code O-6182 or B-6182 to identify the munitions fill, which may have been an O filling (homologous mustard) or a B filling (winterlost); and 14-15.0 Kilogram were stenciled in black on the forward end of the midsection. On the aft end of the midsection, 166 Kilogram was stenciled in black, followed by one green and one yellow ring and the alphanumeric code KC 250 Gr stenciled in black.

KC 250 II Gr filled with GA:

The main body color was tan or field gray, with the number 6181 stamped and three green rings stenciled on the nose. On the forward end of the midsection of the body, the designation 14-4.6 Kilogram and G-6181 or Ga-6181 were stenciled in black. (If the bomb was stenciled GA or Ga instead of G, the filling contained 20 percent chlorobenzene.) On the aft end of the midsection, there were three green rings and the alphanumeric code KC 250 III Gr stenciled in black. On the aft section, the number 55 (circled) was stenciled in white or black.

KC 250 II Gr filled with CG:

The main body color was tan or field gray, with one or two green rings stenciled on the nose. (This bomb may have been marked with one or two green rings, although the nomenclature is the same: KC 250 Gr.) On the forward end of the midsection of the body, F-6181 and 14-0.9 Kilogram were stenciled in black. (If the bomb had the filling code letter H instead of F, it was filled with diphosgene.) On the aft end of the midsection, the designation 160 Kilogram, and one or two rings with an alphanumeric code KC 250 III Gr were stenciled in black along with the number 55.

Description:

All 250-kilogram German chemical bombs used identical casings. The fill, markings, and fuzes were different. The casing consisted of a section to which a rounded nose section and a pointed tail section of sheet steel were welded. There was only one fuze pocket. A central exploder tube ran the length of the bomb case. Two baffles were welded to the body where the sections were welded together. The wall thickness was 0.16 centimeter (0.063 inch). A standard eyebolt may have been screwed into the side or nose for suspension. The tail was 54.61 centimeters (21.5 inches) long and 60.96 centimeters (24 inches) wide and was made of sheet steel. Four sheet steel vanes were secured directly to the body cone. Bar struts were used.

Explosive Train:

Transverse fuzes may include:

Model no.:	El. A.Z. 26 (26 circled) El. Zt.Z9 (circled) El. A.Z. 55 (circled)
Overall length:	10.48 centimeters (4.125 in.) without gaine
Total weight:	unknown

Booster charge: ammonium picrate (weight unknown),
or picric acid (0.1 kilogram)

Burster:

Model no.:	central burster
Explosive type:	TNT
Explosive weight:	ranging from 3.2 kilograms (7.04 lb) to 15 kilograms (33.08 lb), depending upon model

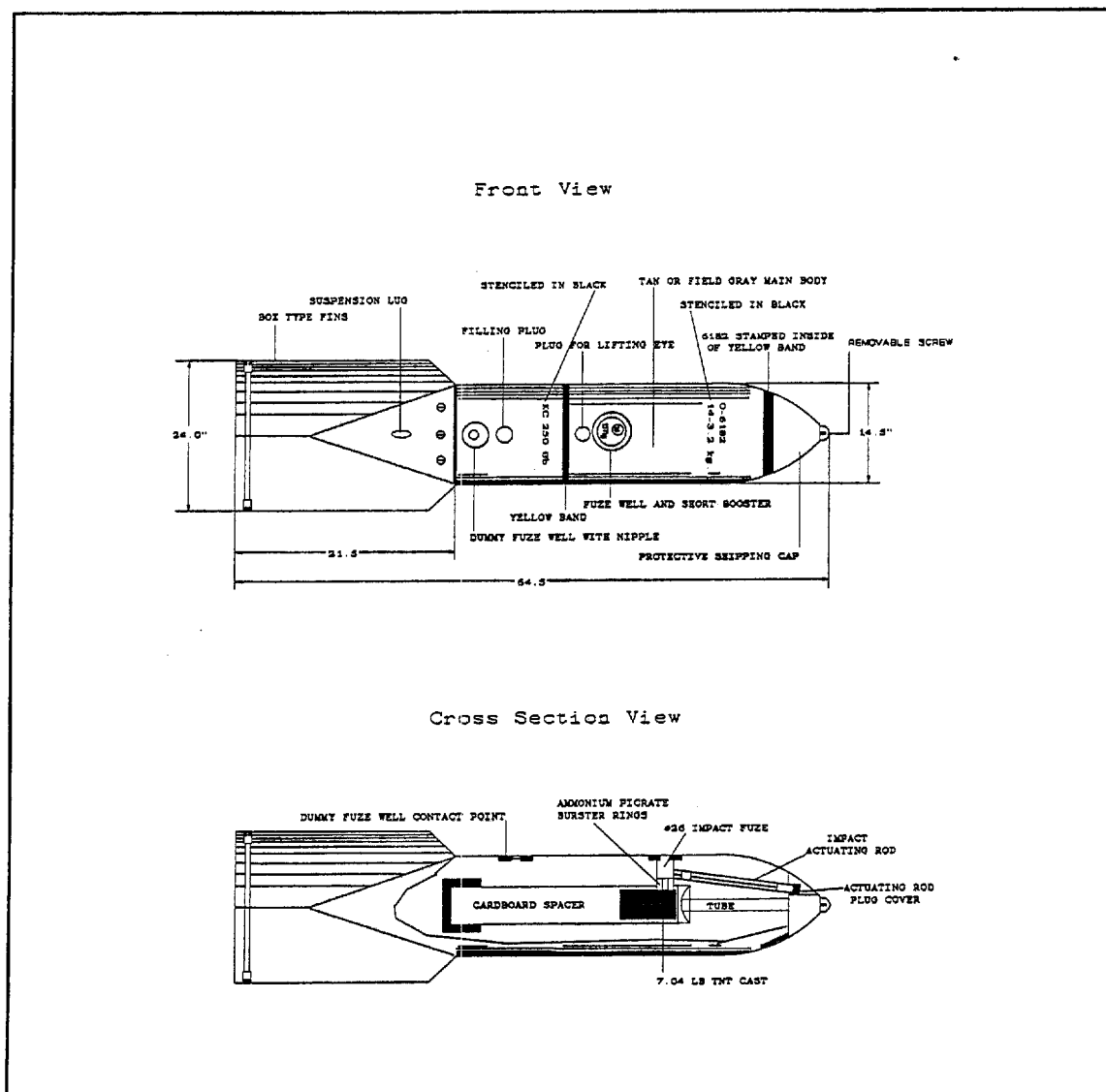
ENGINEERING DATA:

Construction:

Main body:	steel
Wall thickness:	0.16 centimeter (0.063 in.)

REFERENCES:

1. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operations (N.p.: U.S. Army, n.d.) II-B-6.
2. War Department, Technical Manual (TM) E9-1983, Enemy Bombs and Fuzes (Washington, DC: n.p., November 12, 1942) 1330.0, 2322.6, and 1325.1.
3. Anonymous, German Air Force Chemical Munitions (N.p.: n.p., n.d.) 1-2.



Drawing not to scale

Figure 3.4.12-1. KC 250 Aerial Chemical Bomb, One Yellow Ring (Ref. 1)

3.4.13 NOMENCLATURE:

**KC 500 Aerial Chemical Bomb, One or Two
Green Rings (KC 500 II Gr)**

TABULATED DATA:

Length: 196.86 centimeters (77.5 in.)

Diameter: 46.99 centimeters (18.5 in.)

Type of Fill and Fill Weight:

CG or DP: 215.46 kilograms (475 lb)

Total Weight with Fill:

CG or DP: 471.74 kilograms (1040 lb)

Markings:

The main body color was tan or field gray overall; the characteristic nose markings are unknown. On the forward end of the midsection of the body, F-6211 was stenciled in black. (If the bomb bore the code letter H instead of F, it was filled with diphosgene.) On the aft end of the midsection, one or two green rings were stenciled, followed by the alphanumeric code KC 500 III Gr in black.

Description:

The German 500-kilogram chemical bomb was constructed of a drawn steel cylindrical case, a cast steel nose welded to the case, a steel casting with male filling plug welded to the case or a domed cap without filling plug attached by screws. One or two fuze pockets may have been found in this bomb. The wall thickness was 0.16 centimeter (0.063 inch). A standard German eye-bolt may have been screwed into the nose or side of the bomb for suspension. The tail was 76.2 centimeters (30 inches) long and 60.96 centimeters (24 in.) wide made of sheet metal. The tail assembly consisted of four vanes welded to the tail cone with box type struts made of steel bars. (The weight, kind, and location of the burster is not known, but it was probably similar to the KC 250 II Gr bomb.)

Explosive Train: unknown

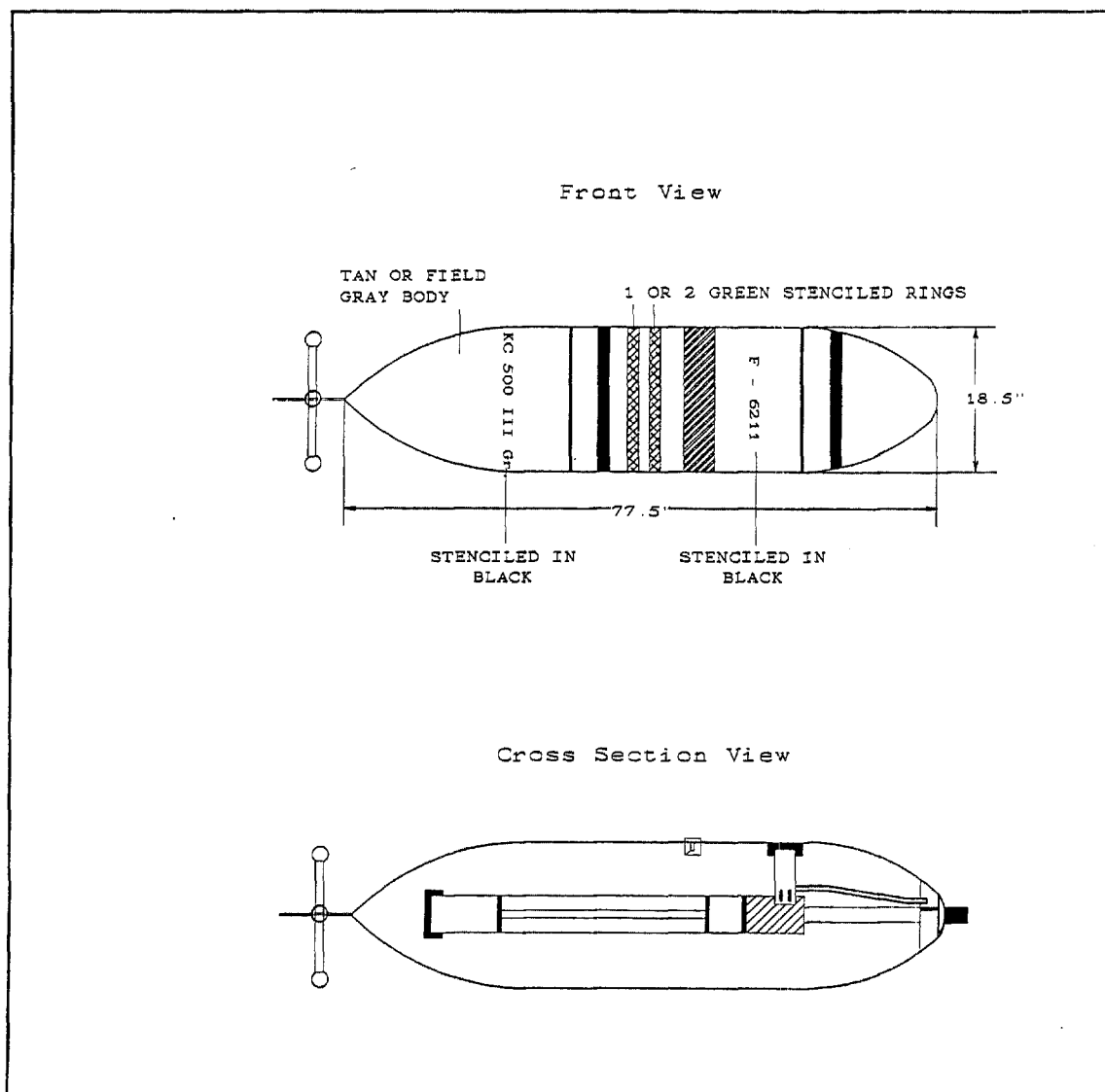
ENGINEERING DATA:

Construction:

Main body:	drawn steel cylindrical case
Wall thickness:	1.42 centimeters (0.56 in.)
Suspension eyebolts:	side or nose
Tail fins:	76.2 centimeters (30 in.) by 60.96 centimeters (24 in.) sheet metal, steel bar struts

REFERENCES:

1. Intelligence Division, Office of the Chief Chemical Warfare Officer, German Chemical Warfare Materiel, Headquarters, European Theater of Operations (N.p.: U.S. Army, n.d.) II-B-9.
2. War Department, Technical Manual (TM) E9-1983, Enemy Bombs and Fuzes (Washington, DC: n.p., November 12, 1942) 1325.1.



Drawing not to scale

Figure 3.4.13-1. 500-kilogram Aerial Chemical Bomb, One or Two Green Rings (KC 500 II Gr) (Ref. 2)

**JAPANESE
CHEMICAL MUNITIONS**

TABLE OF CONTENTS

Section	Title	Page
	LIST OF ILLUSTRATIONS	4-ii
	LIST OF TABLES	4-ii
4	JAPANESE CHEMICAL MUNITIONS	
4.1	INTRODUCTION	4-1
4.2	MUNITIONS MARKINGS	4-1
4.3	TECHNICAL DESCRIPTIONS	4-4
4.3.1	Frangible AC (HCN) Grenade	4-5
4.3.2	90-millimeter Mortar Chemical Shell, Type 95	4-8
4.3.3	Livens Projectile, Type, 16-centimeter	4-12
4.3.4	7.5-centimeter Artillery Chemical, Shell 92 and 94	4-14
4.3.5	15-centimeter (150-millimeter) Artillery Chemical Shell	4-18
4.3.6	50-kilogram Chemical Bomb, Type 92	4-21
4.3.7	50-kilogram Chemical Bomb, Type 100	4-25
4.3.8	Navy Chemical Bomb, Land, Type 1, No.6, MK I; No. 6, MK I; Type 4, No. 6, MK I	4-28

LIST OF ILLUSTRATIONS

Figure	Title	Page
4-1	Japanese Old and New Marking System	4-2
4.3.1-1	Frangible AC (HCN) Grenade	4-7
4.3.2-1	90-millimeter Mortar Chemical Shell, Type 95	4-11
4.3.4-1	7.5-centimeter Artillery Chemical Shell 92 and 94	4-16
4.3.5-1	15-centimeter (150-millimeter) Artillery Chemical Shell	4-19
4.3.6-1	50-kilogram Chemical Bomb, Type 92	4-23
4.3.7-1	50-kilogram Chemical Bomb, Type 100 ⁸	4-26
4.3.8-1	Navy Chemical Bomb, Land, Type 1, No. 6, MK 1	4-30
4.3.8-2	Navy Chemical Bomb, Land, No. 6, MK I	4-31
4.3.8-3	Navy Chemical Bomb, Land, Type 4, No. 6, MK 1	4-32

LIST OF TABLES

Table	Title	Page
4-1	Japanese Chemical Weapons Color Codes	4-1
4-2	Japanese Munitions Weight Codes	4-3
4-3	Japanese and United States War Gas Comparison	4-4

SECTION 4

JAPANESE CHEMICAL MUNITIONS

4.1 INTRODUCTION

The Japanese chemical weapons inventory consists of a full array of chemical-filled munitions, including artillery shells, aerial bombs, grenades, and mortars. Most of these weapons were developed during the World War II period. Toxic gas artillery projectiles typically were painted gray, with colored bands around the middle of the munition body to signify the type of fill. Table 4-1 summarizes the color code for each type of filling.

Table 4-1. Japanese Chemical Weapons Color Codes

Color	Type
yellow	blister
blue	choking
brown	blood
red	vomiting
green	tear

Note: The Japanese had no true nerve agents during World War II, but they refer in their period literature to hydrogen cyanide (AC) and cyanogen chloride (CK), both cyanide agents, as blood and nerve agents. In American texts these are referred to as blood agents.

4.2 MUNITIONS MARKINGS

In addition to colored bands that identified the type of filling, the Japanese added colored bands to indicate other characteristics of the projectiles (see figure 4-1, which gives the color and type of the fill shown on the old and new marking system for toxic gas artillery projectiles).

At the extreme tip of the projectile, a red band indicated that the shell had been filled with explosive components.

Immediately below the red band, a blue band indicated that the projectile was filled with liquid/chemical components.

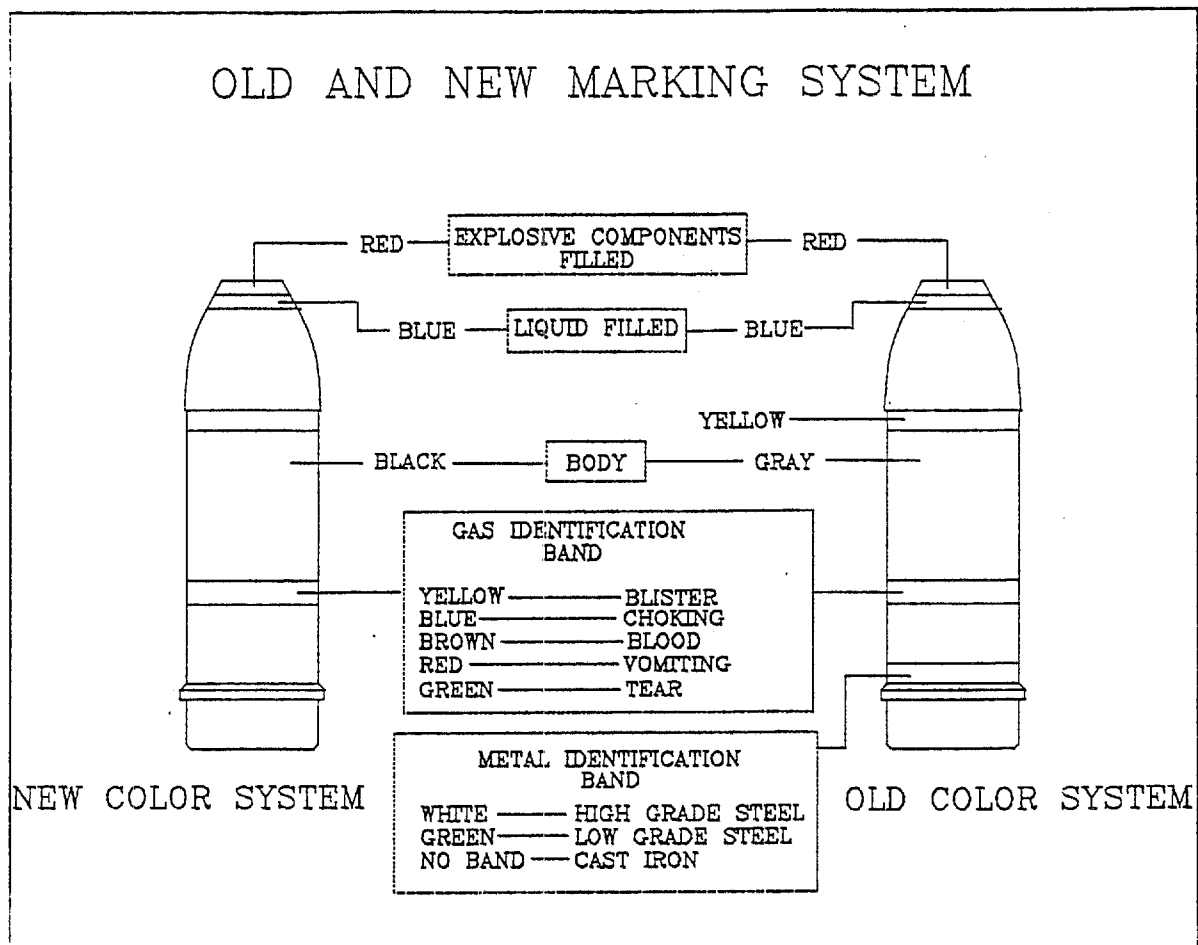


Figure 4-1. Japanese Old and New Marking System

If the bursting charge was other than fine grain powder a yellow band behind the bourrelet was used.

Approximately one-half the distance down the main body of the shell, a series of numbers indicated the date the projectile was filled.

Above the date mark, a series of plus and minus signs showed the weight variation.

Below the date marks, a symbol indicated the place where the shell had been filled.

Below the place symbol, a colored band twice the width of the rotating band indicated the type of fill.

Table 4-2 indicates the overweight/underweight variations.

Table 4-2. Japanese Munitions Weight Codes

Symbol	Meaning
++	1.5-2.5% overweight
+	0.5-1.5% overweight
±	0.5% plus or minus
-	0.5-1.5% underweight
--	1.5-2.5% underweight

Japanese Army liquid-filled aerial bombs were painted gray overall, with nose markings and colored bands around the body of the bomb similar to those for artillery shells. The colored bands were placed in front of and behind the suspension lug, and the white band was located in front of the suspension lug.

The Japanese Navy MK I aerial bombs had a series of green/yellow, gray, and yellow bands around the body of the bomb. It is believed that the markings on toxic chemical mortar rounds were similar to those of the toxic chemical artillery rounds. The location of the yellow color band may be below (old system) or above (new system) the gas check rings. The color bands were probably 10 to 12 millimeters wide, and the gas check rings, 20 to 24 millimeters wide, as in the 90-mm mortar. No specific

information is available on the markings of Japanese Navy toxic chemical munitions.

The Japanese system of shell marking was based on colored rings painted on the shells. This color system represented the type of gas, rather than a specific gas. Table 4-3 indicates the toxic war gas nomenclature comparison between Japan and the United States.

Table 4-3. Japanese and United States War Gas Comparison

Japanese War Gas	United States War Gas
blister gases	mustard (H), Lewisite (L), a mixture of both (H/L), possibly a thickened mustard
lung gas (choking)	phosgene (CG)
blood and nerve poison	hydrogen cyanide (AC)
vomiting gas	diphenylcyanarsine (DC)
tear gas	chloracetophenone, possibly arsenic trichloride

4.3 TECHNICAL DESCRIPTIONS

The following pages present technical information on each Japanese chemical munition.

4.3.1 NOMENCLATURE: Frangible AC (HCN) Grenade

TABULATED DATA:

Length: neck - 2.54 centimeters (1 in.)

Diameter: 8.89 - 10.16 centimeters (3.5 - 4.0 in.)

Type of Fill and Fill Weight:

AC: 300.50 - 345.86 grams [10.6 - 12.2 oz (at 80% strength)]

Total Weight with Fill:

AC: 0.54 kilogram (1.2 lb)

Markings:

There were no markings on the grenade. There are two models of this grenade, distinguishable by their color and shape. The TB10 type had a yellow tint. The 172 types appeared to be light green. The metal can had a khaki color with a red band above the two handles.

Description:

These grenades were recognizable mainly as round glass bowls filled with AC. Two types of grenades were manufactured and put into use: a copper-stabilized model, and one designated 172. They differ in minor details, as summarized below.

The copper stabilized type (TB10) had a rounded bottom, a yellow tint, and a single molded ring around the bottom; it was carried in a sheet metal container. This model of the grenade was closed by a crown cap over a cork stopper.

The 172 B-K and C-K had flat bottoms, a light green tint, and two molded rings around the outside. These models were sealed by means of a crown cap over a rubber washer. The 172 models were carried in cardboard containers. The inside of the grenade was coated with a white deposit of arsenic oxide, giving the flask-like container a frosted appearance.

Explosive Train: none

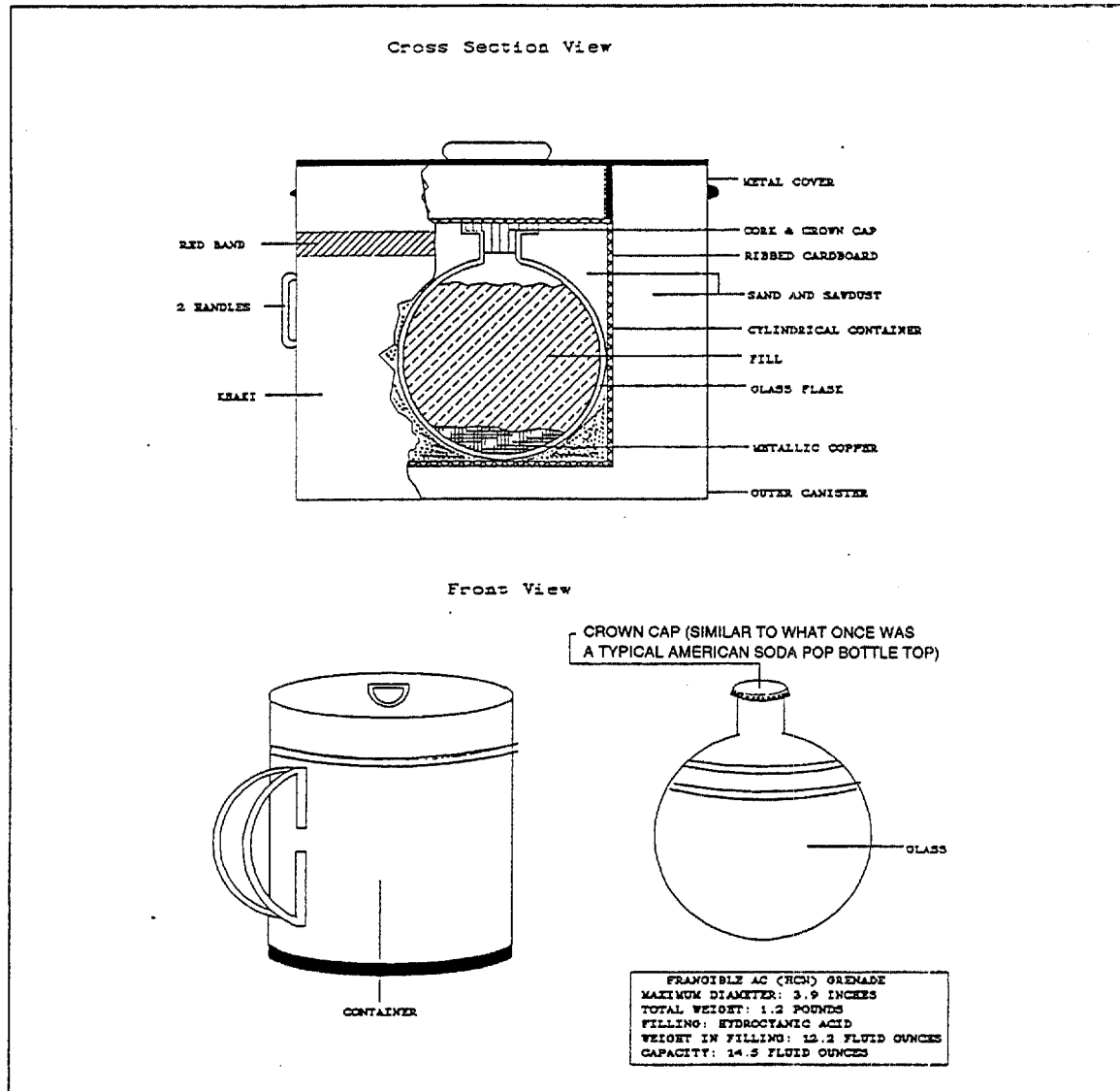
ENGINEERING DATA:

Construction:

Main body: glass flask with round or flat bottom closed by a crown cork stopper or a crown cap over a rubber washer

REFERENCES:

1. Department of the Army, Technical Manual (TM) 9-1985-4, Japanese Explosive Ordnance (Bombs, Bomb Fuzes, Land Mines, Grenades, Firing Devices and Sabotage Devices) (Washington, DC: Department of the Army, March 1953) 238-239.
2. The War Office (M.I.10), Notes on Japanese Chemical Warfare, Section 6, Gas Ordnance, Amendment No. 2 (London, S.W.I.: July 1944) pg. 26-28, 51-52.
3. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 8, Japanese Chemical Weapons and Equipment (Washington, DC: February 15, 1943) 25.
4. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 10, Hydrocyanic Acid (HCN) (Washington, DC: February 15, 1943) 1.



Drawing not to scale

Figure 4.3.1-1. Frangible AC (HCN) Grenade (Ref. 1)

4.3.2 NOMENCLATURE: 90-millimeter Mortar Chemical Shell,
Type 95

TABULATED DATA:

Length: 40.39 centimeters (15.9 in.) (without fuze);
fin assembly 10.16 centimeters (4 in.)

Diameter: 8.99 centimeters (3.54 in.) at bourrelet (90 mm);
maximum diameter of tail fins 8.99 centimeters (3.54 in.).

Type of Fill and Fill Weight:

50% H and 50% L (1:1): 0.86 kilogram (1.9 lb)
DC: 0.23 kilogram (0.5 lb)
AC: unknown

Total Weight with Fill:

H/L: 5.44 kilograms (12.0 lb)
DC: 5.44 kilograms (12.0 lb)
AC: 6.53 kilograms (14.4 lb)

Markings:

The body color of the shell was black. Painted on the nose was a red band just below the fuze and a blue band halfway between the fuze and the bourrelet. The following list shows the different fills and the colored bands:

- Blister gas: a yellow band between the bourrelet and fin assembly
- Vomiting gas: a red band halfway between the bourrelet and the fin assembly and a white band at the junction of the shell body and the tail
- Blood and nerve agents: a brown band halfway between the bourrelet and the fin assembly. Note: The Japanese referred to AC and CK as *nerve* agents. The U.S. considered these compounds *blood* agents.

Description:

This shell was similar in design to the Type 94 90-millimeter H.E. mortar shell, with the following exceptions:

- An enlarged booster cup threaded into the nose of the projectile. It contained a well for the lower fuze body and detonator, a burster charge, and a wooden block.

- A fuze adapter threaded into the forward end of the booster cup.

The Type 94 Mortar Shell had an exploder tube that screwed internally into the nose adapter, which in turn screwed into the body. Note: Other types of ammunition for this chemical mortar are reported in captured documents. White phosphorus and vomiting agents were also used in the shell and were identified by different color bands.

There were three gas check rings. The tail unit threaded into the body and was retained by three crimps. The tube of the tail unit contained 24 holes arranged in 6 vertical rows of 4 each. Three brackets forming six tail fins were spot-welded to the tube. The difference between these two projectiles was the length of the forward and rear sections of the body. The long type was constructed of steel, while the short type was made of semisteel.

Explosive Train:

Fuze:

Model no.:	instantaneous short delay No. 93
Overall length:	9.68 centimeters (3.81 in.) (with gaine); 7.14 centimeters (2.81 in.) (without gaine)
Total weight:	unknown

Burster:

Model no.:	unknown
Explosive type:	unknown
Explosive weight:	79.38 grams (2.8 oz.)

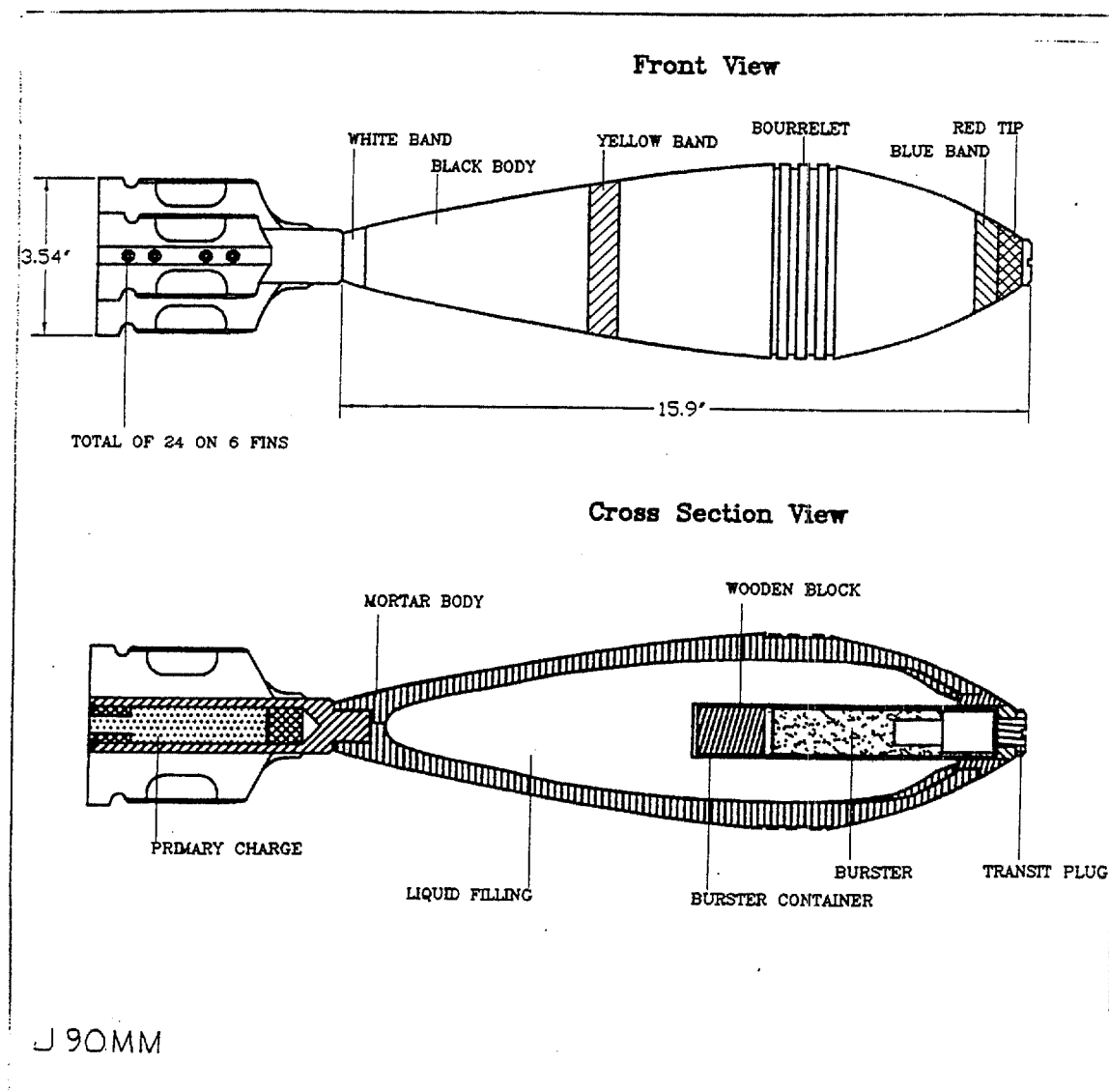
ENGINEERING DATA:

Construction: steel (long body); semisteel (cast iron of low carbon content) (short body)

REFERENCES:

1. Department of the Army, Technical Manual (TM) 9-1985-5, Japanese Explosive Ordnance, (Army Ammunition, Navy Ammunition) (Washington, DC: Department of the Army, March, 1953) 386-387, 402.
2. The War Office (M.I.10), Notes on Japanese Chemical Warfare, Section 6, Gas Ordnance, Amendment No. 2 (London, S.W.I.: July 1944) 24-25, 49.
3. Office of the Chief, Chemical Warfare Service, Chemical Warfare Intelligence Bulletin No. 49, Part I, Japanese Gas Shells (Washington, DC: 1 February, 1945) 3-7.

4. War Department, Military Intelligence Division, Special Series No. 19, Japanese Infantry Weapons (Washington, DC: 31 December 1943) 160-167.



Drawing not to scale

Figure 4.3.2-1. 90-millimeter Mortar Chemical Shell, Type 95 (Ref. 2)

4.3.3 NOMENCLATURE:

Gas Projectile, Livens Type, 16-centimeter

TABULATED DATA:

Length: unknown

Diameter: unknown

Type of Fill and Fill Weight:

Nonpersistent gas: 13.61 kilograms (30 lb)

Total Weight With Fill:

Nonpersistent gas: 35.5 kilograms (78.28 lb)

Markings:

There is no information available on the markings for this munition. Sketches for the Japanese Livens projectile are not available.

Description:

No information that describes this munition could be found in sources reviewed.

Explosive Train:

Model no.: unknown

Explosive type: unknown

Explosive weight: 300 grams (10.58 oz.) (explosive charge)

ENGINEERING DATA: unknown

REFERENCES:

1. The War Office (M.I.10), Notes on Japanese Chemical Warfare, Section 6, Gas Ordnance, Amendment No. 2 (London, S.W.I.: July 1944) 20.

4.3.4 NOMENCLATURE: 7.5-centimeter Artillery Chemical, Shell 92
and 94

TABULATED DATA:

Length: 30.48 centimeters (12 in.) (without fuze)

Diameter: 7.5 centimeters (2.95 in.) at bourrelet

Type of Fill and Fill Weight:

crude L:	0.65 kilograms (1.44 lb)
50% H and 50% L:	0.63 kilograms (1.38 lb)
DC:	0.167 kilograms (0.369 lb)
CG/smoke (Type 92):	0.63 kilograms (1.38 lb)
50% chloropicrin and 50% stannic chloride:	0.50 kilograms (1.1 lb)

Total Weight with Fill:

L:	5.47 kilograms (12.06 lb)
H/L:	5.5 kilograms (12.13 lb)
DC:	6 kilograms (13.23 lb)
CG/smoke:	unknown
chloropicrin and stannic chloride:	5 kilograms (11 lb)

Note: This combination of chloropicrin and stannic chloride may have been an experimental chemical filling. The body of the shell was scarlet with black markings.

Markings:

Note: Color will vary with different type fill: yellow - blister gas; green - tear gas; red - vomiting gas; blue - choking gas; brown - blood and nerve poisons.

On munitions filled with crude Lewisite, the color over the body of the munition was gray with one white band and one yellow band, and a red tip on the nose, followed by a blue ring. Munitions filled with a mustard and Lewisite mixture were bluish gray with a red band and a blue band on the nose and a yellow and a white band on the body. The white band appeared just above the driving band. In addition, there was a white cross and the number 134 in the middle of the body and a double cross near the base.

DC munitions had a gray body with a red band on the tip of the nose, followed by a blue band. Below the shoulder of the munition, there was a yellow band. There was

a red band 4.44 centimeters (1.75 inches) above the driving band. Immediately above the driving band, there was a white band. The date marks were on the middle of the projectile; as an example, 1411 meant November 1939 (painted in white) or 1412 meant December 1939 (also painted in white). There were weight discrepancy marks on the middle of the body (\pm or $+$) painted in white. Near the base of the shell, \pm or $+$ was painted in blue. There was a letter N (in white) below the date mark. The meaning of this letter designation is unknown.

Description:

This projectile had a blunt nose, with one rotating band. The difference in each model of this munition depended on the various types of fill and the markings on the projectile itself. The burster for the DC projectile was very large in comparison with the crude Lewisite and the mustard/Lewisite mixture projectile. Another difference is the addition of a primer in the crude Lewisite projectile.

Explosive Train:

Fuze:

Model no.:	Type 88, instantaneous
Overall length:	9.05 centimeters (3.56 in.) (with gaine); 7.30 centimeters (2.875 in.) (without gaine)
Total weight:	unknown

Burster:

Model no.:	unknown
Diameter:	unknown
Length:	unknown
Type tube:	central head container
Explosive type:	picric acid or 70% TNT and 30% naphthalene
Explosive weight:	0.062 - 0.070 kilograms (2.2-2.5 oz.)
Bursting charge with DC:	0.463 kilograms (1.02 lb) of a mix of TNT (69.9%) and naphthalene (30.1%)

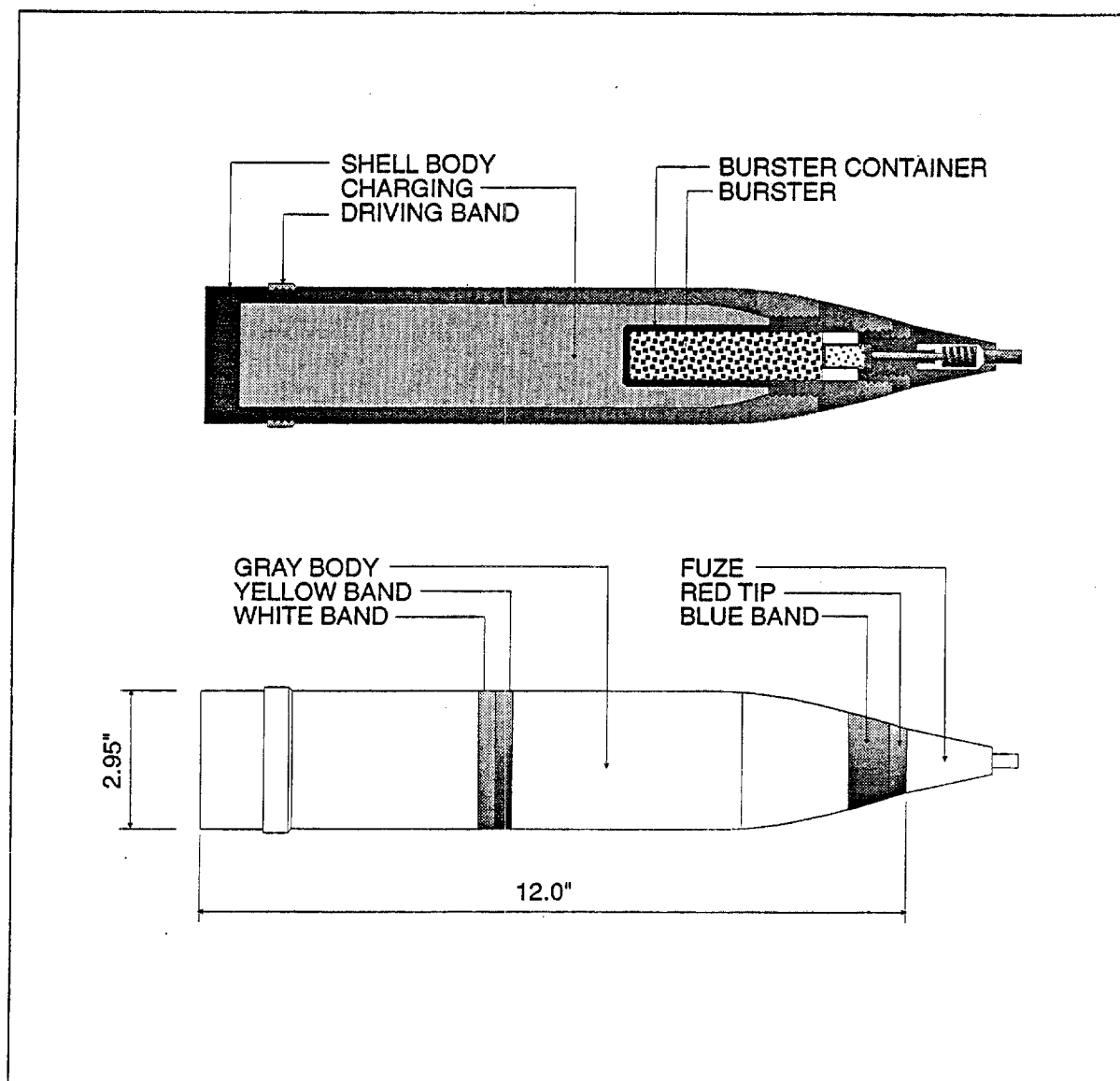
ENGINEERING DATA:

Construction:

Main body:	forged steel
Width of rotating band:	0.99 centimeter (0.39 in.)

REFERENCES:

1. Department of the Army, Technical Manual (TM) 9-1985-5, Japanese Explosive Ordnance, (Army Ammunition, Navy Ammunition) (Washington, DC: March 1953) 341, 399-400.
2. The War Office (M.I.10), Notes on Japanese Chemical Warfare, Section 6, Gas Ordnance, Amendment No. 2 (London, S.W.I.: July 1944) 21-22, 46-47.
3. Office of the Chief, Chemical Warfare Service, Chemical Warfare Intelligence Bulletin No. 49, Part I, Japanese Gas Shells (Washington, DC: 1 February, 1945) 7.
4. Office of the Chief, Chemical Warfare Service, Chemical Warfare Intelligence Bulletin No. 8, Japanese Chemical Warfare Weapons and Equipment (Washington, DC: February 15, 1943) 23.
5. Dere, Abraham J., T4 Ord. Dept., Ordnance Sergeant, Japanese Ammunition, Vol. 9 (N.p.: n.p., 1945) 12-15, 22-23.



Drawing not to scale

Figure 4.3.4-1. 7.5-centimeter Artillery Chemical Shell 92 and 94 (Ref. 2)

4.3.5 NOMENCLATURE: 15-centimeter (150-millimeter) Artillery
Chemical Shell

TABULATED DATA:

Length: 59.18 centimeters (23.3 in.)

Diameter: 15 centimeters (5.9 in.)

Type of Fill and Fill Weight:

AC:	3.21 kilograms (7 lb)	<i>Note: AC (hydrogen cyanide) contained 50 grams of copper stabilizer; the intent of this was unknown.</i>
-----	-----------------------	---

DC:	1.27 kilograms (2.8 lb)	
blister gas:	3.81 kilograms (8.4 lb)	<i>Note: Blister gas is considered mustard, Lewisite, a mixture of both, possibly a thickened mustard.</i>

CG/smoke (95:5): 7.17 kilograms (15.8 lb)

Total Weight with Fill:

AC:	30.98 kilograms (68.3 lb)
DC:	32.11 kilograms (70.8 lb)
blister gas:	31.25 kilograms (68.9 lb)
CG/smoke:	unknown

Markings:

The overall color of the shell is unknown. On the main body, the munition was marked by a red band followed by a blue band on the nose. A white band was marked immediately above the driving band (16 to 20 millimeters wide). A yellow band was placed 80 millimeters above the driving band (30 millimeters wide). Weight discrepancy marks (+) were stenciled in white in the middle of the shell body. Under the weight discrepancy marks were the numbers 1410 painted in white. The word Shong was stamped in Japanese script into the metal, above the white band, followed by the number 8. The meaning of the Japanese script is unknown.

Description:

The munition was housed in a steel projectile case and consisted of a burster tube containing a burster charge, which threaded into the nose. The booster and fuze adapter threaded into the burster tube. According to the reference, the bursting charge appeared to be considerably greater than that required to burst the shell.

Explosive Train:

Fuze:

Model no.: assumed to be Type 88, instantaneous
Overall length: 9.04 centimeters (3.56 in.) (with gaine);
7.32 centimeters (2.88 in.) (without gaine)
Total weight: unknown

Booster: unknown

Burster:

Model no.: unknown
Explosive type: picric acid
Explosive weight: 0.38 kilograms (0.838 lb)

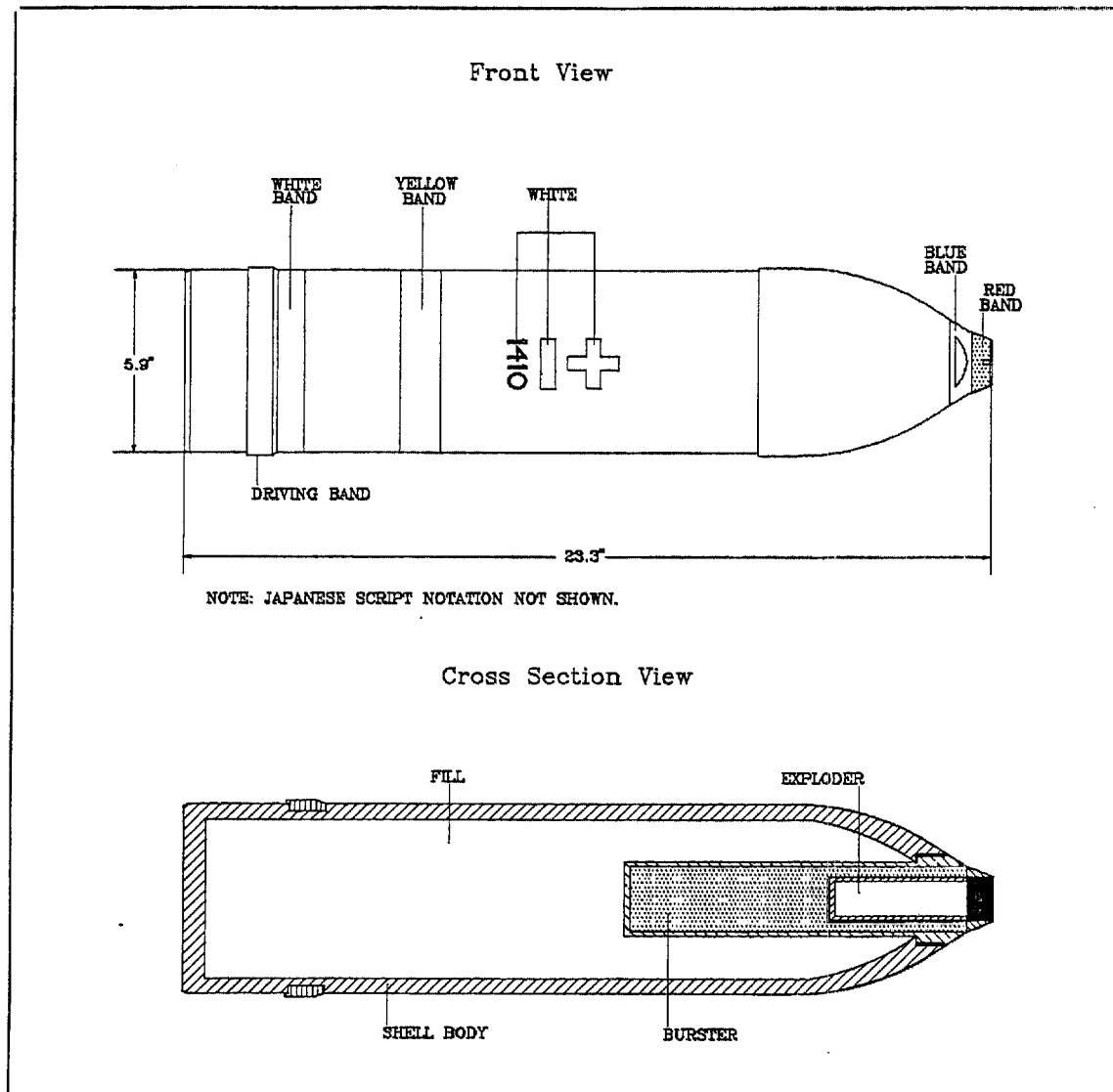
ENGINEERING DATA:

Construction:

Main body: steel
Wall thickness: 1.27 centimeter (0.5 in.) (approximately)

REFERENCES:

1. The War Office (MI 10), Notes on Japanese Chemical Warfare, Section 6, Gas Ordnance, Amendment No. 2 (London, S.W.I.: July 1944) 23-24, 48.
2. Office of the Chief, Chemical Warfare Service, Chemical Warfare Intelligence Bulletin No. 49, Part I, Japanese Gas Shells (Washington, DC: 1 February 1945) 8.
3. Dere, Abraham J., T4 Ord. Dept., Ordnance Sergeant, Japanese Ammunition, Vol. 9 (N.p.: n.p., 1945) 15.



Drawing not to scale

Figure 4.3.5-1. 15-centimeter (150-millimeter) Artillery Chemical Shell (Ref. 1)

4.3.6 NOMENCLATURE: 50-kilogram Chemical Bomb, Type 92

TABULATED DATA:

Length: 114.3 centimeters (45 in.) (with tail assembly);
67.31 centimeters (26.5 in.) (without tail assembly)

Diameter: 19.05 centimeters (7.5 in.)

Type of Fill and Fill Weight:

H/L: 23 kilograms (50.6 lb) or 30 kilograms (66 lb)

Total Weight with Fill:

H/L: 50 kilograms (110.25 lb)

Markings:

There were two different color schemes for the 50-kilogram bomb. In the first scheme, the color of the main body was grayish-green. The nose had a red tip and a blue band; a yellow band and a white band appeared forward of the suspension lug; and a yellow band was placed aft of the suspension lug. The munition also may have been bluish-gray with one yellow and one white band between the nose and the plug, and one yellow band between the tail cone and lug.

Description:

The 50-kilogram aircraft gas bomb, Type 92, consisted of a steel nose, cylindrical casting and tail assembly, with an overall length of 114.3 centimeters (45 inches). The steel body had a wall thickness of 0.48 centimeter (0.19 inch) and was 67.31 centimeters (26.5 inches) long by 19.05 centimeters (7.5 inches) in diameter. The cast steel nose was attached to the body by three one-quarter inch grub screws or dowel pins, and the sheet iron tail assembly, consisting of four fins welded to the tail cone, was welded to the body.

Explosive Train:

Nose Fuze:

Model no.: A-2(a), A-2(b), A-2(c)
Overall length: 5.72 centimeters (2.25 in.) (with vanes, less gaine)
Total weight: unknown

Delay Action Fuze:

No information is available on the delay action fuze.

Booster Charge:

Model no.: Type 1 or Type 2 (instantaneous or delay)
Explosive type: tetryl, booster pellet and percussion cap
Explosive weight: unknown

Burster:

Model no.: unknown
Explosive type: picric acid
Explosive weight: unknown

ENGINEERING DATA:

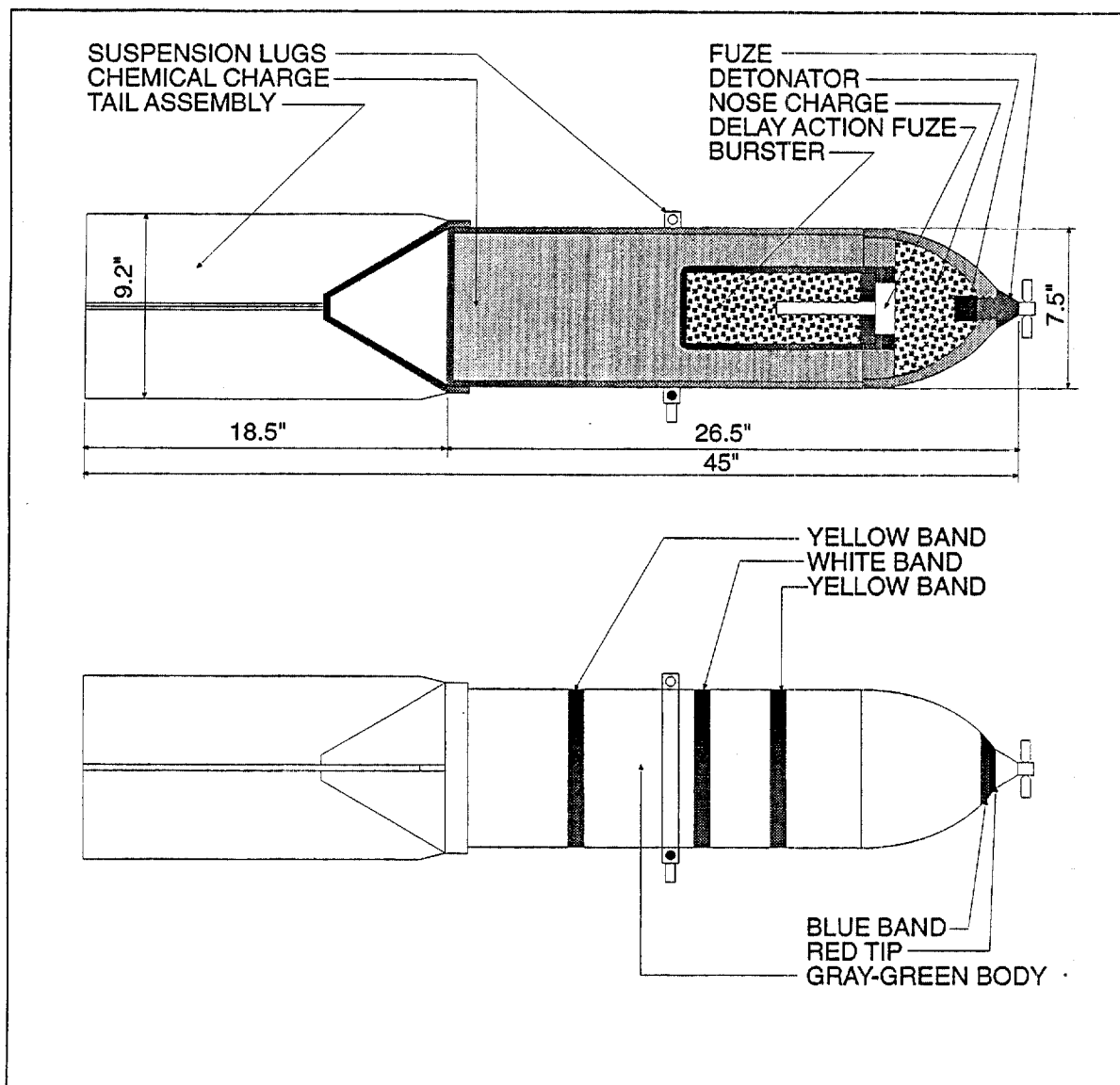
Construction:

Main body: steel
Nose: steel
Wall thickness: 0.48 centimeter (0.19 in.)
Tail assembly: four fins 47 centimeters (18.5 in.) long by
23.37 centimeters (9.2 in.) wide
Width of tail fins: 12.37 centimeters (4.87 in.), sheet iron welded to tail cone, which
is welded to the body; two sets of box type struts 17.15
centimeters (6.75 in.) long, 0.079 centimeter (0.031 in.) diameter
each

REFERENCES:

1. Department of the Navy, OPNAV 30-3M, Handbook of Japanese Explosive Ordnance (Washington, DC: Department of the Navy, 15 August, 1945) 71, 78.
2. The War Office (M.I.10), Notes on Japanese Chemical Warfare, Section 6, Gas Ordnance, Amendment No. 2 (London, S.W.I.: n.p., July 1944) 18-19, 45.
3. Office of the Chief of Chemical Warfare, Chemical Warfare Intelligence Bulletin No. 8, Japanese Chemical Warfare Weapons and Equipment (Washington, DC: n.p., February 15, 1943) 24.
4. War Department, Technical Manual (TM) E9-1983, Enemy Bombs and Fuzes, Section III, Japanese Bombs, File No. 1533.10, 2500.10 and 2500.11 (Washington, DC: n.p., November 12, 1942).

5. War Department, Technical Manual (TM) E9-1983, Enemy Bombs and Fuzes, Section 7, Japanese Fuzes, File No. 2511.n21 (Washington, DC: n.p., November 12, 1942).
6. Department of the Army, Technical Manual (TM) 9-1985-4, Japanese Explosive Ordnance (Bombs, Bomb Fuzes, Land Mines, Grenades, Firing Devices, and Sabotage Devices) (Washington, DC: Department of the Army, March, 1953) 22.
7. Office of the Chief, Chemical Warfare Service, Chemical Warfare Intelligence Bulletin No. 14, Aerial Gas Weapons of Germany, Italy and Japan (Washington, DC: n.p., May 15, 1943) 9-10.



Drawing not to scale

Figure 4.3.6-1. 50-kilogram Chemical Bomb, Type 92 (Ref. 2)

4.3.7 NOMENCLATURE: 50-kilogram Chemical Bomb, Type 100

Note: According to one source, this munition was recovered and identified as a smoke bomb with gas markings painted over.

TABULATED DATA:

Length: 102.87 centimeters (40.5 in.) (less fuze)
70.82 centimeters (27.88 in.) (without tail assembly)

Diameter: 18.42 centimeters (7.25 in.)

Type of Fill and Fill Weight:

FS/chlorosulfonic acid solution (smoke): unknown
WP: unknown

Total Weight with Fill:

FS/smoke: 53.2 kilograms (117.31 lb)
WP: 43.5 kilograms (95.92 lb)

Markings:

The color of the main body was gray with a red-tipped nose. A yellow and a white band appeared forward of the suspension lug, and a yellow band was painted aft of the suspension lug. Alternatively, the bomb may have been bluish-gray with one yellow and one white band between nose and plug, and one yellow band between tail cone and lug.

Description:

The 50-kilogram aircraft gas bomb, Type 100, consisted of a steel nose, cylindrical casting and tail assembly, with an overall length of 102.87 centimeters (40.5 inches). The steel body had a wall thickness of 0.33 centimeters (0.13 inch) and was 70.82 centimeters (27.88 inches) long by 18.42 centimeters (7.25 inches) in diameter. The cast steel nose was attached to the body by three one-quarter inch grub screws, and the sheet iron tail assembly, consisting of four fins welded to the tail cone, was welded to the body.

Explosive Train:

Nose Fuze:

Model no.: A-2(b) or D-5(a)
Overall length: 5.72 centimeters (2.25 in.)
Total weight: unknown

Burster:

Model no.: central type
Overall length: 29.54 centimeters (11.63 in.) (incendiary)
44.30 centimeters (17.44 in. (smoke)
Explosive type: unknown
Explosive weight: unknown

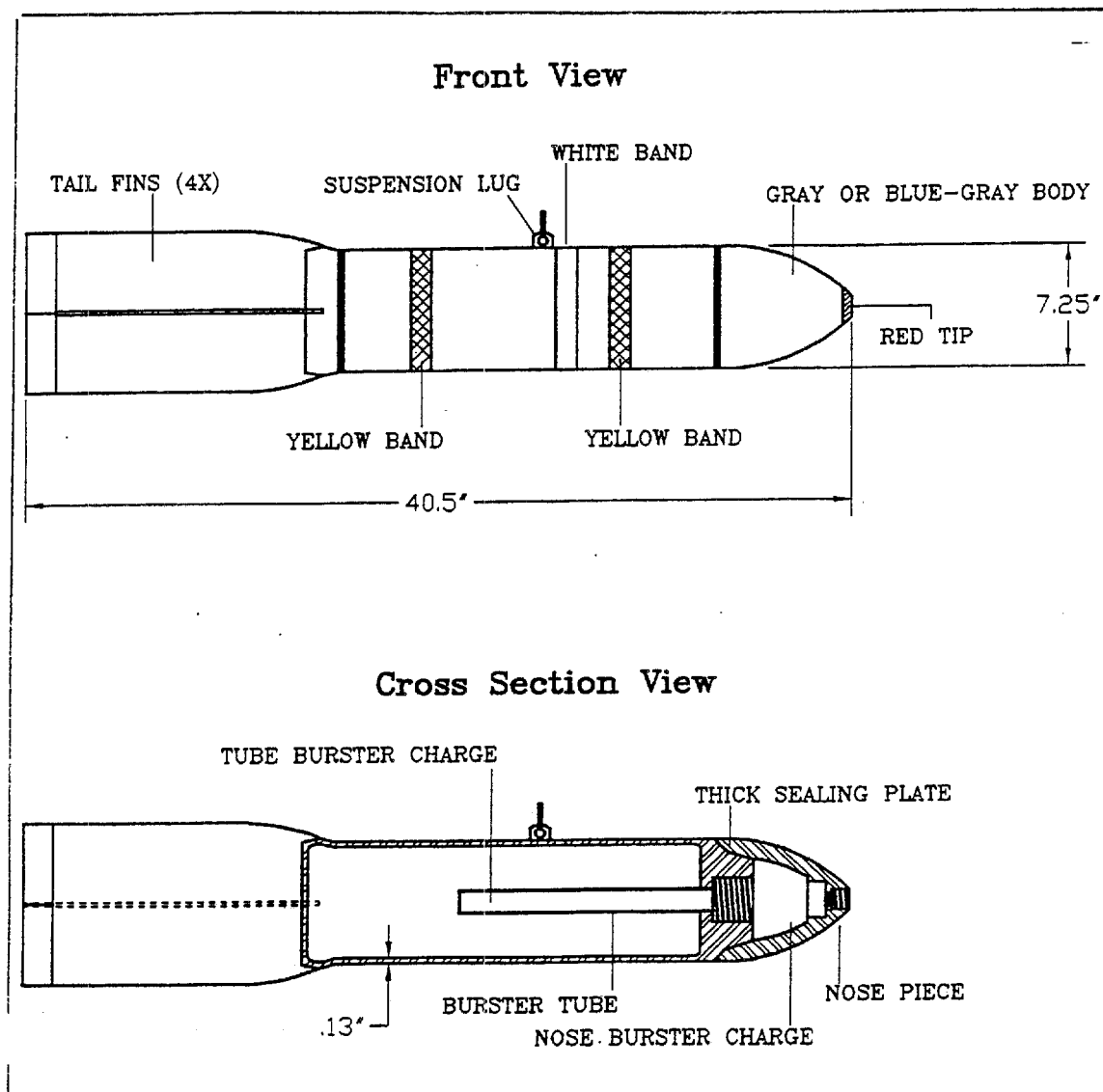
ENGINEERING DATA:

Construction:

Main body: steel
Nose: steel
Fuze: brass
Wall thickness: 0.33 centimeter (0.13 in.)
Tail assembly: four fins 40.64 centimeters (16 in.) long by 24.77 centimeters (9.75 in.) wide (diagonally); sheet iron welded to tail cone, which was welded to the body

REFERENCES:

1. Department of the Navy, OPNAV 30-3M, Handbook of Japanese Explosive Ordnance, (N.p.: Department of the Navy, 15 August 1945) 71-72, 78.
2. Mobile Explosives Investigation Unit # One, Japanese Army 50 Kilograms, Type 100 (1940) Chemical Bomb, Fleet Post Office (San Francisco: n.p., 1 September 1944) 1-2, 4.
3. U.S. Navy, Bomb Disposal Intelligence Bulletin, Number 64 (N.p.: n.p., 22 June 1944) 13-14.
4. War Department, Technical Manual (TM) E9-1983, Enemy Bombs and Fuzes, Section 7, Japanese Fuzes, File No. 2511.n21 (Washington, DC: n.p., 12 Nov 1942).



Drawing not to scale

Figure 4.3.7-1. 50-kilogram Chemical Bomb, Type 100 (Ref. 2)

4.3.8 NOMENCLATURE: Navy Chemical Bomb, Land, Type 1, No.6,
MK I; No. 6, MK I; Type 4, No. 6, MK I

TABULATED DATA:

Length:

Type 1, No. 6: 101.6 centimeters (40 in.) overall (without fuze)
No. 6, MK I: 107.21 centimeters (42.21 in.) (without fuze)
Type 4, No. 6: data not available

Diameter:

Type 1, No. 6: 19.94 centimeters (7.85 in.)
No. 6, MK I: 24.00 centimeters (9.45 in.)
Type 4, No. 6: data not available

Type of Fill and Fill Weight:

mustard thickened with methacrylates and polyvinyl alcohols:

Type 1 No. 6: 18 kilograms (39.69 lb) (approximate)
No. 6, MK I: 23 kilograms (50.72 lb)

Note: These bombs were capable of being filled with any gas, although the standard filling was mustard.

Total Weight with Fill:

Type 1 No. 6: unknown
H (No. 6, MK I): 69 kilograms (152.15 lb)

Markings:

The overall color of the bomb was gray, with a green-tipped nose and a yellow band aft of the nose. A yellow band was also painted on the tail.

Description:

The chemical fillings for the Type 1, No. 6 and the No. 6 bombs were contained in cans that fit inside the bomb casing and were sealed in place with paraffin. Two cans were used for each bomb: a conical can, which fit into the tail cone, and a cylindrical can with a channel down its center to provide space for the central explosive burster charge. Besides the central buster charge, a nose charge was provided, separated from the forward end of the gas containers by a spacer disk. The nose charge was designed to force the spacer disk and chemical filling back out of the crater, thus

helping to spread the fill. The Type 4, No. 6 MK I was designed to take the place of both the improvised No. 6 and the No. 6 MK I, Type 1 bombs.

Explosive Train:

Nose Fuze:

Model no.: A-3(a)
Overall length: unknown
Total weight: unknown

Burster:

Model no.: Type 98
Explosive type: TNT
Explosive weight: 4 kilograms (8.82 lb)

ENGINEERING DATA:

Construction:

Main body:

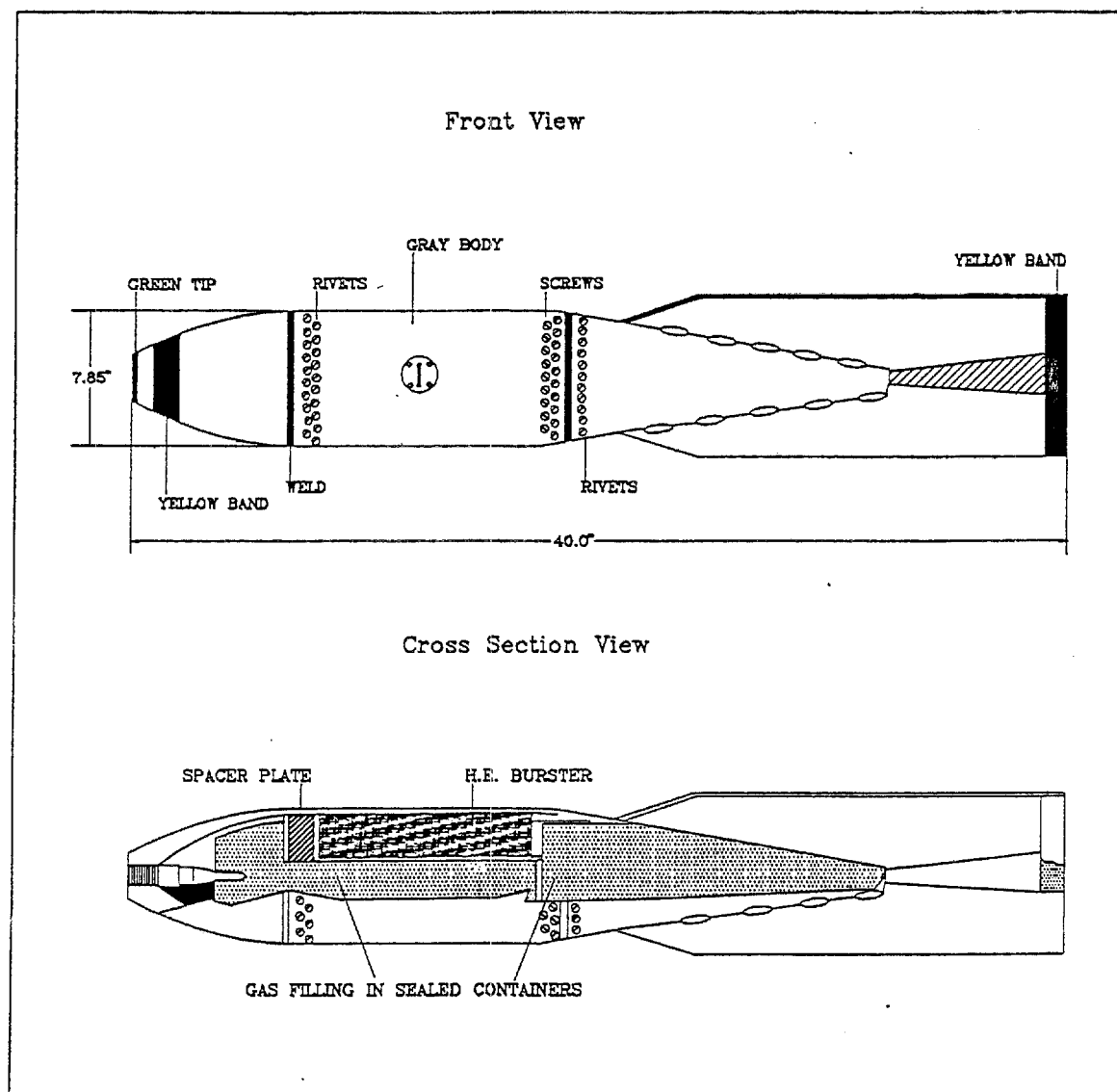
Type 1, No. 6, MK I: A cast-steel nose was attached by a continuous weld and 2 rows of 10 rivets each to a tubular-steel body. A circumferential weld to a collar was fitted into the after end of the body, which was held there by 2 rows of screws (14 per row).

No.6 MK I: *Note: This bomb may be found with only one set of struts.* A cast-steel nose was attached to a tubular-steel body by a continuous circumferential weld and 2 rows of 16 plug welds. A tail cone was attached to a collar by a continuous circumferential weld and 16 plug welds. The collar fitted into the after end of the body and was held there by 2 rows of screws (16 per row).

Type 4 No.6 MK I: This bomb was constructed of wood throughout to save steel. The barrel, nose section, and tail fins of the bomb were constructed of light plywood. A steel adapter was provided in the nose to take a standard Navy instantaneous fuze and gaine. Chemical filling for the bomb was contained in a cylindrical can with a central pocket at its forward end to receive the central burster.

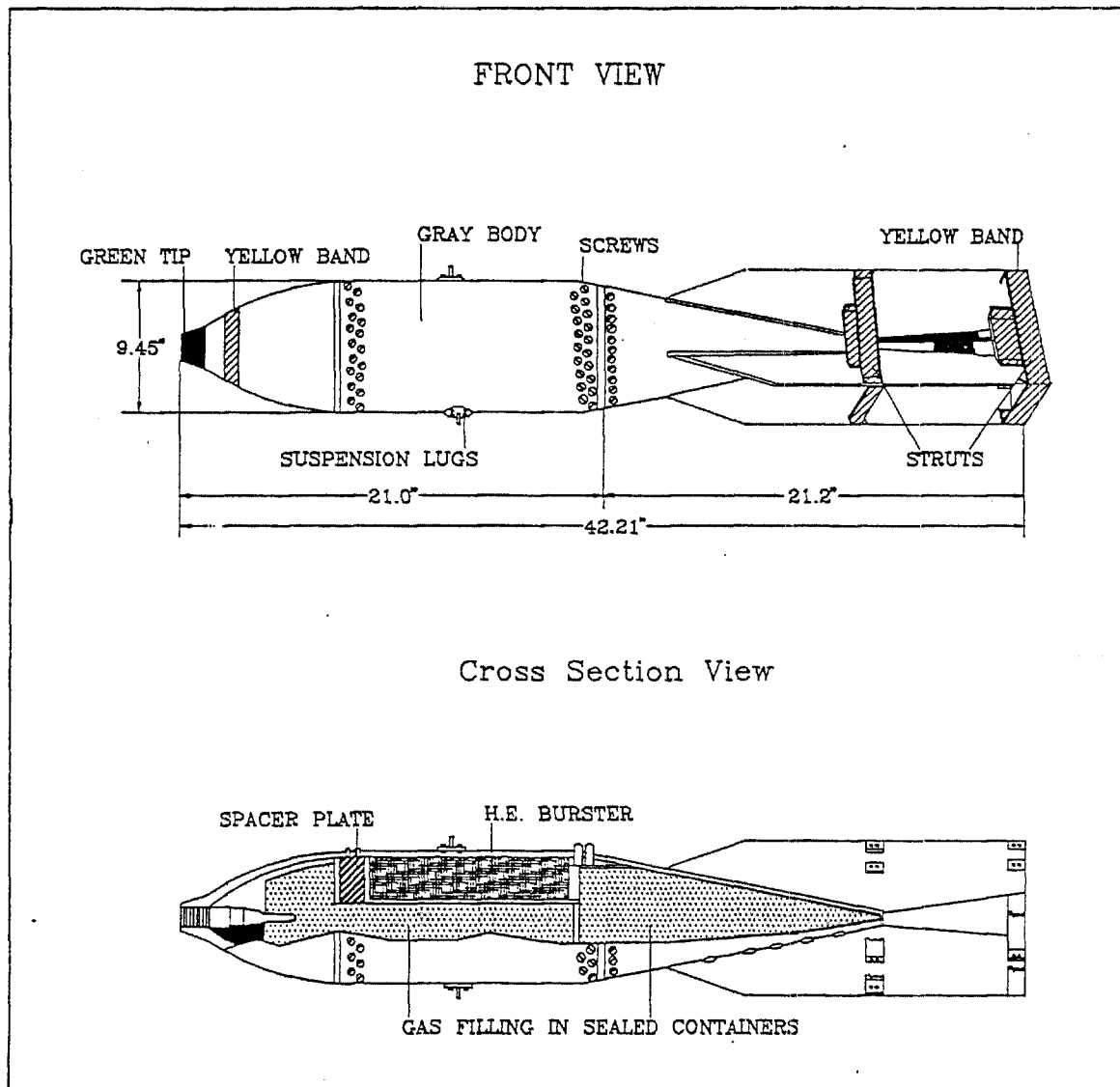
REFERENCES:

1. Department of the Navy, Japanese Explosive Ordnance, OP 1667, Volume 2, A Bureau of Ordnance Publication (N.p.: Department of the Navy, 14 June 1946) iv, 1-3, 56-58.
2. Department of the Navy, OPNAV 30-3M, Handbook of Japanese Explosive Ordnance (Washington, DC: Department of the Navy, 15 August 1945) 94-95.



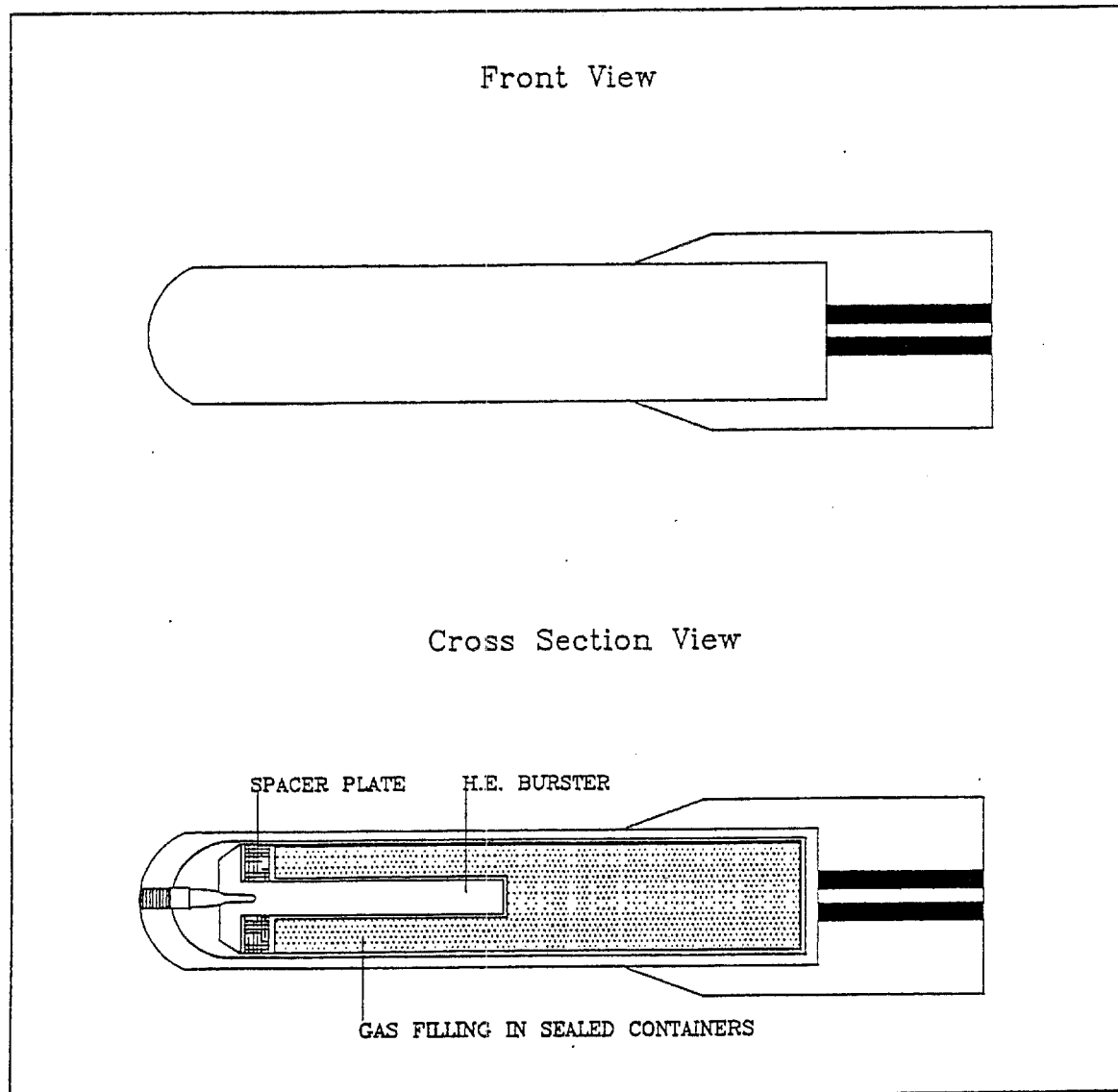
Drawing not to scale

Figure 4.3.8-1. Navy Chemical Bomb, Land, Type 1, No. 6, MK 1 (Ref. 1)



Drawing not to scale

Figure 4.3.8-2. Navy Chemical Bomb, Land, No. 6, MK I (Ref. 1)



Drawing not to scale

Figure 4.3.8-3. Navy Chemical Bomb, Land, Type 4, No. 6, MK 1 (Ref. 1)

**AMERICAN
CHEMICAL MUNITIONS**

TABLE OF CONTENTS

Section	Title	Page
LIST OF ILLUSTRATIONS		5-iii
LIST OF TABLES		5-iv
5	AMERICAN CHEMICAL MUNITIONS	5-1
5.1	INTRODUCTION	5-1
5.2	AMERICAN CHEMICAL CODES AND MARKING SYSTEM	5-1
5.2.1	World War I	5-1
5.2.2	World War II	5-2
5.3	TECHNICAL DESCRIPTIONS	5-3
5.3.1	4-Inch Stokes Mortar	5-4
5.3.2	Cartridge, Mortar, 4.2-Inch	5-8
5.3.3	Livens Projectile, Mk II (M1)	5-12
5.3.4	Artillery Shell, 75-Millimeter, Common Steel Shell Mk II	5-16
5.3.5	Artillery Shell, 4.7-Inch, Common Steel Shell, Mk II	5-20
5.3.6	Artillery Shell, 5-Inch, Common Steel Shell, Mk VI	5-24
5.3.7	Artillery Shell, 6-Inch, Common Steel Shell, Mk III	5-28
5.3.8	Chemical Shell, 5-Inch/38, Mk 53 GB (USN)	5-31
5.3.9	Chemical Shell, 5/54, Mk 54, GB (USN)	5-34
5.3.10	Artillery Shell, 155-Millimeter (Howitzer) Common Steel Shell, Mk II and Mk IIA1, Mk VII	5-37
5.3.11	Artillery Projectile, 175-Millimeter, Gun, (GB), T-223	5-41
5.3.12	Artillery Shell, 8-Inch, Common Steel Shell, Mk III	5-44
5.3.13	Artillery Projectile, 8-Inch, T-174	5-48
5.3.14	Chemical Spray Tank, M10	5-51
5.3.15	Tank, Smoke, M33 (formerly E16R1 tank; also known as the M33A1)	5-54
5.3.16	Rocket, 2.36-Inch, Gas, M26	5-57
5.3.17	Rocket, 7.2-Inch (C.W.R.-N) and Army M25 and M27	5-60
5.3.18	Agent Kit, Toxic (GB), 3.5-Inch Rocket, E8	5-64
5.3.19	Chemical Rocket, 5-Inch, Warhead Mk 40	5-67
5.3.20	Bomb, Gas (GB), 10-Pound, M125A1	5-70
5.3.21	Bomb, Gas, Persistent, 30-Pound, M1	5-73
5.3.22	Bomb, Chemical, 100-Pound (H), M47 and M47A2	5-76
5.3.23	Bomb (Navy), 100-Pound, Mk 42	5-81
5.3.24	Bomb, Chemical (Gas), 115/125-Pound, E-46, E52, M70, M70A1, and M113	5-85
5.3.25	Bomb, Chemical, 500-Pound (CG, CK, and AC) AN-M78	5-90
5.3.26	Bomb, Chemical, 1000-Pound, AN-M79	5-94
5.3.27	Bomb, Chemical, 1000-Pound, T2	5-98
5.3.28	Chemical Bomblet, M139	5-101
5.3.29	Bomblet, Spherical, 3.4-Pound, M134 (GB)	5-104

Section	Title	Page
5.3.30	Bomblet, Nonpersistent, E139 (GB)	5-107
5.3.31	Bomblet, Chemical, BLU/50/B	5-110
5.3.32	Land, Mine, Chemical, 1-Gallon	5-113

LIST OF ILLUSTRATIONS

Figure	Title	Page
5.3.1-1	4-Inch Stokes Mortar	5-7
5.3.2-1	Cartridge, Mortar, 4.2-Inch	5-11
5.3.3-1	Livens Projectile, Mk II (M1)	5-15
5.3.4-1	Artillery Shell, 75-Millimeter, Common Steel Shell MK II	5-19
5.3.5-1	Artillery Shell, 4.7-Inch, Common Steel Shell, Mk II	5-23
5.3.6-1	Artillery Shell, 5-Inch, Common Steel Shell, Mk VI)	5-27
5.3.7-1	Artillery Shell, 6-Inch, Common Steel Shell, Mk III	5-30
5.3.8-1	Chemical Shell, 5-Inch/38, Mk 53, GB (USN)	5-33
5.3.9-1	Chemical Shell, 5/54, Mk 54, GB (USN)	5-36
5.3.10-1	Artillery Shell, 155mm, (Howitzer) Common Steel Shell, Mk II and Mk IIA1 and Mk VII	5-40
5.3.11-1	Artillery Projectile, 175-Millimeter, Gun, (GB), T-223	5-44
5.3.12-1	Artillery Shell, 8-Inch, Common Steel Shell, Mk III	5-47
5.3.13-1	Artillery Projectile, 8-Inch, T-174	5-50
5.3.14-1	Chemical Spray Tank, M10	5-53
5.3.15-1	Tank, Smoke, M33 (formerly E16R1 tank; also known as the M33A1)	5-56
5.3.16-1	Rocket, 2.36-Inch, Gas, M26	5-59
5.3.17-1	Rocket, 7.2-Inch (C.W.R.-N) and Army M25 and M27	5-63
5.3.18-1	Agent Kit, Toxic (GB), 3.5-Inch Rocket, E8	5-66
5.3.19-1	Chemical Rocket, 5-Inch, Warhead Mk 40	5-69
5.3.20-1	Bomb, Gas (GB), 10-Pound, M125A1	5-72
5.3.21-1	Bomb, Gas, Persistent, 30-Pound, M1	5-75
5.3.22-1	Bomb, Chemical, 100 Pound (H), M47, and M47A2	5-80
5.3.23-1	Bomb (Navy), 100 pound, Mk 42	5-84
5.3.24-1	Bomb, Chemical (Gas), 115/125-Pound, E-46, E52, M70, M70A1, and M113	5-89
5.3.25-1	Bomb, Chemical, 500 pound (CG, CK, and AC) AN-M78	5-93
5.3.26-1	Bomb, Chemical, 1000-Pound, AN-M79	5-97
5.3.27-1	Bomb, Chemical, 1000-Pound, T2	5-100
5.3.28-1	Chemical Bomblet, M139	5-103
5.3.29-1	Bomblet, Spherical, 3.4 pounds, M134 (GB)	5-106
5.3.30-1	Bomblet, Nonpersistent, E139 (GB)	5-109
5.3.31-1	Bomblet, Chemical, BLU/50/B	5-112
5.3.32-1	Land, Mine, Chemical, 1-Gallon	5-115

LIST OF TABLES

Table	Title	Page
5-1	United States World War I Chemical Fillings and Markings	5-1

SECTION 5 AMERICAN CHEMICAL MUNITIONS

5.1 INTRODUCTION

The United States inventory of old chemical weapons includes artillery and mortar shells, rockets, bomblets, aerial bombs and spray tanks, chemical mines, and other associated items, such as agent containers and chemical agent identification sets. These items were developed under an active research and development program that began during World War I and continued until the late 1970s. During these periods, codes and marking systems that signified agent fills and types of explosives common to many of the items in this compendium were used. See appendix A for a list of chemical agent fills and related items.

5.2 AMERICAN CHEMICAL CODES AND MARKING SYSTEM

5.2.1 World War I. During World War I, the United States chemical artillery shells were painted gray with the words Special Gas in black. A series of colored stripes or bands (white or red), which circled the shell body, depicted the persistency of the filling. Shells with persistent filling were marked with red bands; nonpersistent with white bands; and semipersistent with a combination of red and white bands. The number of bands gave the relative persistency within the group; that is, one band depicted the least persistent, two bands the next persistent, etc. Table 5-1 lists the chemical fillings used by the United States during World War I and the markings used to distinguish each filling.

Table 5-1. United States World War I Chemical Fillings and Markings

Filling	Marking
CG (phosgene)	2 white bands
PD [CG and diphenylchlorarsine (DA)]	3 white bands
PG [chloropicrin (PS) and CG]	1 white band, 1 red band, 1 white band
HS (mustard gas)	3 red bands

After World War I, an effort was made to reduce and standardize the number of fills for chemical shells. Only one type of filling was approved as standard within each persistency group (circa 1937). When a new filling that was more effective than the current standard type was developed, it was approved as the standard within its type, and the previous standard then became the substitute standard or it was discarded entirely.

5.2.2 World War II. With the introduction of aerial bombs in World War II, a system, similar to the one used for marking artillery shells, was developed. The bomb body was painted light gray with colored bands signifying the type of filling. The colored bands were located between the suspension lugs and ahead of the center of gravity. Nonpersistent fillings were indicated by one green band; persistent fillings by two green bands.

Another source gives the same color scheme but indicates that the colored bands were located at the nose, center, and tail. The source also indicates that the other markings (type, weight, model, filler, and lot number) on the bombs were painted in green.

To differentiate between different designs of the same bomb, Mark (MK) numbers for the Navy, and Model (M) numbers for the Army were given when the item was standardized. The Navy MK number was followed by an Arabic number. Changes to the original design were shown by the term Mod and an Arabic number after the MK number. Army-designed bombs were designated by the letter M and an Arabic number. Modifications to the original bombs are indicated by the letter A and the appropriate number. A bomb designated by the letter T was a developmental or experimental item. Items that have been type classified for use by both the Army and Navy were indicated by the letters AN. This information would be included in the markings found on the bomb body.

Circa 1960, a new color marking system was initiated for aerial bombs. The overall color of gray was retained. Green bands were retained for lethal fillings, while red bands were used for harassing agents. The old color marking system for artillery ammunition was included in the event that a round was discovered that had the old marking system.

Under the old system, artillery ammunition was overall gray with green markings. Nonpersistent (including G-series agents) shells had one green band, while persistent (including V-series agents) shells had two green bands.

The new system had artillery ammunition in overall gray with green markings and a yellow band if an explosive burster was present. Nonpersistent fillings had one green band; persistent fillings had two green bands; and nerve agent fillings had three green bands. Also, the word GAS and the chemical agent symbol in green were painted on the shell.

A third system, new/new, is that used with the current stockpile. Those items are not included in this document.

5.3 TECHNICAL DESCRIPTIONS

The following pages present technical information on each American chemical munition.

5.3.1 NOMENCLATURE: 4-Inch Stokes Mortar

TABULATED DATA:

Length: 17.56 - 19.56 inches (up to 496.8 mm) (depending on lot)

Diameter: 4.178 inches (106.1 mm) (end and base disks)
4 inches (106.1 mm) (body)

Type of Fill and Fill Weight:

Note: The Stokes Mortar fill weight was between 6.3 and 9.5 pounds (2.8 to 4.3 kg). The weight depended on the chemical agent in the shell.

CG: exact weight unknown
NC: exact weight unknown
PS: exact weight unknown
PG: exact weight unknown
HS: exact weight unknown
WP: exact weight unknown
TH3: exact weight unknown

Total Weight with Fill:

Note: A 4-inch Stokes mortar filled and completely assembled could weigh up to 25 pounds (11.36 kg).

CG: exact weight unknown
NC: exact weight unknown
PS: exact weight unknown
PG: exact weight unknown
HS: exact weight unknown
WP: exact weight unknown
TH3: exact weight unknown

Markings:

The main body color was blue-gray. Marking varied depending on fill. The following markings apply:

CG: two white bands and the word GAS CG or HS stenciled on body
NC: one red band, one white band, and one yellow band with the word GAS stenciled on body
PS: one red band, one white band, and the word GAS stenciled on the body
PG: one white band, one red band and one white band and the word GAS stenciled on the body

The following was stenciled on all shells:

4-IN-CM
EA
LOT NO.

Description:

The complete 4-inch Stokes mortar consisted of the shell body, burster, fuze, propellant charge, and filling. The shell body was a cylinder, 4 inches in diameter, fabricated from drawn steel tubing or rolled metal with an overlapped weld.

The body contained a forward disk and a base disk. The forward or nose disk was machined to 4.178 inches in diameter and designed to retain the forward end of the burster tube and fuze. The base disk was also machined to 4.178 inches and designed to support the aft end of the burster tube and accommodate the cartridge container. The cartridge container was a steel cylinder 2.875 inches in length, 1 inch in diameter, and perforated with 16 holes to provide outlets for the gases generated by the propellant. The forward end (or nose disk) and base disk served as guides when the round was expelled from the mortar barrel. (Note: U.S. used British version as well as U.S. version of Stokes mortar.)

The total length of the shell body assembly varied, depending on the type of filling that was required. For example, the 4-inch Stokes mortar, designed for the lethal gases, was 19 inches long; the smoke model was 18.56 inches long; and the round designed for incendiary was 17.56 inches long.

Explosive Train:

Fulminate of mercury:	unknown
Tetryl:	unknown
Black powder:	0.297 ounce (8.41 g)

Fuze:

Model No.:	M-X1
Total Weight:	1 pound, 9 ounces (708.8 g)
Overall Length:	2.659 inches (67.5 mm), M-XI, 2.5 inches (63.5 mm)

Burster:

The burster consists of a detonator, which contains fulminate of mercury, and a 0.5-inch-diameter central tube filled with tetryl.

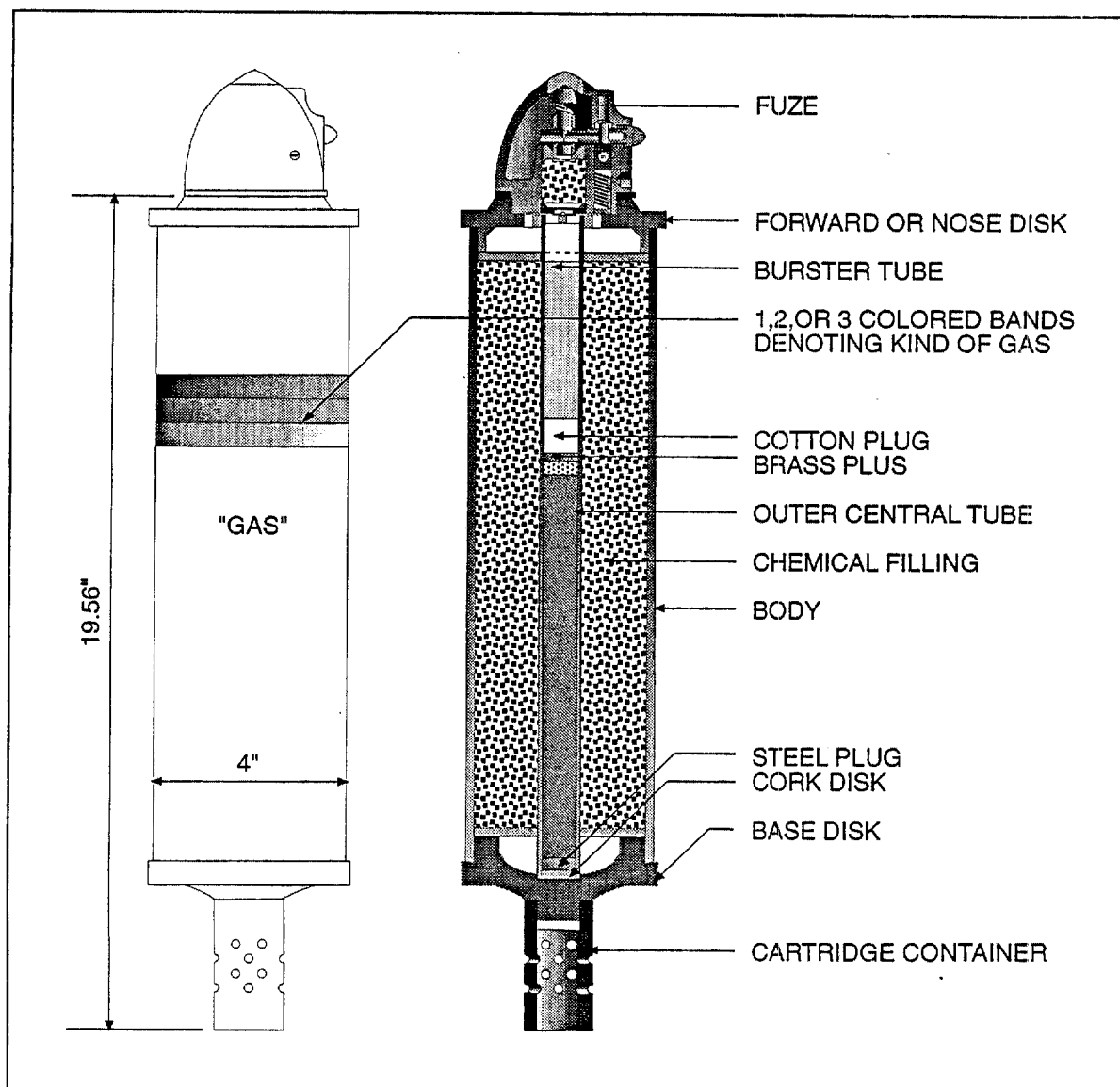
ENGINEERING DATA:

Construction:

Main body: drawn steel tubing or rolled metal with an overlapped weld

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937).
2. Anonymous, Gas Manual, Part III, Use of Gas by Gas Troops, American Expeditionary Forces No. 1475-3 (N.p.: n.p., March 1919) 17-42.



Drawing not to scale

Figure 5.3.1-1. 4-Inch Stokes Mortar (Ref. 1)

5.3.2 NOMENCLATURE: Cartridge, Mortar, 4.2-Inch

TABULATED DATA:

Length: 21.01 inches (533.7 mm) with fuze

Diameter: 4.19 inches (106.42 mm)

Type of Fill and Fill Weight:

HD: 6.00 pounds (2.7 kg)	WP: 7.5 pounds (3.4 kg)
H: 6.2 to 6.5 pounds (2.8 to 3.0 kg)	PWP: 7.5 pounds (3.4 kg)
CG: 6.25 pounds (2.8 kg)	CNB: 5.45 pounds (2.5 kg)
HT: 5.75 pounds (2.6 kg)	FS: 7.5 pounds (3.4 kg)
CNS: 7.00 pounds (3.2 kg)	HE: 7.08 pounds (3.2 kg)
CK: 5.00 pounds (2.3 kg)	GA: unknown
L: 7.6 pounds (3.5 kg)	

Total Weight with Fill:

HD: 23.50 pounds (10.68 kg)	WP: 24.91 pounds (11.32 kg)
H: 23.70 pounds (10.77 kg)	PWP: 24.91 pounds (11.32 kg)
CG: 23.80 pounds (10.82 kg)	CNB: 21.62 pounds (9.82 kg)
HT: 23.30 pounds (10.59 kg)	FS: 25.75 pounds (11.70 kg)
CNS: 23.17 pounds (10.53 kg)	HE: 26.2 pounds (11.91 kg)
CK: 23.45 pounds (10.66 kg)	GA: unknown
L: 25.54 pounds (11.61 kg)	

Markings:

L, HD, H, HT:	gray body with two green bands, green markings, and one yellow band
CG, CNB, CNS:	gray body with one green band, green markings, and one yellow band
GA:	gray body with one green band or three green bands, green markings, and one yellow band (derived from color code scheme; no listing noted)
WP, PWP:	gray body with one yellow band and yellow markings or light green body with red markings and a yellow band
FS:	gray body with one yellow band and yellow markings
HE:	olive drab body with one yellow band and yellow markings

Description:

The complete round consisted of a one-piece, forged-steel case projectile body, integral base and walls, the casing swaged to form the ogive, a PD fuze with an

integral burster, and a tail assembly. The agent was sealed into the round with a steel burster well. The body contained a perforated vane assembly welded to the inside of the body, and was designed to accommodate the burster tube that extends from the fuze. The tail assembly consisted of a pressure plate and rotating disk, propelling charge, cartridge container and ignition cartridge, and striker nut assembly.

Explosive Train:

Fuze:

Model no.: M8 (agent), M567 (HE)
Total weight: 1.4 pounds (653.6 g)
Overall length: 16.138 inches (409.9 mm) - with burster tube

Earlier rounds, circa 1927, used Point Detonating fuze E2R8.

Burster:

Model no.: HD, M14
Diameter: 1.33 inches (33.8 mm)
Length: extends the length of the body cavity
Explosive type: tetryl
Explosive weight: 0.73 pound (331 g)

ENGINEERING DATA:

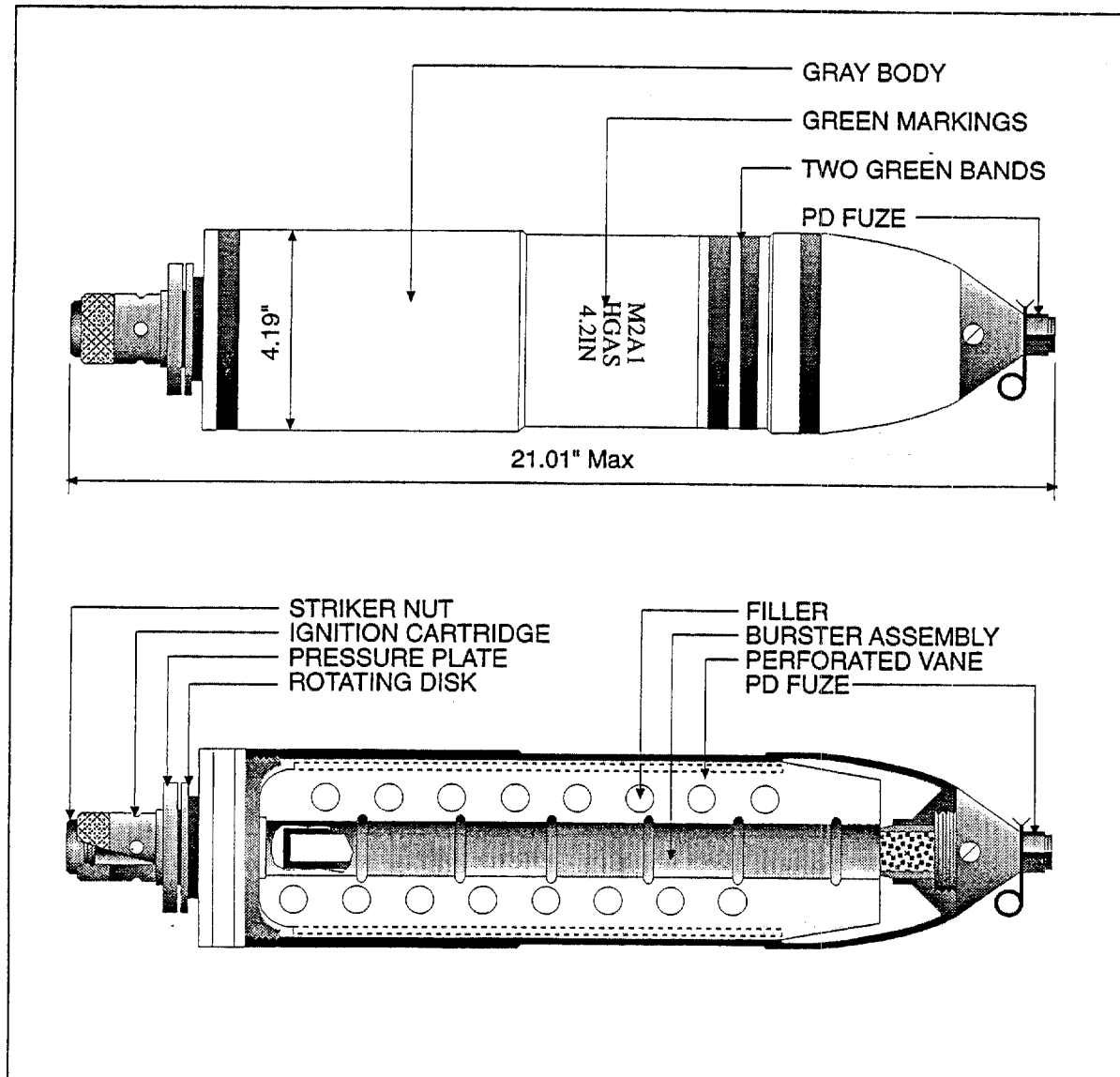
Construction:

Cartridge: steel
Fuze assembly: aluminum or steel
Wall thickness: recessed portion 0.2 inch (5.08 mm)
near base 0.23 inch (5.84 mm)
base 0.443 inch (11.25 mm)

REFERENCES:

1. Headquarters, Department of the Army, Federal Supply Catalog, Ammunition over 75 mm up to 125 mm, SC 1305/30-IL (N.p.: Department of the Army, 29 July 1977).
2. Headquarters, Department of the Army, Army Ammunition Data Sheets For Artillery Ammunition, Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers and Artillery Fuzes, TM 43-0001-28 (Washington, DC: Department of the Army, April 1977) 4-50 through 4-70.

3. Headquarters, Department of the Army, Organizational Maintenance Manual for Mortar 4.2", TM 9-1015-215-12 (N.p.: Department of the Army, n.d.).
4. Department of the Army, Organizational Maintenance Manual Including Repair Parts and Special Tools List: Artillery Ammunition for Guns, Howitzers, Mortars, Recoilless Rifles, and 40 MM Grenade Launchers, TM 9-1300-251-20 (Washington, DC: Department of the Army, 21 December 1973).
5. Department of the Navy, Chief of the Bureau of Naval Weapons, Miscellaneous Chemical Weapons, Description and Operation, NAVWEPS OP 2217 (Washington, DC: Department of the Navy, n.d.).
6. Robert L. Edgin, CPT, CMLC, Technical Data Booklet for Chemical Munitions and Materiel, Technical Escort Center (Aberdeen Proving Ground, Edgewood Area, MD: Department of the Army, 22 June 1970).
7. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).
8. Anonymous, Shell, 4.2-Inch Chemical Mortar, M2. Document located at U.S. Chemical Corps Museum, Ft. McClellan, AL, File 1, Drawer 1. (N.p.: Department of the Army, n.d.).
9. Anonymous, Photographs with captions. Photos located at U.S. Chemical Corps Museum, Ft. McClellan, AL, File 1, Drawer 1. (N.p.: Department of the Army, n.d.).
10. Basil T. Fedoroff, and Oliver E. Sheffield, Encyclopedia of Explosives and Related Items, PATR 2700, Vol. 4 (Picatinny Arsenal, Dover, NJ: n.p., 1969).
11. Artillery Ammunition, TM 9-1901 (N.p.: Department of the Army, 1950) 19.



Drawing not to scale

Figure 5.3.2-1. Cartridge, Mortar, 4.2-Inch

5.3.3 NOMENCLATURE: Livens Projectile, MK II (M1)

TABULATED DATA:

Length:

MK II Shell Body: 21.62 inches (549.1 mm)
MK IIA1 Shell Body: 23 inches (584.2 mm)

Diameter:

MK II Shell Body: 7.62 inches (193.5 mm)
MK IIA1 Shell Body: 7.75 inches (196.8 mm)

Type of Fill and Fill Weight:

CG: 28 pounds (12.72 kg)
FS: 28 pounds (12.72 kg)
CL: 28 pounds (12.72 kg)
CH: 28 pounds (12.72 kg)
NC: unknown (PS & KF)
FM: 30 pounds (13.64 kg) (titanium tetrachloride)
BM: unknown

Note: BM, or Berger Mixture, was a mix of zinc dust, zinc oxide, and carbon tetrachloride.

Total Weight with Fill:

CG: 61 pounds (27.73 kg)
FS: 61 pounds (27.73 kg)
CL: 61 pounds (27.73 kg)
CH: 28 pounds (12.72 kg)
NC: unknown
FM: 63 pounds (28.63 kg)
BM: unknown

Markings:

Two different markings were present depending on the model.

MK II: The shell body of the CG round was slate gray with two white bands, 0.5 inch wide, and stenciled around the body. The word GAS was stenciled in 1-inch white block letters, lengthwise of the projectile.

MK IIA1: The shell body of the CG round was blue and gray with one green band, 0.5 inch wide, painted around the body 8 inches from the fuze end. The symbol and word GAS-CG was painted in green 0.25 inch below the green band. LIVENS PROJECTILE, EA, and LOT NO. were placarded below GAS-CG.

Description:

The shell body MK II was made of seamless drawn steel tubing 0.188 inch thick with forge-steel welded hemispherical ends. It can be identified by the projections at each end, which are 1.69 inches in diameter and approximately 1 inch long. The shell had a capacity of approximately 660 cubic inches. A central tube ran the length of the shell and was welded into it at both ends. A steel plug (coupling plug) was welded into the tube to divide it into the section used to receive the burster tube and the section used for filling the shell. The shell filling passed from the tube into the shell through four holes located near the filling end of the shell. There were also two vent holes. After filling, the shell was sealed by screwing a tapered plug into the filling hole.

The shell body (MK IIA1) differed in construction in that the hemispherical ends were closed by fusion welding. The MK IIA1 shell body had a capacity of 716 cubic inches. The remaining details of the MK IIA1 shell body are the same as the MK II.

CG was the common agent filling. Chlorine and chloropicrin were used individually and as a mixture. Mustard and Berger Mixture (BM) smoke mixtures were both attempted as test fills, but were not standard. During World War I, titanium tetrachloride (FM) was a common smoke filling in the Livens projectile with a total fill weight of 30 pounds.

Explosive Train:

Fuze:

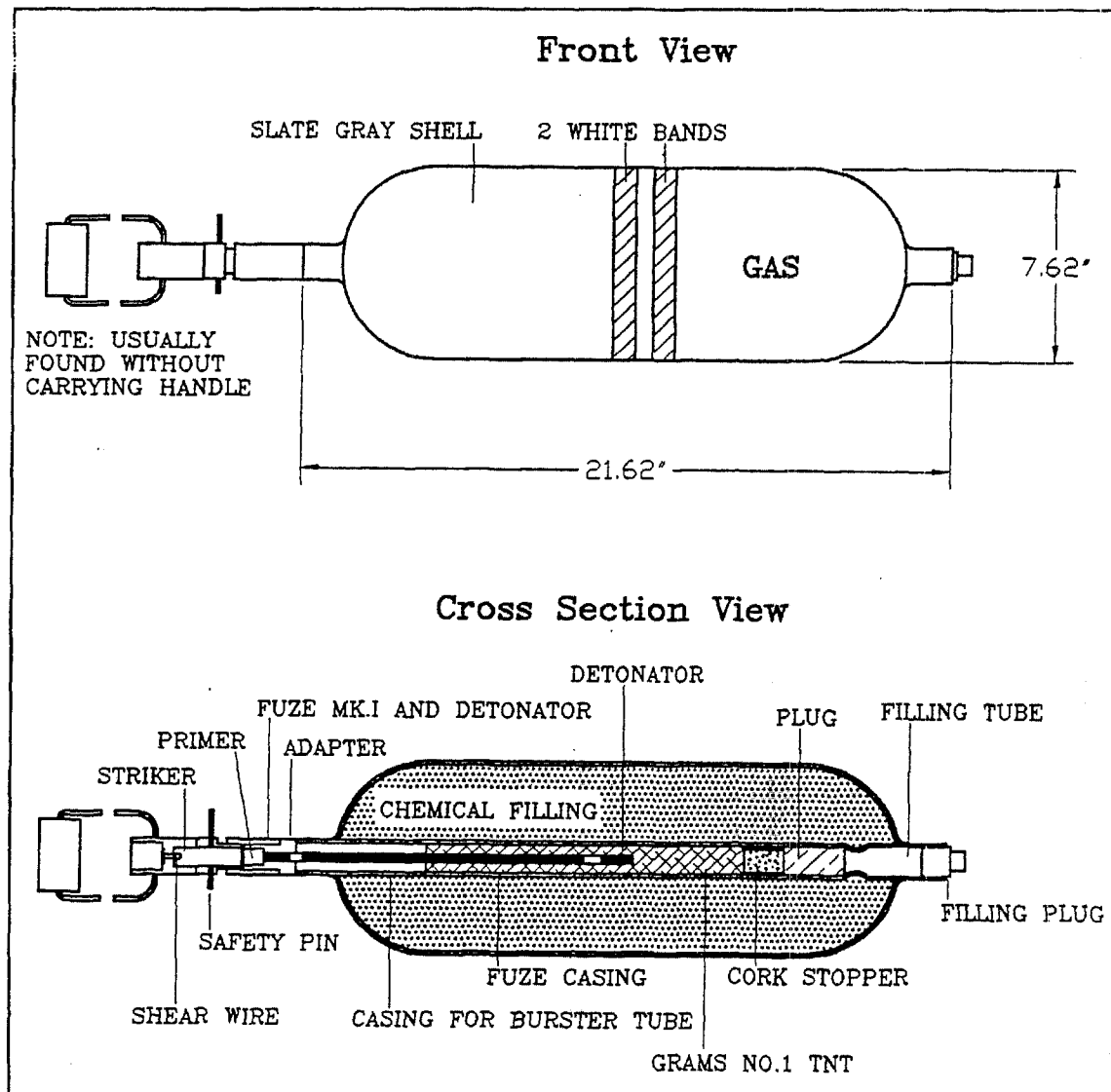
Model no.:	Bickford
Total weight:	unknown

Burster:

Model no.:	M1
Diameter:	unknown
Length:	length of interior of shell
Explosive type:	TNT
Explosive weight:	2.11 ounces (59.9 g)

REFERENCES:

1. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937).
2. Department of Army, TM 3-325, Livens Projectile, MI (Washington, DC: Department of Army, 1942).
3. G.H. Burrell, CPT, C.W.S., Monograph on the Use of War Gases in Liven's Projectiles, American University Experiment Station, Chemical Warfare Service (Washington, DC: n.p., December 1918).
4. Amos A. Fries, Brigadier General, American Expeditionary Forces Chemical Warfare Services, Manual of Gas Warfare (France: n.p., March 1919).
5. Anonymous, Document located at U.S. Chemical Corps Museum, Ft. McClellan, AL, File 1, Drawer 2 (N.p.: Department of Army, n.d.)
6. Anonymous, Shell, Chemical, Mark II, L.P., CG (Approved Standard For Manufacture). Document located at U.S. Chemical Corps Museum, Ft. McClellan, AL, File 1, Drawer 2. (N.p.: Department of Army, n.d.).
7. Anonymous, Fuze Assembly, Bickford, Mark I (Time) for Shell, L.P., Chemical. Document located at U.S. Chemical Corps Museum, Ft. McClellan, AL, File 1, Drawer 2. (N.p.: Department of Army, n.d.).



Drawing not to scale

Figure 5.3.3-1. Livens Projectile, MK II, (M1) (Ref. 2)

5.3.4 NOMENCLATURE: Artillery Shell, 75-Millimeter, Common Steel Shell MK II

TABULATED DATA:

Length: 10.95 inches (278 mm) (without fuze)

Diameter: 2.95 inches (75 mm)

Type of Fill and Fill Weight:

HS: 1.35 pounds (0.61 kg)
CG: 1.32 pounds (0.6 kg) (approximately)
NC: 1.74 pounds (0.79 kg)
CA: 1.45 pounds (0.66 kg)
BA: 1.97 pounds (0.90 kg)
FM: 1.71 pounds (0.78 kg)
WP: 1.90 pounds (0.86 kg)

Total Weight with Fill:

HS: 11.62 pounds (5.28 kg)
CG: 11.59 pounds (5.27 kg)
NC: 12.01 pounds (5.46 kg)
CA: 11.72 pounds (5.34 kg)
BA: 12.24 pounds (5.56 kg)
FM: 11.98 pounds (5.45 kg)
WP: 12.17 pounds (5.53 kg)

Markings:

The main body color was slate gray. The band identification and special markings for the various fills are shown in the following table.

Shell Fill	Color of Bands			Stenciled Markings
	1st Band	2nd Band	3rd Band	
HS	red	red	red	SPECIAL GAS
CG	white	white	none	SPECIAL GAS
NC	white	red	yellow	SPECIAL GAS
CA	red	red	none	SPECIAL GAS
BA	red	none	none	SPECIAL GAS
FM	yellow	yellow	none	SMOKE
WP	yellow	yellow	none	SMOKE

The bands were 0.5 inch wide and 0.5 inch apart. The bands were painted around the shell with the words Special Gas or Smoke stenciled on the shell. Other markings on the shell included the shell weight, code, caliber and lot number. The weight marks just above the driving band were marked with an L, +, ++, +++, or +++, depending on the weight of the projectile. Immediately above the weight marks, and on the side of the shell, opposite the words SPECIAL GAS was 75-G. The bottom of the cartridge case was marked with a black band 0.375 inch wide with the words SPECIAL GAS.

Description:

The gas shell consisted of the shell body, which contained the gas; the gaine tube (adapter and booster casing), which screwed into the nose of the shell and contained the bursting charge; and the bursting charge, which consisted of a small quantity of high explosive sufficient to open the shell, and in some cases, atomize the liquid content. Since most of the gases used entered the shell as liquids, they expanded as liquids when heated, and a space was left for this expansion by only partially filling the shell.

Three fuzes were normally used with this shell, which was tapped through the nose to receive the adapter for French-type fuzes. The fuzes are: the U.S. MK III; French I.A.L., Model 1916; and French I.A., Model 1915.

Explosive Train:

Fuze:

Model no.:	U.S. MK III; French I.A.L., Model 1916; or French I.A., Model 1915
Overall length:	up to 7.38 inches (187.4 mm)
Total weight:	0.6 to 1.2 pounds (272.4 to 544.8 g) (three types)

Booster:

Explosive type:	tetryl
Explosive weight:	0.078 pound (35.4 g)

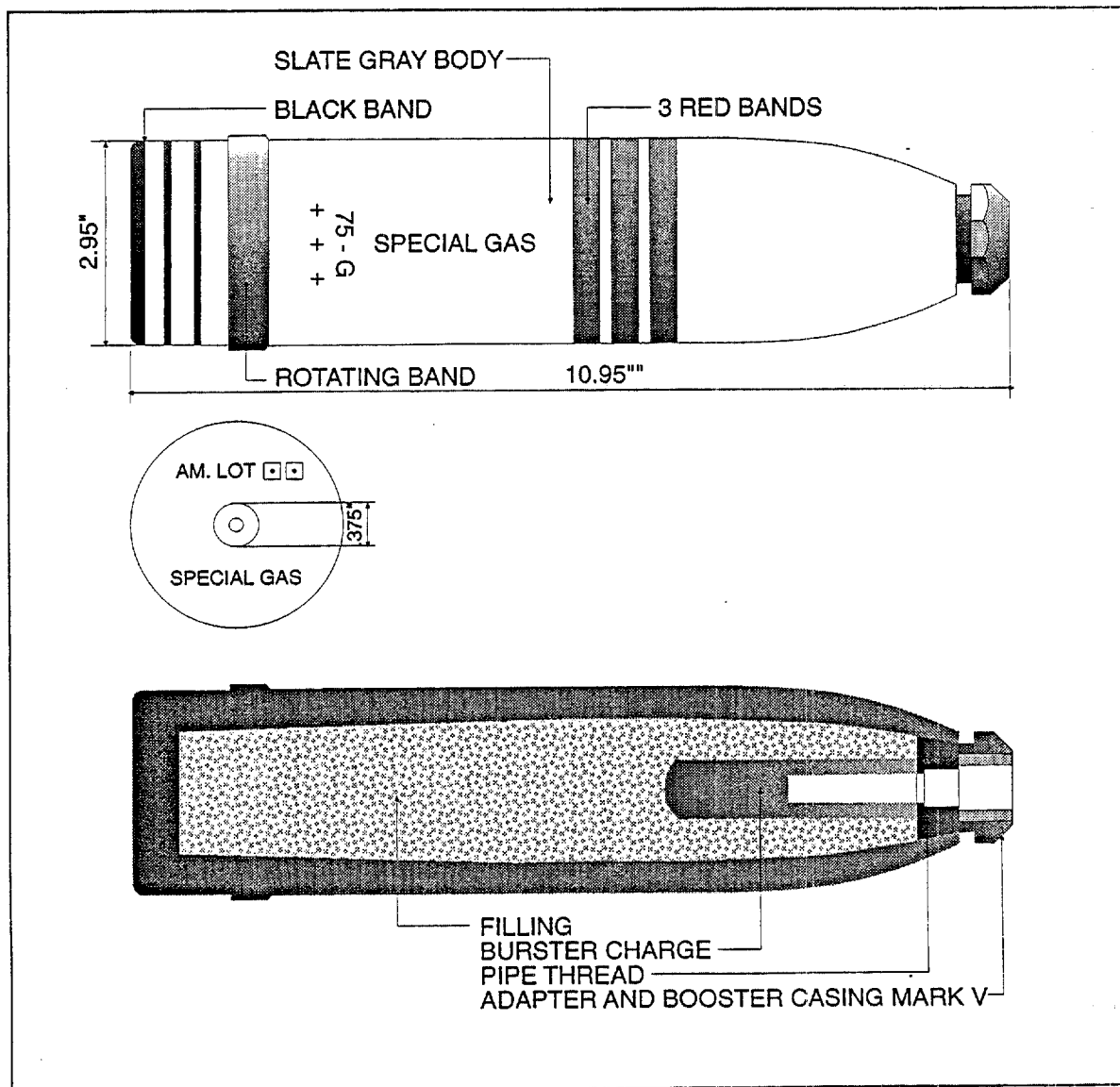
ENGINEERING DATA:

Construction:

Main body: steel
Wall thickness: 0.303 inch (7.69 mm)

REFERENCES:

1. General Headquarters, American Expeditionary Forces, Chemical Warfare Service, Manual of Gas Warfare (France: n.p., March 1919) 495-500.
2. Office, Chief of Ordnance, Handbook of Ordnance Data, USA (N.p.: Government Printing Office, 15 November 1918) 150.



Drawing not to scale

Figure 5.3.4-1. Artillery Shell, 75-Millimeter, Common Steel Shell MK II

5.3.5 NOMENCLATURE: Artillery Shell, 4.7-Inch, Common Steel Shell, MK II

TABULATED DATA:

Length: 16.7 inches (424 mm) (without fuze)

Diameter: 4.72 inches (120 mm)

Type of Fill and Fill Weight:

HS: 4.38 pounds (1.99 kg)
CG: 4.27 pounds (1.94 kg)
NC: 5.62 pounds (2.55 kg)
PS: 5.30 pounds (2.41 kg)
CA: 4.44 pounds (2.02 kg)
BA: 6.36 pounds (2.89 kg)
FM: 5.53 pounds (2.51 kg)
WP: 6.14 pounds (2.79 kg)

Total Weight with Fill:

HS: 41.78 pounds (18.99 kg)
CG: 41.67 pounds (18.94 kg)
NC: 43.02 pounds (19.55 kg)
PS: 42.70 pounds (19.41 kg)
CA: 41.84 pounds (19.02 kg)
BA: 43.76 pounds (19.89 kg)
FM: 42.93 pounds (19.51 kg)
WP: 43.54 pounds (19.79 kg)

Markings:

The main body color was slate gray. The band identification and special markings for the various fills are shown in the following table.

Shell Fill	Color of Bands			Stenciled Markings
	1st Band	2nd Band	3rd Band	
HS	red	red	red	SPECIAL GAS
CG	white	white	none	SPECIAL GAS
NC	white	red	yellow	SPECIAL GAS
CA	red	red	none	SPECIAL GAS
BA	red	none	none	SPECIAL GAS
FM	yellow	yellow	none	SMOKE
WP	yellow	yellow	none	SMOKE

The bands were 0.5 inch wide and 0.5 inch apart. The bands were painted around the shell with the words SPECIAL GAS or SMOKE stenciled on the shell. Other markings on the shell included the shell weight, code, caliber, and lot number. The weight marks just below the bourrelet were 0.5 inch squares with a center-punch mark in the center of each square. Immediately above the driving band, 4.7 G was stenciled on the projectile. The bottom of the cartridge case was marked with a black band 0.375 inch wide with the words SPECIAL GAS.

Description:

The shell body of the 4.7-inch gas shell was identical to the point fuzed common steel shell (MK I), except that it had no base cover, and the tap hole to receive the adapter was tapered to make a gastight joint. This shell had an ogival head, fitted with a copper rotating band forced into an annular groove 1.9 inches from the base. About 0.5 and 1 inch, respectively, below the rotating band, two circumferential grooves were cut to receive the crimping of the cartridge case. When assembling the round, the shell was forced into the case up to the band, and the metal case was set into the grooves at several points, securely fixing it. Sufficient space was left for expansion when the gas regained atmospheric temperature. The installation of an adapter sealed the gas hermetically in the shell body. A booster charge was located in the adapter, which was sufficient to open the nose of the shell and release the gas.

Any of the fuzes used with the common steel shell fit the gas shell; however, three fuzes were normally used with this shell, which was tapped through the nose to receive the adapter for one United States and two French-type fuzes. These fuzes are: the United States MK III; the French I.A.L., Model 1916; and French I.A., Model 1915. The three fuzes varied in weight from 0.6 to 1.2 pounds. The shell was never issued fuzed.

Explosive Train:

Fuze:

Model no.:	U.S. MK III, French I.A.L., Model 1916 or French I.A., Model 1915
Overall length:	unknown
Total weight:	0.6 to 1.2 pounds (272.4 to 544.8 g) (three types)

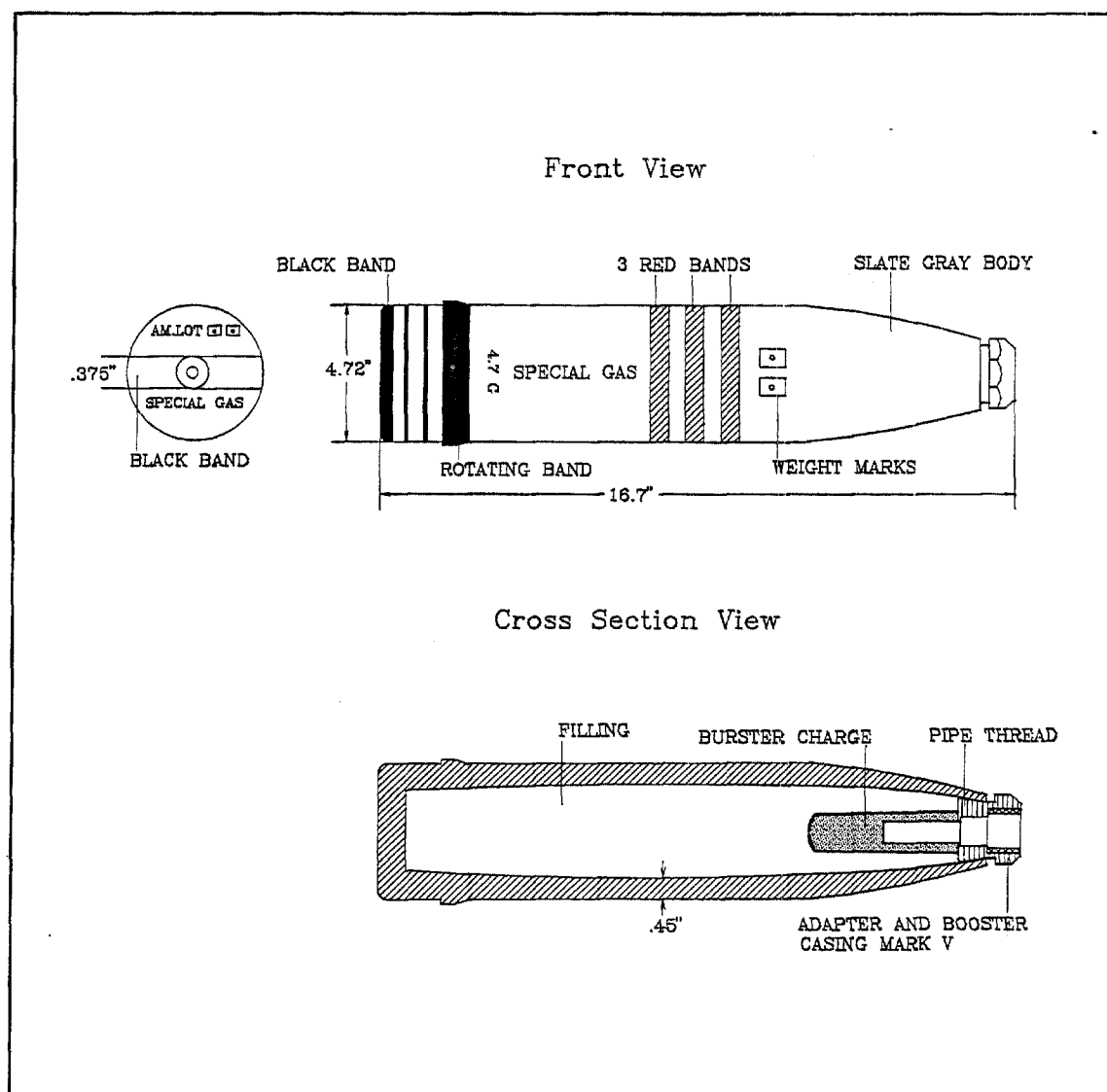
ENGINEERING DATA:

Construction:

Main body:	steel
Wall thickness:	0.45 inch (11.43 mm)

REFERENCES:

1. Amos A. Fries, Brigadier General, American Expeditionary Forces Chemical Warfare Services, Manual of Gas Warfare (France: n.p., March 1919) 46.
2. Office, Chief of Ordnance, Handbook of Ordnance Data, USA (N.p.: Government Printing Office: 15 November 1918).
3. U.S. Army, Ordnance Department, No. 1784, Handbook of the 4.7 Inch Gun Materiel, Model of 1906, Motorized, With Instructions For Its Care (Washington, DC: U.S. Army, 25 March 1918).



Drawing not to scale

Figure 5.3.5-1. Artillery Shell, 4.7-Inch, Common Steel Shell, MK II (Ref. 2)

5.3.6 NOMENCLATURE: Artillery Shell, 5-Inch, Common Steel Shell, MK VI

TABULATED DATA:

Length: 17.2 inches (437 mm) (without fuze)

Diameter: 4.98 inches (127 mm)

Type of Fill and Fill Weight:

HS: 5.38 pounds (2.45 kg)

FM: 6.70 pounds (3.05 kg)

Total Weight with Fill:

HS: 48.22 pounds (21.92 kg)

FM: 49.54 pounds (22.52 kg)

Markings:

The main body color was slate gray, with three 0.5-inch red bands around the central part of the body. The band identification and special markings for the various fills are shown in the following table.

Shell Fill	Color of Bands			Stenciled Markings
	1st Band	2nd Band	3rd Band	
CG	white	white	none	SPECIAL GAS
NC	white	red	yellow	SPECIAL GAS
PS	white	red	none	SPECIAL GAS
CA	red	red	none	SPECIAL GAS
WP	yellow	none	none	SPECIAL GAS
BA	red	none	none	SPECIAL GAS
HS	red	red	red	SPECIAL GAS
FM	yellow	yellow	none	SMOKE

The bands were 0.5 inch wide and 0.5 inch apart. The bands were painted around the shell with the words SPECIAL GAS or SMOKE stenciled on the shell. Other markings on the shell included the shell weight, code, caliber, and lot number. The words SPECIAL GAS appeared longitudinally on the shell. There were weight marks on the ogive, which were 0.5-inch squares with a center-punch mark in the center of

each square. Just below the weight marks, the ammunition lot number was stenciled in letters 1-inch high. The weight stencils just above the driving band were 1-inch letters, and just above them was 5-G.

Description:

The shell body of the 5-inch gas shell was a common steel shell with a threaded hole to receive the adapter, which was tapered to make a gastight joint. The installation of the adapter sealed the gas hermetically in the shell body. A booster charge, used to explode the common steel shell, was located in the adapter, and was sufficient to open the nose of the shell and release the gas.

Three fuzes were normally used with this shell, which was tapped through the nose to receive the adapter for French-type fuzes. The fuzes are: The United States MK III; French I.A.L., Model 1916; and French I.A., Model 1915.

Explosive Train:

Fuze:

Model no.:	United States MK III; French I.A.L., Model 1916; or French I.A., Model 1915
Overall length:	7.38 inches (187.4 mm)
Total weight:	0.6 to 1.2 pounds (272.4 to 544.8 g)(three types)

Booster:

Model no.:	unknown
Explosive type:	tetryl
Explosive weight:	0.078 pound (35.4 g)

ENGINEERING DATA:

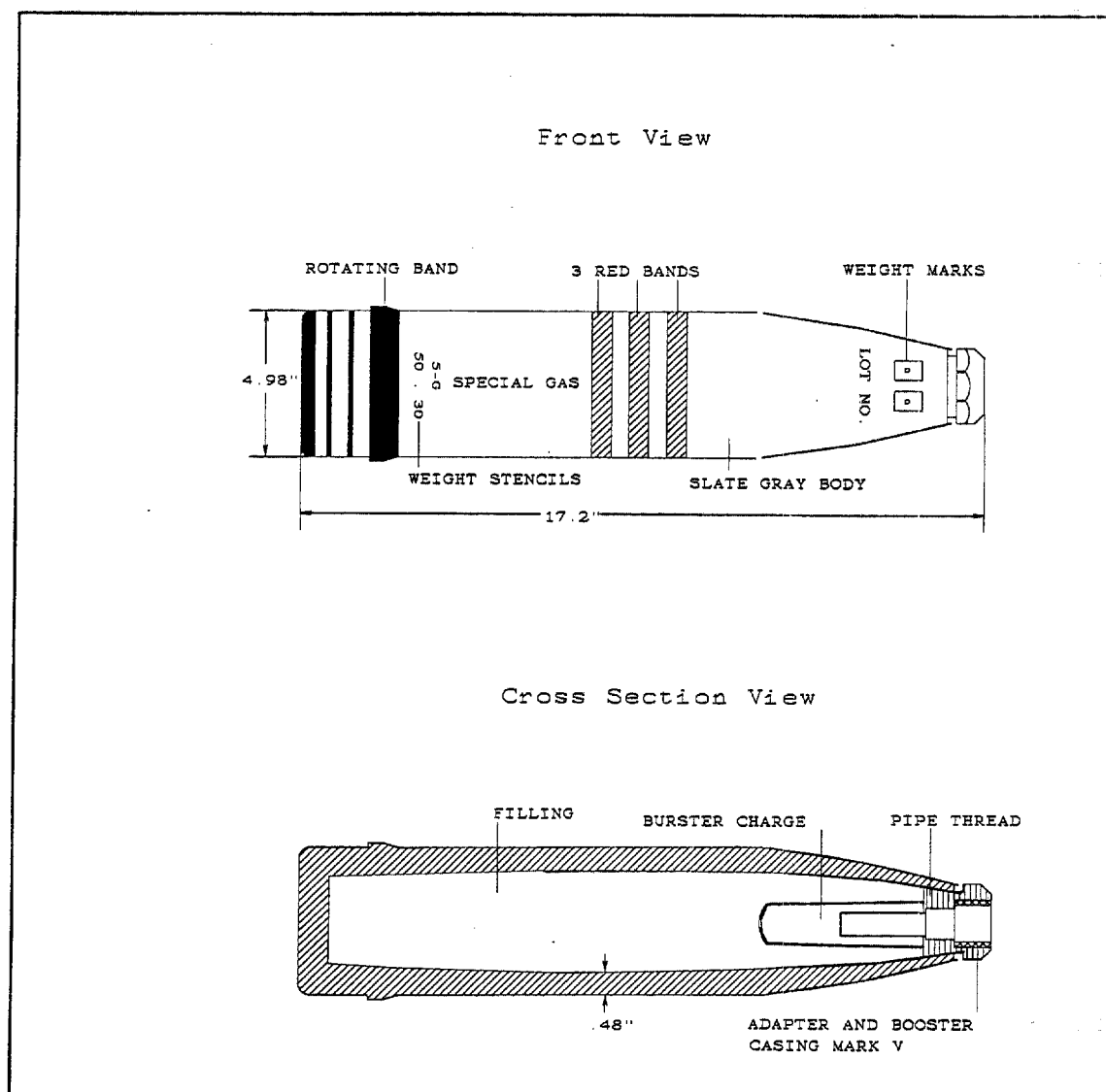
Construction:

Main body:	steel
Wall thickness:	0.48 inch (12.2 mm)

REFERENCES:

1. Amos A. Fries, Brigadier General, American Expeditionary Forces Chemical Warfare Services, Manual of Gas Warfare (France: n.p., March 1919) 49.mmm
2. Office, Chief of Ordnance, Handbook of Ordnance Data, USA (N.p.: Government Printing Office, 15 November 1918).

3. U.S. Army, Ordnance Department, No. 1784, Handbook of the 4.7 Inch Gun Materiel, Model of 1906, Motorized, With Instructions For Its Care (Washington, DC: Department of the Army, 25 March 1918).
4. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed. (New York and London: McGraw-Hill Book Company, Inc., 1937) 462, 498-500.



Drawing not to scale

Figure 5.3.6-1. Artillery Shell, 5-Inch, Common Steel Shell, MK VI

5.3.7 NOMENCLATURE: Artillery Shell, 6-Inch, Common Steel Shell, MK III

TABULATED DATA:

Length: 21.25 inches (540 mm) (without fuze)

Diameter: 6.00 inches (152.4 mm)

Type of Fill and Fill Weight:

HS: 10.50 pounds (4.77 kg)

FM: 13.28 pounds (6.04 kg)

Total Weight with Fill:

HS: 85.48 pounds (38.85 kg)

FM: 88.26 pounds (40.12 kg)

Markings:

The main body color was slate gray with three 0.5-inch red bands around the central part of the body. The band identification and special markings for the various fills are shown in the following table.

Shell Fill	Color of Bands			Stenciled Markings
	1st Band	2nd Band	3rd Band	
HS	red	red	red	SPECIAL GAS SMOKE
FM	yellow	yellow	none	

The bands were 0.5-inch wide and 0.5-inch apart. The bands were painted around the shell with the words SPECIAL GAS or SMOKE stenciled on the shell. Other markings on the shell included the shell weight, code, caliber, and lot number. The words SPECIAL GAS appeared longitudinally on the shell. Weight marks on the ogive, were 0.5-inch squares with a center-punch mark in the center of each square. Just below the weight marks, the ammunition lot number was stenciled in letters 1 inch high. The weight stencils just above the driving band were 1-inch letters, and just above them was 6-G.

Description:

This shell had an ogival head, and was fitted with a copper rotating band forced into an annular groove 1.9 inches from the base. About 0.5 and 1 inch, respectively,

below the rotating band, two circumferential grooves were cut to receive the crimping of the cartridge case. The shell body of the 6-inch gas shell was a common steel shell with a hole to receive the adapter, which was tapered to make a gastight joint. The installation of the adapter sealed the gas hermetically in the shell body. A booster charge, used to explode the common steel shell, was located in the adapter, and was sufficient to open the nose of the shell and release the gas.

Three fuzes were normally used with this shell, which was tapped through the nose to receive the adapter for French-type fuzes. The fuzes are: the United States MK III; French I.A.L., Model 1916; and French I.A., Model 1915.

Explosive Train:

Fuze:

Model No.:	U.S. MK III; French I.A.L., Model 1916; or French I.A., Model 1915
Overall Length:	unknown
Total Weight:	0.6 to 1.2 pounds (272.4 to 544.8 g) (three types)

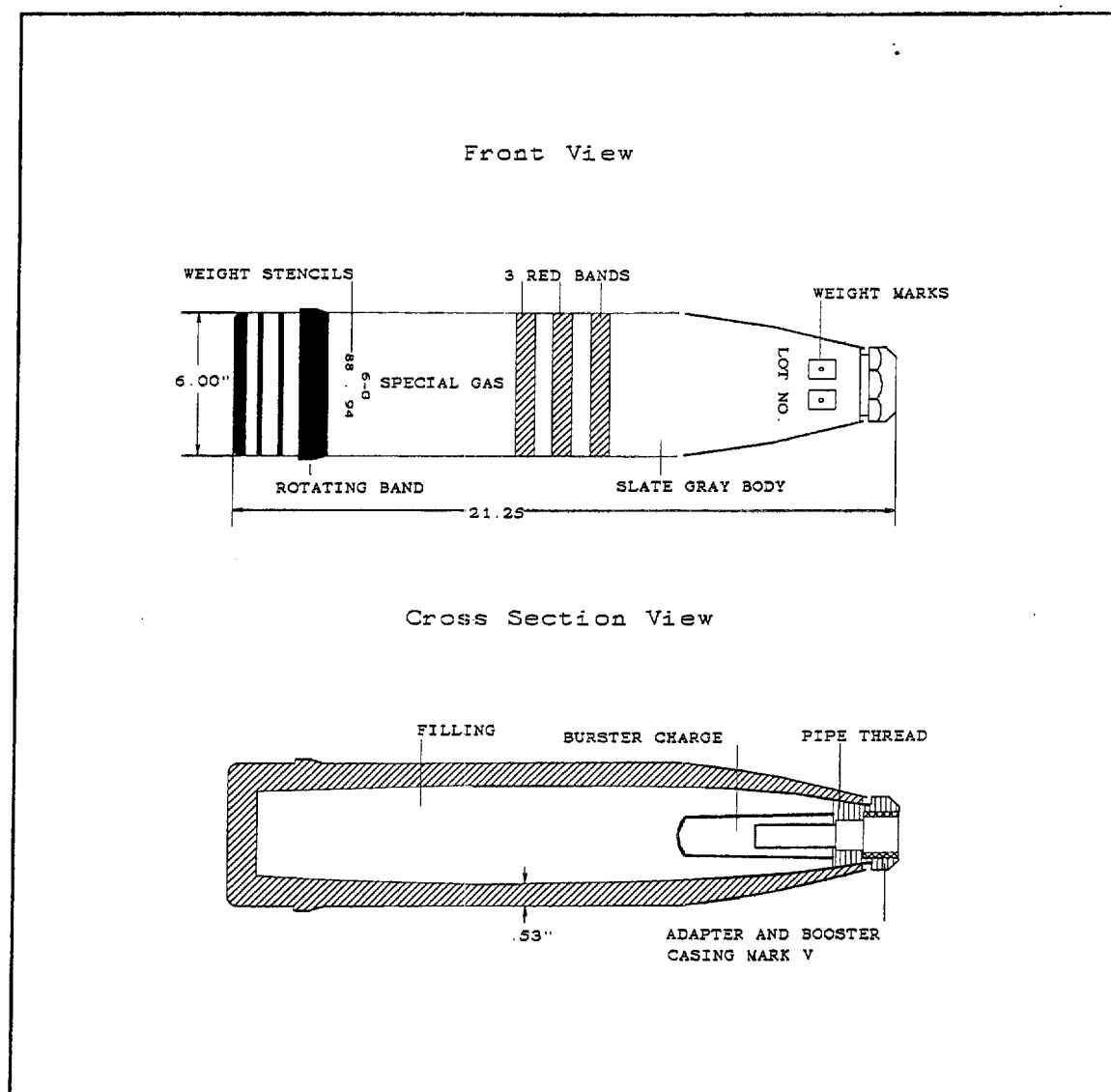
ENGINEERING DATA:

Construction:

Main body:	steel
Wall thickness:	0.53 inch (13.46 mm)

REFERENCES:

1. Amos A. Fries, Brigadier General, American Expeditionary Forces Chemical Warfare Services, Manual of Gas Warfare (France: n.p., March 1919).
2. Office, Chief of Ordnance, Handbook of Ordnance Data, No. 1861, (Government Printing Office: 15 November 1918) 150
3. Augstin M. Prentiss, Chemicals in War, A Threatise on Chemical Warfare, 1st Ed. (New York and London: McGraw-Hill Book Company, Inc., 1937) 462



Drawing not to scale

Figure 5.3.7-1. Artillery Shell, 6-Inch, Common Steel Shell, MK III

5.3.8 NOMENCLATURE: Chemical Shell, 5-Inch/38, MK 53, GB (USN)

TABULATED DATA:

Length: 20.75 inches (527 mm)

Diameter: 5 inches (127 mm)

Type of Fill and Fill Weight:

GB: 3.25 pounds (1.48 kg)

WP: possible filler

Total Weight with Fill:

GB: 55.2 pounds (25.09 kg)

WP: unknown

Markings:

Gray body with three green bands and one yellow band painted on the outside of the shell body.

Description:

The 5-inch/38, MK 53 shell was a central burst projectile loaded with GB agent. A central burster tube extended the full length of the projectile cavity and was press-fitted into the fuze adapter. A point detonating fuze with auxiliary booster was located on the forward end of the projectile, which (when functioning) initiated the burster charge to explode the projectile and release the filling agent. An adapter, located in the forward end of the projectile, held the fuze and the forward end of the burster tube. There was no base fuze.

Explosive Train:

Fuze:

Model no.: point detonating, MK 29 Mod 3, and auxiliary AD-MK 54, Mod 1

Overall length: 4.14 inches (105.15 mm)

Total weight: 1.49 pounds (676.5 g)

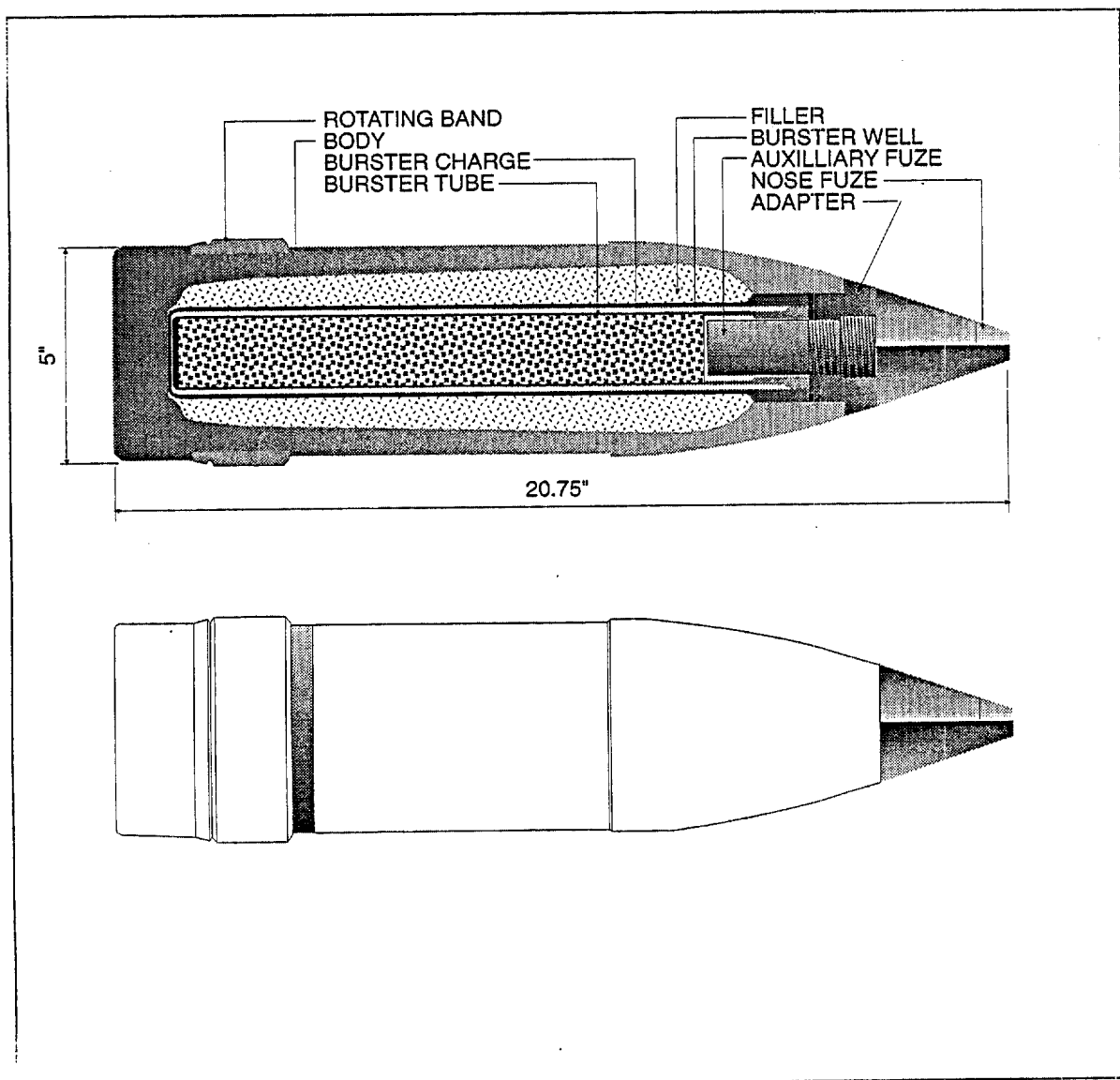
Burster:

Model no.: unknown
Explosive type: D
Explosive weight: 1.5 pounds (681 g)

ENGINEERING DATA: unknown

REFERENCES:

1. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).
2. Departments of the Army, Navy, and the Air Force, Employment of Chemical and Biological Agents, FM 3-10 (Washington, DC: Departments of the Army, Navy, and Air Force, March 1966) 16.
3. Department of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Department of the Navy, 31 March 1961) 4-135 and 4-136.
4. Department of the Army, Characteristics of Offensive and Defensive Chemical and Biological Materiel, DA Pamphlet 71-2 (N.p.: Department of the Army, June 1964).
5. Department of the Navy, NAVORD Report 6954, First Revision (Washington, DC: Department of the Navy, n.d.).



Drawing not to scale

Figure 5.3.8-1. Chemical Shell, 5-Inch/38, MK 53, GB (USN)

5.3.9 NOMENCLATURE: Chemical Shell, 5/54, MK 54, GB (USN)

TABULATED DATA:

Length: 26 inches (660 mm)

Diameter: 5.0 inches (127 mm)

Type of Fill and Fill Weight:

GB: 4.2 pounds (1.9 kg)

WP: possible fill

Total Weight with Fill:

GB: 64 pounds (29.1 kg)

WP: unknown

Markings:

Three green bands and one yellow band painted on the outside of the shell body.

Description:

The 5-inch/54, MK 54 shell was a central burst projectile; the one-piece forged construction and accurately machined press fit closure provided maximum safety. A burster tube extended the entire length of the projectile cavity and was press-fitted into the fuze adapter. A point detonating fuze with auxiliary booster was located on the forward end, which (when functioning) ignited the burster charge to explode the projectile and release the agent. An adapter was also located on the forward end of the projectile to hold the fuze and burster tube.

Explosive Train:

Fuze:

Model no.: MK 30 Mod 3 with auxiliary MK 43-AD

Burster:

Model no.: unknown

Explosive type: D

Explosive weight: 1.72 pounds (780.8 g)

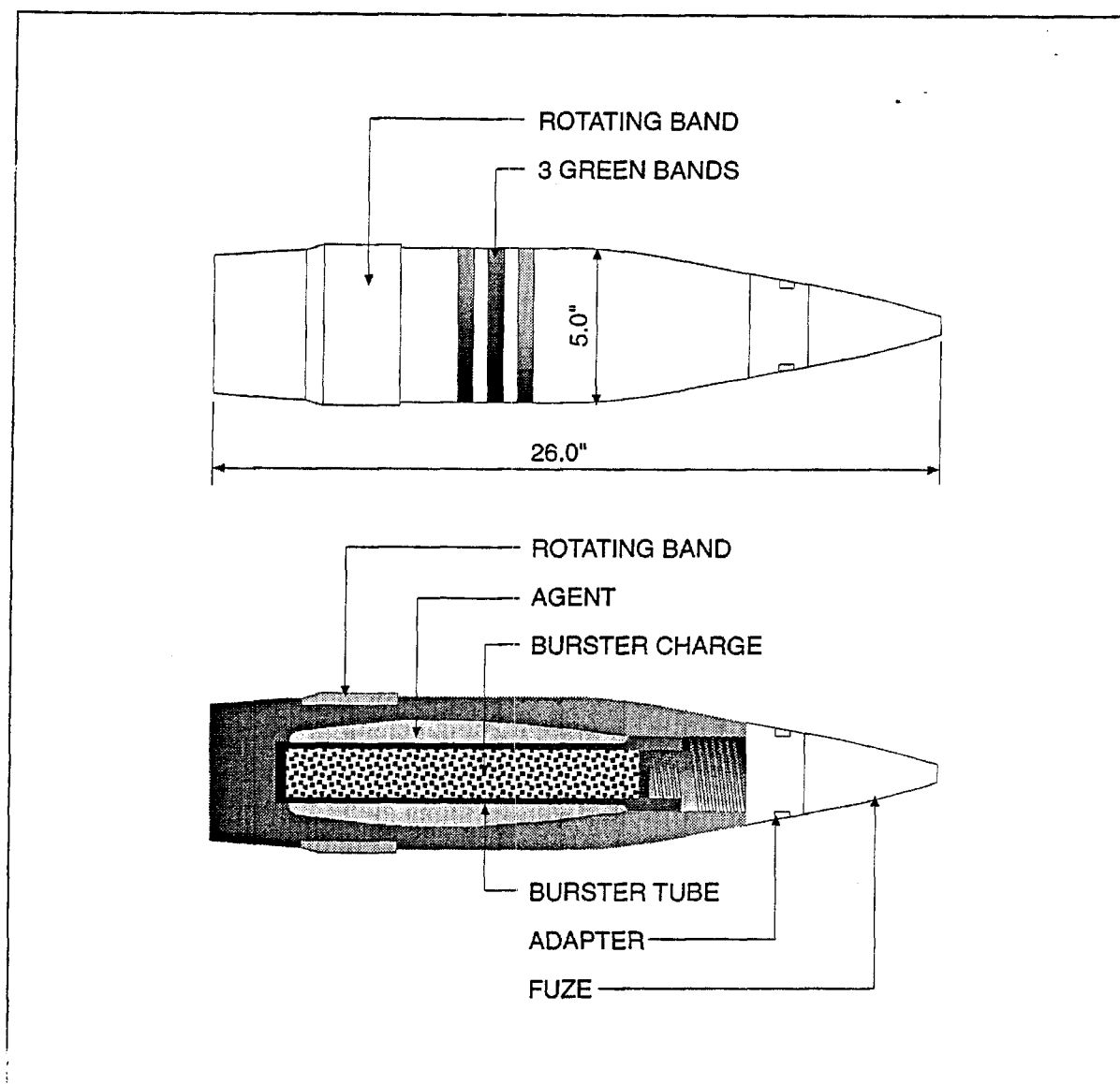
ENGINEERING DATA:

Construction:

Main body: forged steel

REFERENCES:

1. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).
2. Departments of the Army, Navy, and Air Force, Employment of Chemical and Biological Agents, FM 3-10 (Washington, DC: n.p., March 1966).
3. Department of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Department of the Navy, 31 March 1961).



Drawing not to scale

Figure 5.3.9-1. Chemical Shell, 5/54, MK 54, GB (USN) (Ref. 3)

**5.3.10 NOMENCLATURE: Artillery Shell, 155-Millimeter (Howitzer)
Common Steel Shell, MK II and MK IIA1, MK VII**

TABULATED DATA:

Length: 22.83 to 23.40 inches (579 to 594 mm) (without fuze)

Diameter: 6.08 to 6.10 inches at bourrelet (154 to 155 mm)

Type of Fill and Fill Weight:

HS: 11.30 pounds (5.14 kg)
CG: 11 pounds (5.00 kg)
NC: 14.50 pounds (6.59 kg)
PS: 13.66 pounds (6.21 kg)
CA: 12.18 pounds (5.54 kg)
BA: 16.41 pounds (7.46 kg)
FM: 14.30 pounds (6.50 kg)
WP: 15.85 pounds (7.20 kg)

Total Weight with Fill:

MK II and MK II A1	MK VII
HS: 92.1 pounds (41.86 kg)	90.75 pounds (41.25 kg)
CG: 91.8 pounds (41.73 kg)	90.45 pounds (41.11 kg)
NC: 95.3 pounds (43.32 kg)	93.95 pounds (42.70 kg)
PS: 94.46 pounds (42.94 kg)	93.11 pounds (42.32 kg)
CA: 92.98 pounds (42.26 kg)	91.63 pounds (41.69 kg)
BA: 97.21 pounds (44.19 kg)	95.86 pounds (43.57 kg)
FM: 95.1 pounds (43.23 kg)	93.75 pounds (42.61 kg)
WP: 96.65 pounds (43.93 kg)	95.30 pounds (43.32 kg)

Markings:

The band identification and special markings for the various fills are shown in the following table. The bands were 0.5 inch wide and 0.5 inch apart. The bands were painted around the shell with the words Special Gas or Smoke stenciled on the shell. Other markings on the shell included the shell weight, code, caliber, and lot number.

Shell Fill	Color of Bands			Stenciled Markings
	1st Band	2nd Band	3rd Band	
HS	red	red	red	SPECIAL GAS
CG	white	white	none	SPECIAL GAS
NC	white	red	yellow	SPECIAL GAS
PS	white	red	none	SPECIAL GAS
CA	red	red	none	SPECIAL GAS
BA	red	none	none	SPECIAL GAS
FM	yellow	yellow	none	SMOKE
WP	yellow	yellow	none	SMOKE

The bands were 0.5 inch wide painted around central portion of the projectile. The words SPECIAL GAS were painted longitudinally on the shell body. The weight marks on the ogive were 0.5-inch squares with a center-punch mark in the center of each square. Just below the weight marks, the ammunition lot number was stenciled in letters 1 inch high. The weight was stenciled just above the driving band, as 1-inch letters, and just above them was 155H.

Later manufacture: Two 0.5-inch green bands and green stenciling HS GAS 155 H, SHELL MK II, or MK IIA1.

Description:

This gas shell consisted of the shell body, which contained the gas; gaine tube (adapter and booster casing), which screwed into the nose of the shell and contained the bursting charge, which consisted of a small quantity of high explosive sufficient to open the shell and disperse the agent. Since most of the gases used enter the shell as liquids, they expanded when heated, and a space was left for this expansion by only partially filling the shell. The MK VII had two driving bands; the others had one.

Three fuzes were normally used with this shell, which was tapped through the nose to receive the adapter for French-type fuzes. The fuzes are: the United States MK III; the French I.A.L., Model 1916; and French I.A., Model 1915.

Explosive Train:

Fuze:

Model no.: United States MK III; French I.A.L., Model 1916; or French I.A., Model 1915
Overall length: unknown
Total weight: 0.6 to 1.2 pounds (272.4 to 544 g) (three types)

Booster charge:

Model no.: Inner/Outer
Explosive type: tetryl
Explosive weight: 1.02 ounces (28.91 g)

Burster:

Model no.: M1
Explosive type: cast TNT
Explosive weight: 0.60 pound; 0.66 pound with M1

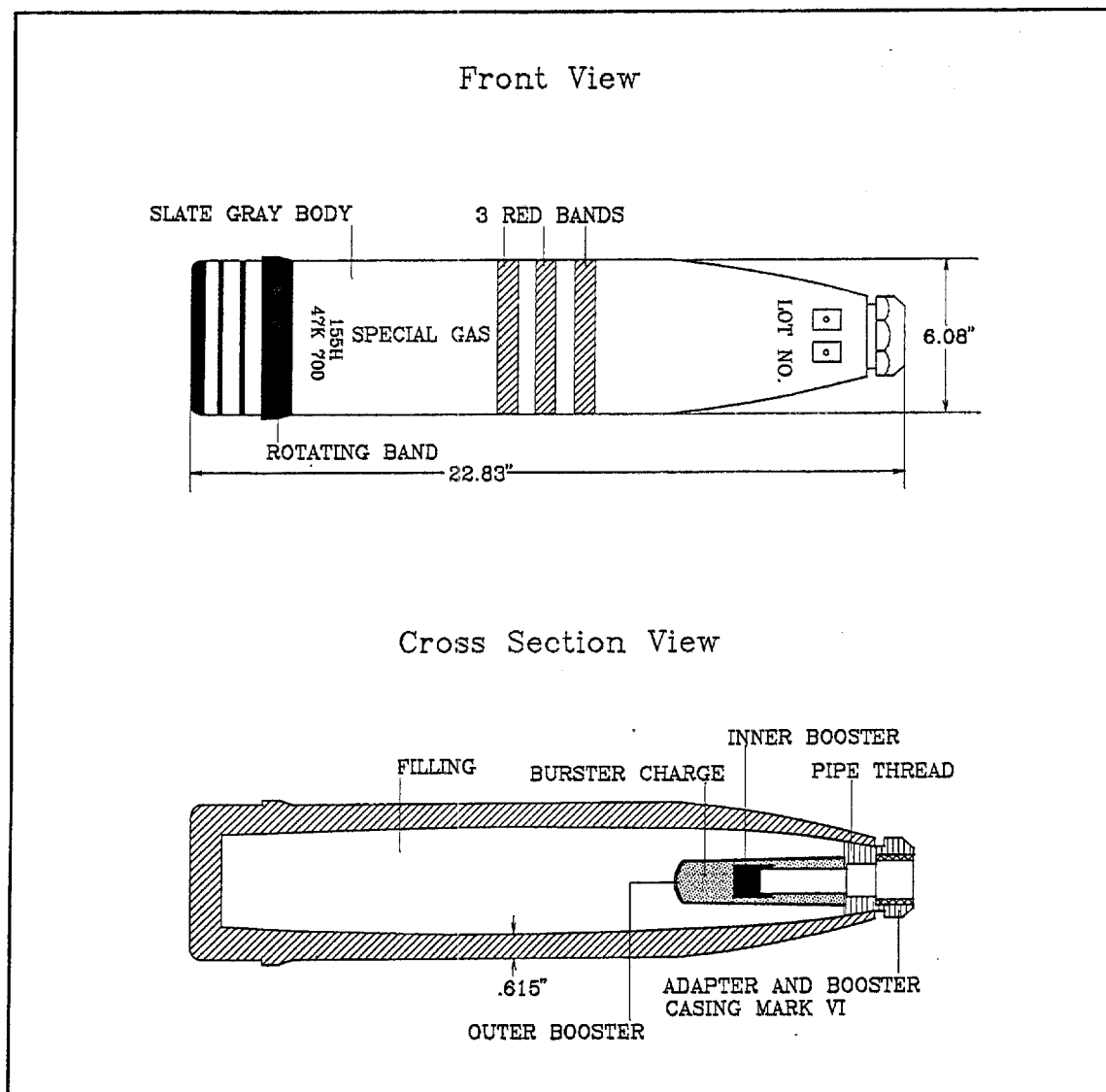
ENGINEERING DATA:

Construction:

Main body: steel
Wall thickness: 0.615 inch (15.62 mm)

REFERENCES:

1. Amos A. Fries, Brigadier General, American Expeditionary Forces Chemical Warfare Services, Manual of Gas Warfare (France: n.p., March 1919).
2. Office, Chief of Ordnance, Handbook of Ordnance Data, No. 1861, (N.p.: Government Printing Office: 15 November 1918) 150.
3. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics, Land Mines, Firing Devices (Washington, DC: Department of the Navy, 1 June 1944).



Drawing not to scale

Figure 5.3.10-1. Artillery Shell, 155mm, (Howitzer) Common Steel Shell, MK II and MK IIA1 and MK VII (Ref. 2)

5.3.11 NOMENCLATURE: Artillery Projectile, 175-Millimeter, Gun, T-223

TABULATED DATA:

Length: 38.8 inches (986 mm) (with fuze)

Diameter: 6.89 inches (175 mm)

Type of Fill and Fill Weight:

GB: 11 pounds (5 kg)

VX: 11 pounds (5 kg)

WP: possible fill

Total Weight with Fill:

148 pounds (67.27 kg)

Markings:

Markings on this munition were not identified. Markings for this era would be gray body with three green bands and one yellow band with green markings.

Description:

The 175-millimeter projectile was a central burst munition. A single rotating band was located near the base of the projectile. The base was boat-tailed. An adapter at the forward end of the projectile held the point detonating fuze and supported the burster tube, which extended the full length of the cavity.

Explosive Train:

Fuze:

Model no.: T212E11 (GB), T368E2 (VX)

Overall length: unknown

Total weight: unknown

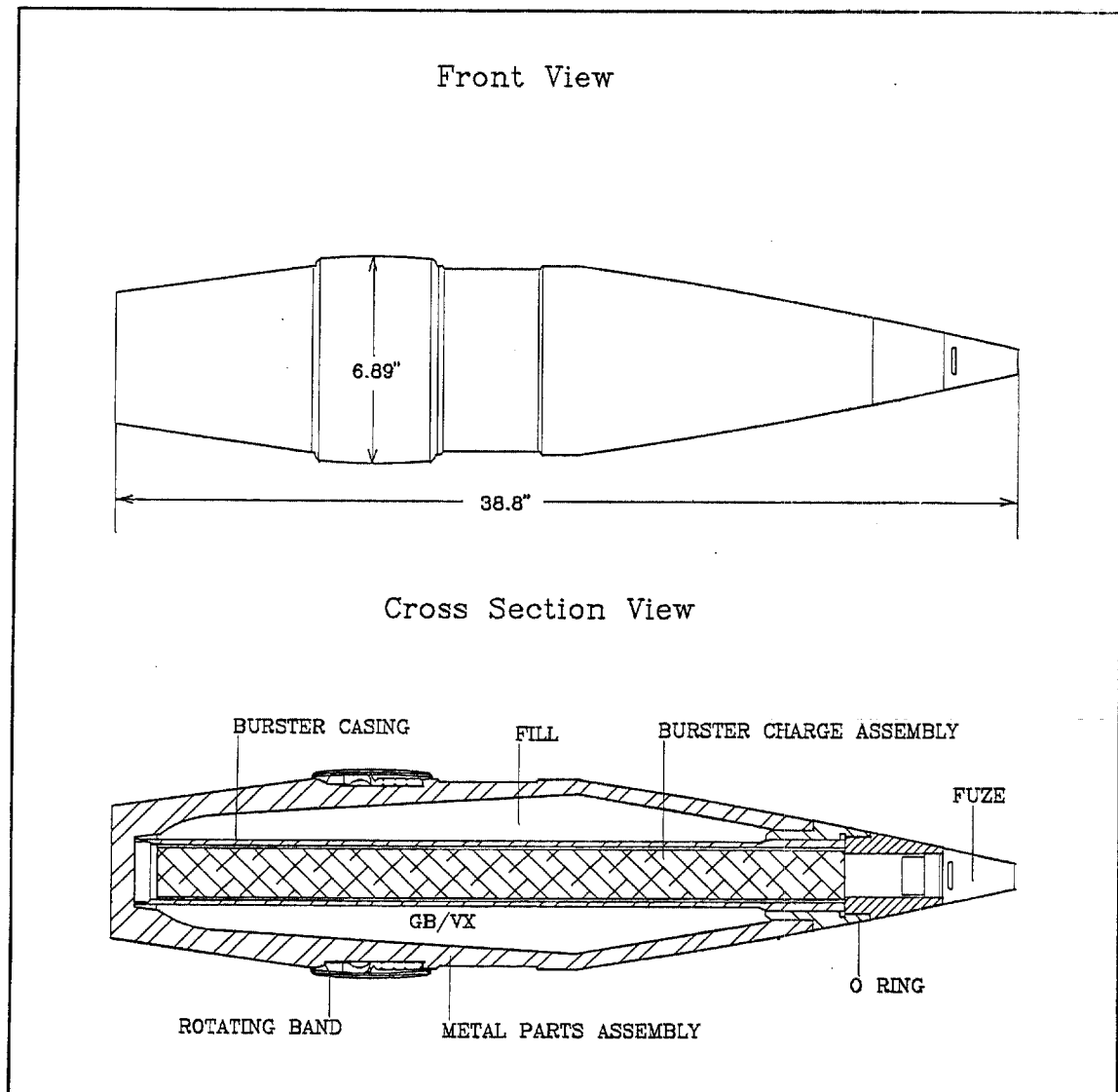
ENGINEERING DATA:

Construction:

Main body: thin-walled steel

REFERENCES:

1. Department of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Department of the Navy, 31 March 1961).
2. Anonymous, Ammunition for M113 175mm Gun Cannon, Technical Information Report 27.4.3.1 (2) (Washington, DC: n.p., June 1968).



Drawing not to scale

Figure 5.3.11-1. Artillery Projectile, 175-Millimeter, Gun, T-223 (Ref. 2)

**5.3.12 NOMENCLATURE: Artillery Shell, 8-Inch, Common Steel Shell,
MK III**

TABULATED DATA:

Length: 26.6 inches (676 mm) (without fuze)

Diameter: 7.98 inches (203 mm)

Type of Fill and Fill Weight:

HS: 22.45 pounds (10.20 kg)
CG: 22.01 pounds (10.00 kg) (approximately)
NC: 28.90 pounds (13.14 kg)
PS: 27.2 pounds (12.36 kg)
CA: 24.2 pounds (11.00 kg)
BA: 32.67 pounds (14.85 kg)
FM: 28.4 pounds (12.91 kg)
WP: 31.5 pounds (14.32 kg)

Total Weight with Fill:

HS: 192.20 pounds (87.36 kg) (approximately)
CG: 191.76 pounds (87.16 kg) (approximately)
NC: 198.65 pounds (90.30 kg)
PS: 196.95 pounds (89.52 kg)
CA: 193.95 pounds (88.16 kg)
BA: 202.42 pounds (92.01 kg)
FM: 198.15 pounds (90.07 kg)
WP: 201.25 pounds (91.48 kg)

Markings:

The main body color was slate gray. Identification and special marking for the various fills is shown in the following table.

Shell Fill	Color of Bands			Stenciled Markings
	1st Band	2nd Band	3rd Band	
HS	red	red	red	SPECIAL GAS
CG	white	white	none	SPECIAL GAS
NC	white	red	yellow	SPECIAL GAS
PS	white	red	none	SPECIAL GAS
CA	red	red	none	SPECIAL GAS
BA	red	none	none	SPECIAL GAS
FM	yellow	yellow	none	SMOKE
WP	yellow	yellow	none	SMOKE

The bands were 0.5 inch wide and 0.5 inch apart. The bands are painted around the shell. The words SPECIAL GAS or SMOKE were also painted on the shell. Other markings include shell weight, caliber and lot number. Specifically, the weight marks just below the fuze were 0.5-inch squares with a center-punch mark in the center of each square. Immediately below the center-punch marks were the numbers 197.88, and the lot number. Immediately above the driving band was 8-GH, which indicated that the shell could have been used in either the 8-inch gun or 8-inch Howitzer.

Description:

The shell body of the 8-inch gas shell was a common steel shell. The installation of the threaded adapter sealed the gas hermetically in the shell body. A booster charge, used to explode the common steel shell, was located in the adapter and was sufficient to open the nose of the shell and release the gas. The same shell was used for both the howitzer and the gun cannons. Only the chemical fill (HS) was used in the 8-inch gun.

Three fuzes were normally used with this shell, which was tapped through the nose to receive the adapter for French-type fuzes. The fuzes are: the United States MK III; French I.A.L., Model 1916; and French I.A., Model 1915.

Explosive Train:

Fuze

Model no.: United States MK III; French I.A.L., Model 1916; or French I.A., Model 1915
 Overall length: 7.38 inches (187.45 mm)
 Total weight: 0.6 to 1.2 pounds (272.4 to 544.8 g) (three types)

Booster:

Model no.: unknown
Explosive type: tetryl
Explosive weight: 0.078 pound (35.4 g)

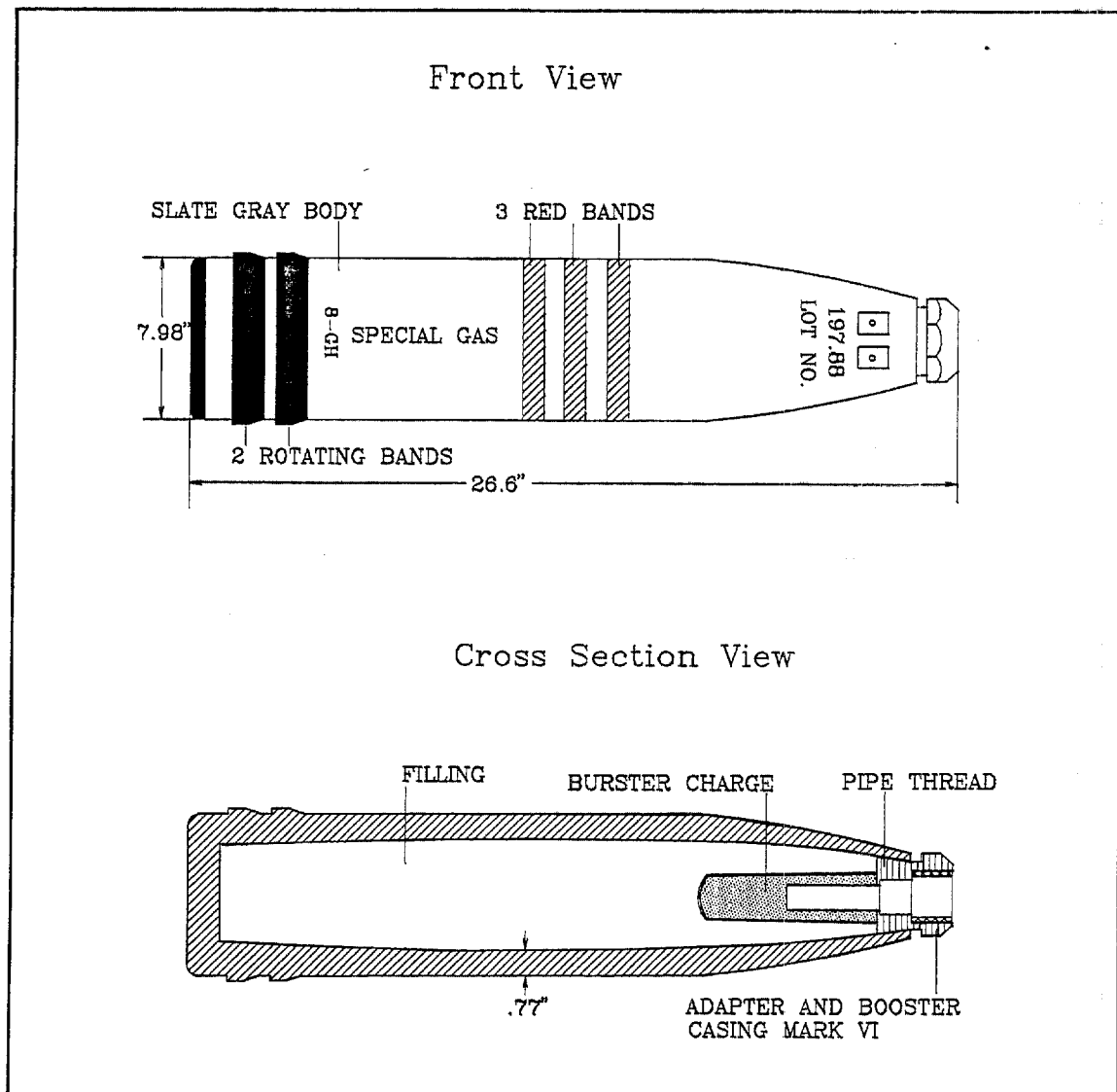
ENGINEERING DATA:

Construction:

Main body: steel
Wall thickness: 0.77 inch (19.55 mm)

REFERENCES:

1. Amos A. Fries, Brigadier General, American Expeditionary Forces Chemical Warfare Services, Manual of Gas Warfare (France: n.p., March 1919).
2. Office Chief of Ordnance, Handbook of Ordnance Data, No. 1861, (N.p.: Government Printing Office, 15 November 1918).
3. Augustin M. Prentiss, Chemicals in War, A Treatise on Chemical Warfare, 1st ed (New York and London: McGraw-Hill Book Company, Inc., 1937) 495-500.



Drawing not to scale

Figure 5.3.12-1. Artillery Shell, 8-Inch, Common Steel Shell, MK III (Ref. 2)

5.3.13 NOMENCLATURE: Artillery Projectile, 8-Inch, T-174

TABULATED DATA:

Length: 35.21 inches (894 mm) (with VT fuze)
35.17 inches (893 mm) (with PD fuze)

Diameter: 7.99 inches (203 mm)

Type of Fill and Fill Weight:

GB: 15.7 pounds (7.14 kg)

VX: 14.1 pounds (6.41 kg)

Total Weight with Fill:

GB: unknown

VX: 200 pounds (90.91 kg) (approximately)

Markings:

The VX-filled projectiles were painted gray with identification markings in green and two green bands to indicate the presence of a persistent gas. One yellow band denoted a high-explosive burster. The usual weight zone identification, normally used to aid in the range matching of medium and larger caliber HE and chemical projectiles, was included. Later versions may have been marked with three green bands and one yellow.

For simulant-filled projectiles, the filling and loading procedure, together with the corresponding identification markings was black over a gray background to indicate that the filler material was inert, and yellow markings to indicate the presence of the explosive burster charge. The markings for GB-filled munition are unknown. During this era GB could have been denoted by one or three green bands.

Description:

The 8-inch projectile was a one-piece, separately loaded central burst gas round for GB and VX agents. It was similar to the HE round in external configuration but had a burster tube, burster charge, and supplemental charge. The burster tube extended the full length of the cavity and was press-fit. A single rotating band was located 6.06 inches from the base end and had two cannelures or grooves. The adapter assembled to the nose end was threaded to receive a point detonator or Proximity (VT) fuze. The variable time fuze was used for air burst.

Explosive Train:

Fuze:

Model no.:	Point Detonating or Proximity (VT)
Overall length:	approximately 6 inches (152.4 mm)
Total weight:	2.15 pounds (976 g)

Burster:

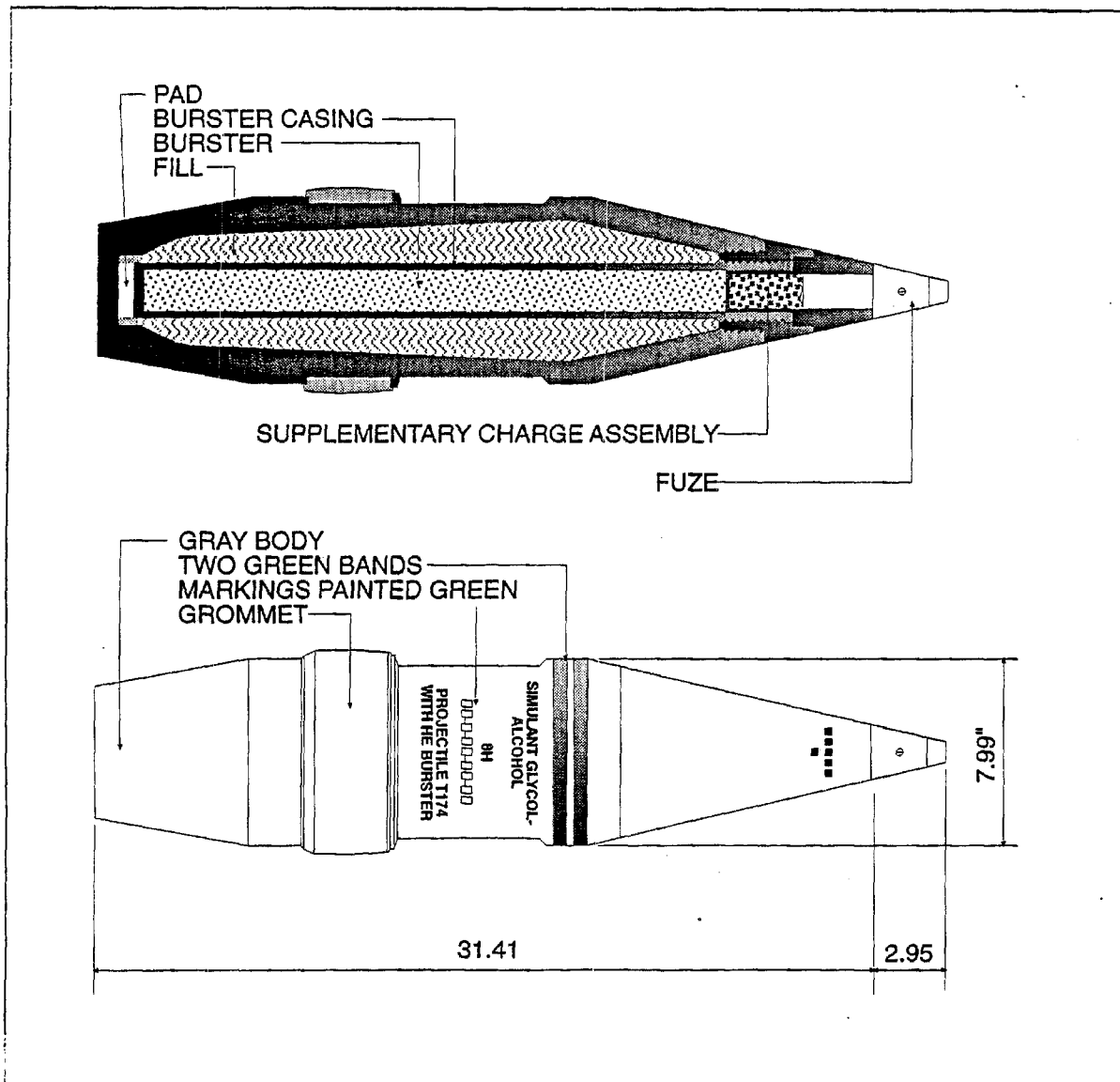
Model no.:	unknown
Explosive type:	composition B
Explosive weight:	6.95 pounds (3.16 kg)

ENGINEERING DATA:

unknown

REFERENCES:

1. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).
2. Department of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Department of the Navy, 31 March 1961) 4-165 through 4-168.
3. Office, Chief of Ordnance, T174 8 Inch VX Persistent Gas Projectile (Picatinny Arsenal, NJ: n.p., November, 1959) 17.
4. Military Standard (MIL STD) 709 A, B, and C (N.p.: n.p., n.d.).



Drawing not to scale

Figure 5.3.13-1. Artillery Projectile, 8-Inch, T-174

5.3.14 NOMENCLATURE: Chemical Spray Tank, M10

TABULATED DATA:

Length: 84 inches (2134 mm) (overall)
68 inches (1727 mm) (container)

Height: 20.5 inches (521 mm)

Diameter: 14 inches (355.6 mm)

Type of Fill and Fill Weight:

H: 339 pounds (195.4 kg)
HD: 321 pounds (145.9 kg)
L: 471 pounds (214.1 kg)
FS: 480 pounds (218.2 kg)
FM: 435 pounds (197.7 kg)

Total Weight with Fill:

H: 407 pounds (274.9 kg)
HD: 389 pounds (176.8 kg)
L: 539 pounds (245.0 kg)
FS: 548 pounds (249.1 kg)
FM: 503 pounds (228.6 kg)

Markings:

The color of the main body is unknown; however, there was a standard identifying nameplate attached to the smoke tank on the aft end of the tank. The markings on the nameplate were: Chemical Warfare Service U.S.A. on top of the plate below the nomenclature of the tank Airplane Smoke Tank M10. Immediately below the nomenclature was the name of the manufacturer and the part number: (Mfg By Douglas Aircraft Co., Inc., Part No. 5096431), along with the contract number, lot number and capacity of the tank (Contract No. W-535-AC-15948, Lot 1, Gross Capacity 33 U.S. Gal).

Description:

The components of the M10 smoke tank were the container, an inlet assembly, and a discharge line. The empty tank weighed approximately 68 pounds. The container proper was 68 inches long and 14 inches wide; the assembled tank was 84 inches long, 20.5 inches high, and 14 inches wide. Equipment required to secure the tanks to the airplane consisted of the racks, hanger bolts, hoist supports, hoists controls, and all interconnecting mechanisms of a mechanical or electrical type installed

between the racks and control switches. This equipment was supplied by the Air Force.

The container was a streamlined, cylindrical tank with a gross capacity of 33 gallons and attached to the rack by means of two carrier lugs. Two hoisting lugs were provided, one on either side of the container. The tank was reinforced at each lug by a small steel plate welded inside the tank.

The air inlet assembly housed a detonator, which was used to break the closure plate. The closure plate was made of frangible glass or plastic 1.89 inches in diameter.

Explosive Train:

Model no.:	CWS No. 4 or CWS No. 6
Explosive type:	electric blasting caps
Overall length:	4.5 inches (114.3 mm) with an outside diameter of 0.25 inch (6.35 mm)

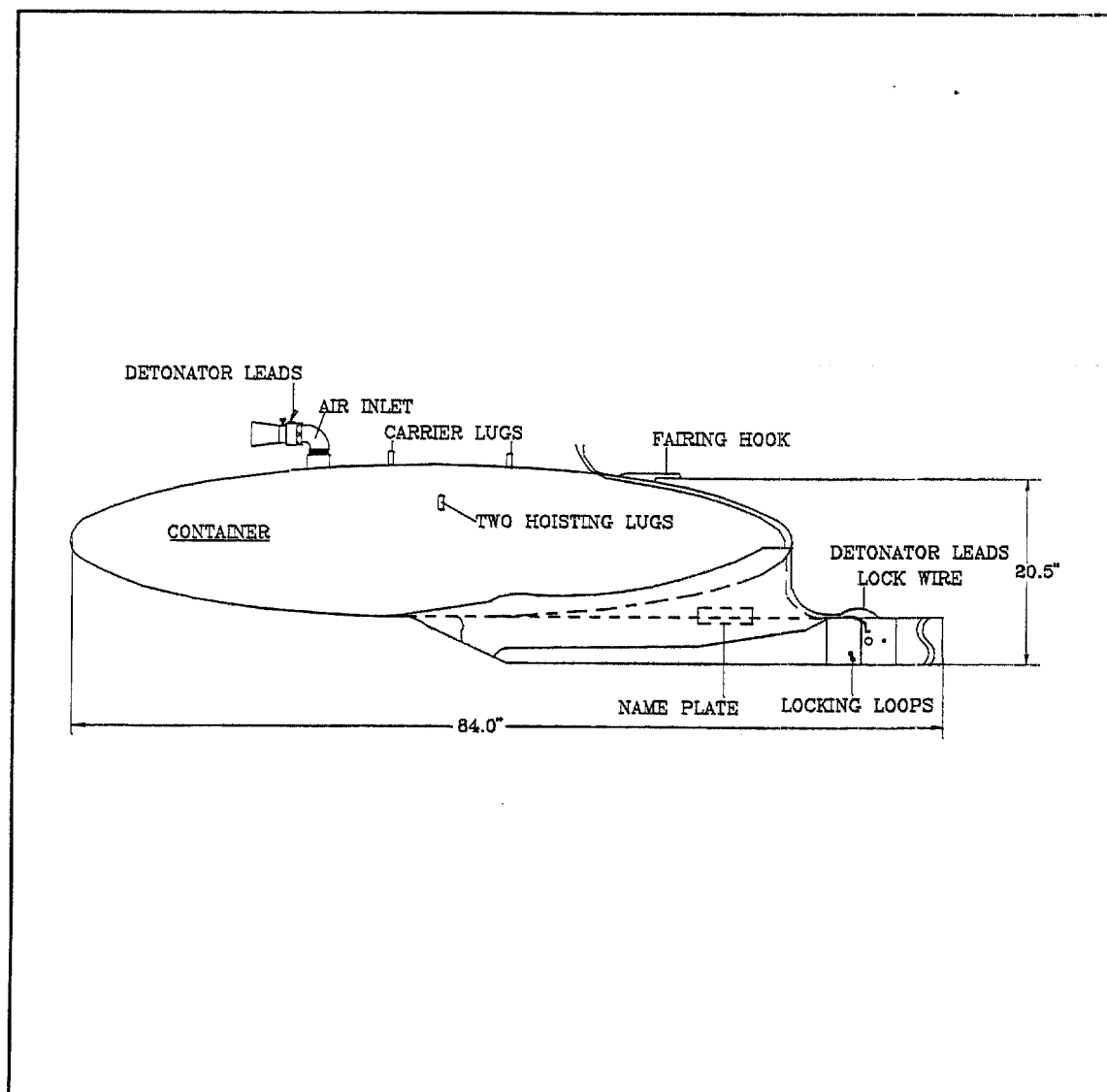
ENGINEERING DATA:

Construction:

Main body: sheet steel

REFERENCES:

1. Headquarters, Department of the Army, Chemical Corps Reference Handbook (Washington, DC: n.p., April 1963).
2. Headquarters, War Department, Chemical Handling and Loading Equipment, TM 3-255 (Washington, DC: n.p., 30 October 1943).
3. Anonymous, Tank, Smoke, Airplane, M10 and Accessories (N.p.: n.p., n.d.)



Drawing not to scale

Figure 5.3.14-1. Chemical Spray Tank, M10 (Ref. 2, 3)

5.3.15 NOMENCLATURE: Tank, Smoke, M33 (formerly E16R1 tank; also known as the M33A1).

TABULATED DATA:

Length: 63.75 inches (1619 mm)

Diameter: 21.25 inches (539.8 mm)

Type of Fill and Fill Weight:

H: 791 pounds (359.5 kg)
HD: 749 pounds (340.5 kg)
L: 1,099 pounds (499.5 kg)
FS: 1,120 pounds (509.1 kg)
FM: 1,015 pounds (461.4 kg)

Total Weight with Fill:

H: 932 pounds (423.6 kg)
HD: 890 pounds (404.5 kg)
L: 1,240 pounds (593.63 kg)
FS: 1,261 pounds (573.2 kg)
FM: 1,156 pounds (525.5 kg)

Markings:

The main body color was blue-gray with the lettering: Chemical Warfare Service U.S.A., Airplane Smoke Tank, M33, manufacturer's identification mark, serial number, and lot number (forged on brass or a steel plate soldered to body of tank, or embossed on the tank in letters and figures 0.90 inch high).

Description:

This was a cylindrical tank with ogival ends, approximately 63.75 inches long and about 21.25 inches in diameter. It consisted of a container (70-gallon capacity of 16-gage copper-bearing steel), discharge-line assembly, and closure-plate wired for electric control. It was adapted for use either from a bomb bay or from racks attached to the wings of a plane.

The M33A1 was identical to the M33 with the following exceptions: (1) two universal suspension bands were substituted for the standard 30-inch suspension bands (adjustments were made for either 30-inch or 14-inch suspension); (2) additional beads rolled in the tank body for use when bands were in the 14-inch suspension position; and (3) the tank was strengthened, by welding pads, to the inside of the

tank at several points where sway braces bore on it when the 14-inch suspension was used.

Explosive Train:

Model no.:	CWS No. 4 or CWS No. 6
Explosive type:	electric detonator only
Explosive weight:	unknown

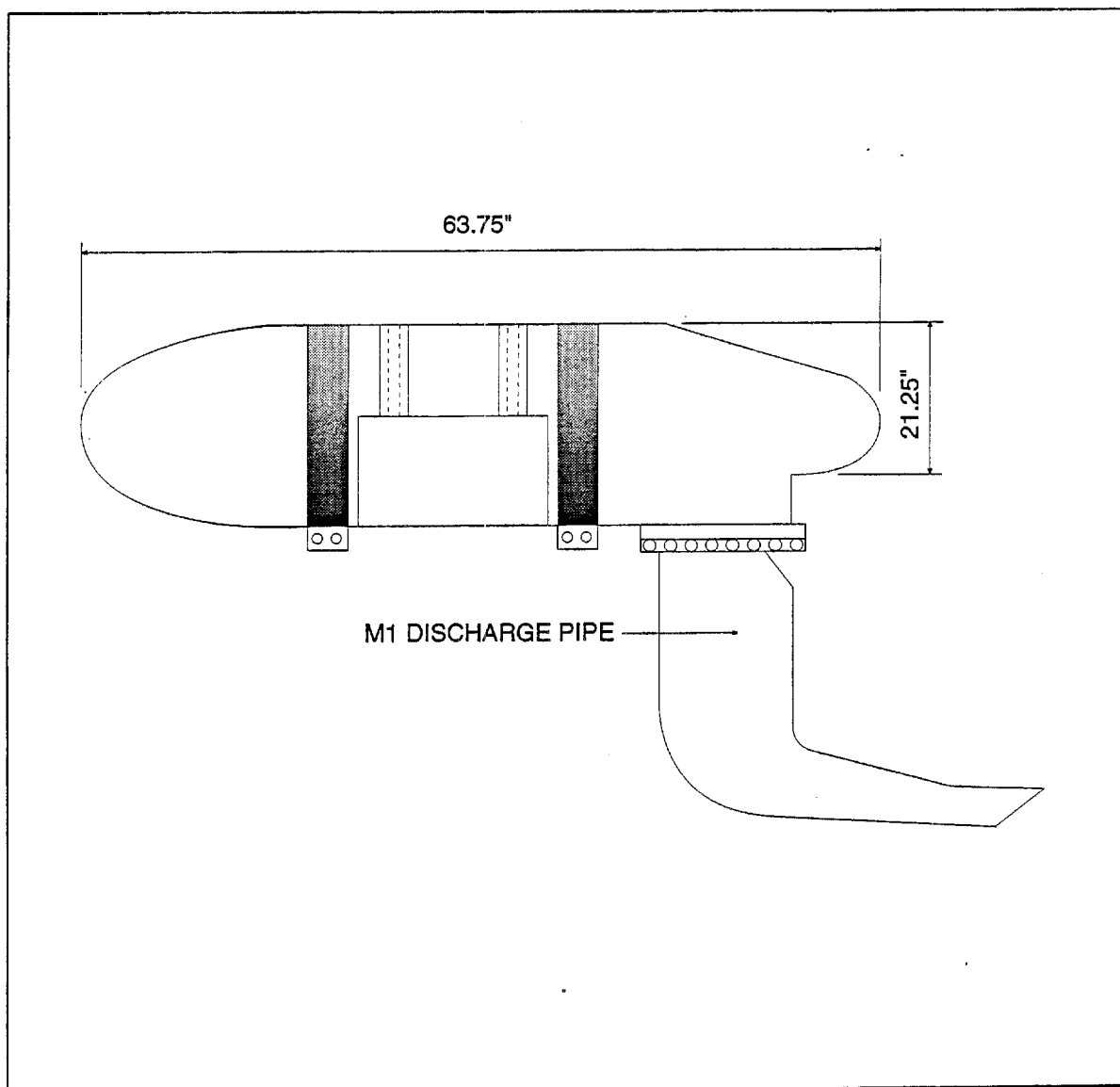
ENGINEERING DATA:

Construction:

Tank:	16-gauge copper-bearing steel
Fuze assembly:	electrically operated detonators
Explosive components:	unknown

REFERENCES:

1. Leo Finklestein, Chemical Research and Development Laboratories, History of Research and Development of the Chemical Warfare Service in World War II (1 July 1940 - 31 December 1945) (Maryland: Army Chemical Center, August 1962) vol. 22, Part V.
2. Anonymous, Tank, Airplane, Smoke, AN-M33A1. Document located at U.S. Chemical Corps Museum, Ft. McClellan, AL, File 1, Drawer 1. (N.p.: Department of the Army, n.d.).



Drawing not to scale

Figure 5.3.15-1. Tank, Smoke, M33 (formerly E16R1 tank;
also known as the M33A1) (Ref. 2)

5.3.16 NOMENCLATURE: Rocket, 2.36-Inch, Gas, M26

TABULATED DATA:

Length: 17.66 inches (449 mm) (overall)
head: 5.5 inches (139.7 mm)

Diameter: 2.36 inches (59.9 mm) (maximum)
head: 2.30 inches (58.4 mm)

Type of Fill and Fill Weight:

CK: unknown
WP: 14.2 ounces (402.6 g)

Total Weight with Fill:

CK: unknown
WP: 3.4 pounds (1.5 kg)

Markings:

Color: motor - olive drab
head - blue gray

Description:

The M26, 2.36-inch rocket was designed for dislodging enemy troops from dugouts and foxholes. The rocket had an overall length of 17.66 inches with a diameter of 2.36 inches. The components of the rocket were the motor and head assembly. The motor used was the M5A1; however, with new motor development, it was contemplated that this rocket would be modified.

Explosive Train:

Fuze:

Bore-Safe M400

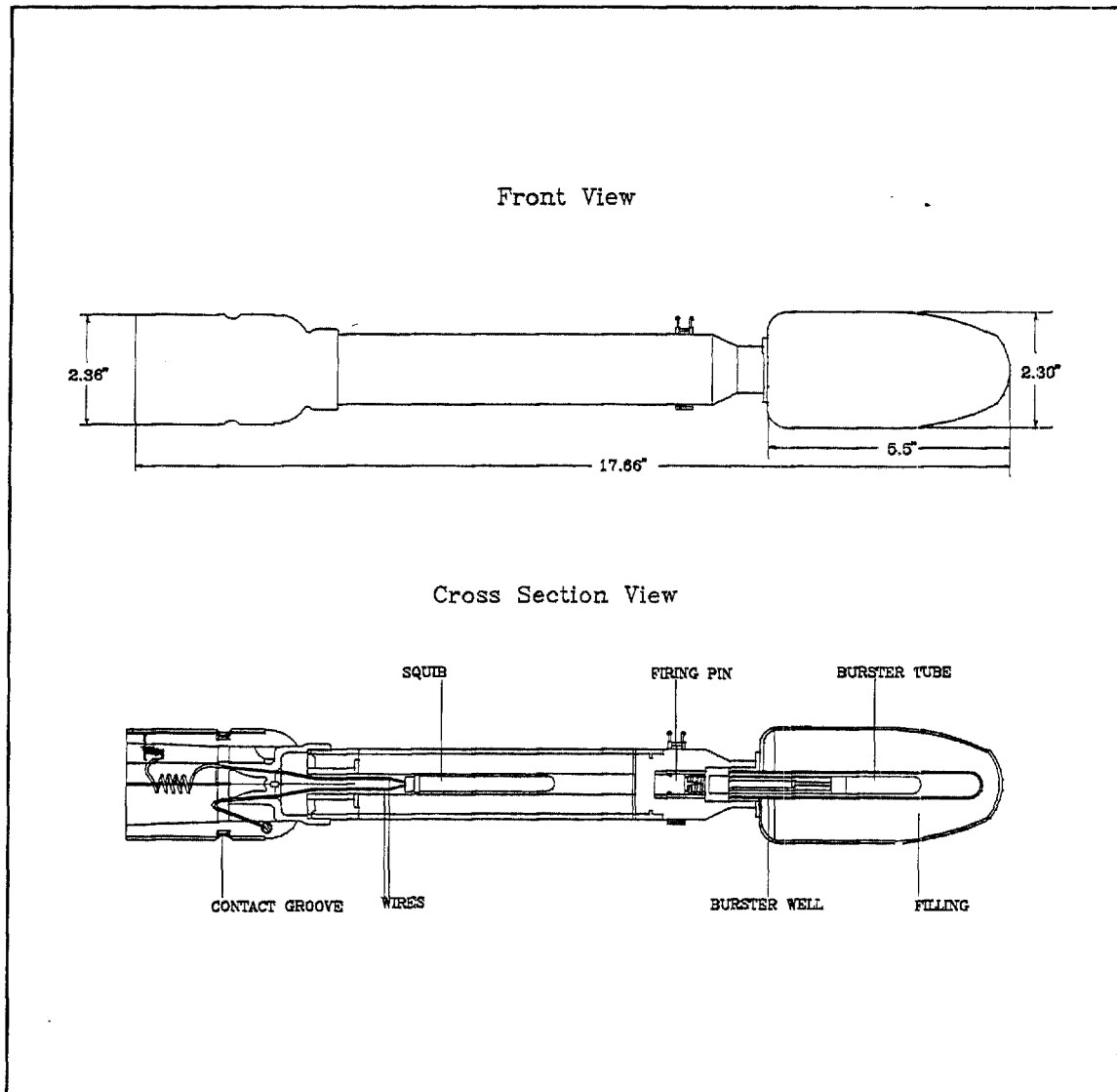
Burster:

Model no.: unknown
Explosive type: PETN
Explosive weight: 0.14 ounce (4 g)

ENGINEERING DATA: unknown

REFERENCES:

1. Department of the Navy, Bureau of Ordnance, OP 1664 (Vol. 1),
U.S. Explosive Ordnance (Washington, DC: Department of the Navy, 28
May 1947) 151-152.



Drawing not to scale

Figure 5.3.16-1. Rocket, 2.36-Inch, Gas, M26

5.3.17 **NOMENCLATURE: Rocket, 7.2-Inch (C.W.R.-N) and Army M25 and M27**

TABULATED DATA:

Length: 48.1 inches (1,222 mm) (overall)
 17.4 to 18.75 inches (442 mm to 475 mm) (head)
 29 inches (737 mm) (motor)

Diameter: 7.2 inches (182.9 mm) (head)

Type of Fill and Fill Weight:

CG: 20 pounds (9.1 kg)

Total Weight with Fill:

CG: 51.8 pounds (23.5 kg)

Markings:

The markings for this munitions are unknown.

Description:

Head: The container was a bulb-shaped steel tube open at both ends. The adapter fit inside the flange on the forward end of the container and was brazed thereto. The wide forward end of the adapter was internally threaded to seat the fuze. The burster tube, made of steel, fit inside the adapter and extended downward into the container. The tube and adapter were held together by a press-fit and sealed with white-lead paste. The rear end of the tube was closed.

Note: A head similar to the MK 7, but loaded with 22 pounds of TNT, is equipped with a booster instead of a burster tube. It is known as MK 9. It is a demolition head, using the fuze MK 137 and the 3.25-inch motor MK 5. The explosive train for the AN-M147 (obsolete) fuze consists of an M19A1 detonator, tetryl booster, and a tetryl lead.

Motor: The motor was a steel tube, with the forward end externally threaded to screw into the connector of the head. The nozzle was slipped down through the open end of the motor body, and the end was welded to the inner edge of the motor-body rim.

Tail: The tail assembly had four tail vanes spot-welded, in pairs, to the motor tube and to the rear shroud. The forward shroud was riveted to the vanes but insulated from them. Four large fins were welded to the motor tube, passed over the forward shroud, and welded to the rear shroud. The lead wires are connected to the two rear shrouds that served as contacts.

Propellant: As produced for the Navy, the propellant consisted of a single grain of solventless extruded ballistite with an outside diameter of 2.5-inches and an inner diameter of 1 inch. This was the grain MK 11.

In the Army Chemical Rocket (M25) the propellant consisted of four sticks of ballistite, with a 1-inch axial hole placed end-to-end with separating washers between the sticks. The sticks were three-ridged, and each had eight sets of holes radiating through it. The overall length of the sticks was 20.5 inches.

Explosive Train:

Fuze:

Model no:	AN-M 147 or MK 147 Mod. 1
Overall length:	5.7 inches (144.8 mm)
Total weight:	1.6 pounds (726.4 g)

Booster Charge:

See note under Description section

Burster:

See note under Description section

ENGINEERING DATA:

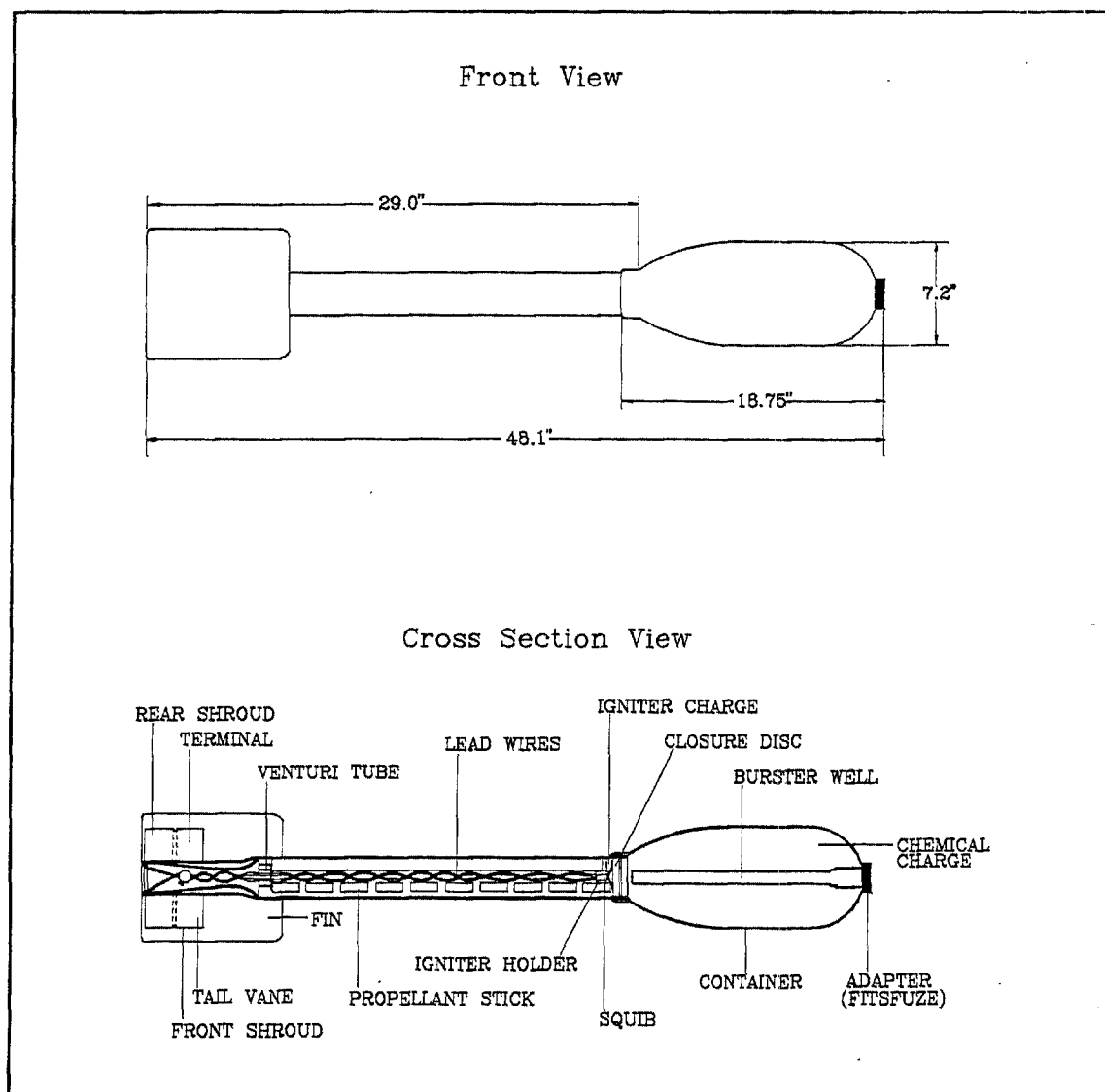
Construction:

Head:	bulb-shaped steel tube
Burster tube:	steel
Motor:	steel tube, 3.25 inches (82.5 mm): rocket motor
Tail:	four vanes and four fins

REFERENCES:

1. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).

2. Department of the Navy, Bureau of Ordnance, U.S. Explosive Ordnance, OP 1664 Volume 1 (Washington, DC: Department of the Navy, 28 May 1947) 178 and 179.
3. Department of the Army, Chemical Corps Safety Directive No. 385-17, General Instructions for Disposal of Bulk Chemical Agents and Munitions, CML C SD-385-17 (Washington, DC: Department of the Army, n.d.) 43 and 44.



Drawing not to scale

Figure 5.3.17-1. Rocket, 7.2-Inch (C.W.R.-N) and Army M25 and M27 (Ref. 2)

5.3.18 NOMENCLATURE: Agent Kit, Toxic (GB), 3.5-Inch Rocket, E8

TABULATED DATA:

Length: 5.5 inches (1397 mm) (agent container only)

Diameter: 3.5 inches (88.9 mm)

Type of Fill and Fill Weight:

GB: 0.42 pound (0.2 kg)

Total Weight with Fill:

GB: 1.25 pounds (0.6 kg)

Markings:

unknown

Description:

The E8 toxic agent kit was designed to be adopted by the individual soldier to the standard 3.5-inch heat rocket (M28A2). The kit consisted of a container and two component adapters. The steel agent container held about 0.42 pound of GB or other comparable liquid agents.

The two-component liquid adapter was made of aluminum and designed to hold the agent container in place between the motor and the rocket head. No special tools were required in the field and the component adapter was fired from the standard 3.5-inch rocket launcher.

Explosive Train:

unknown

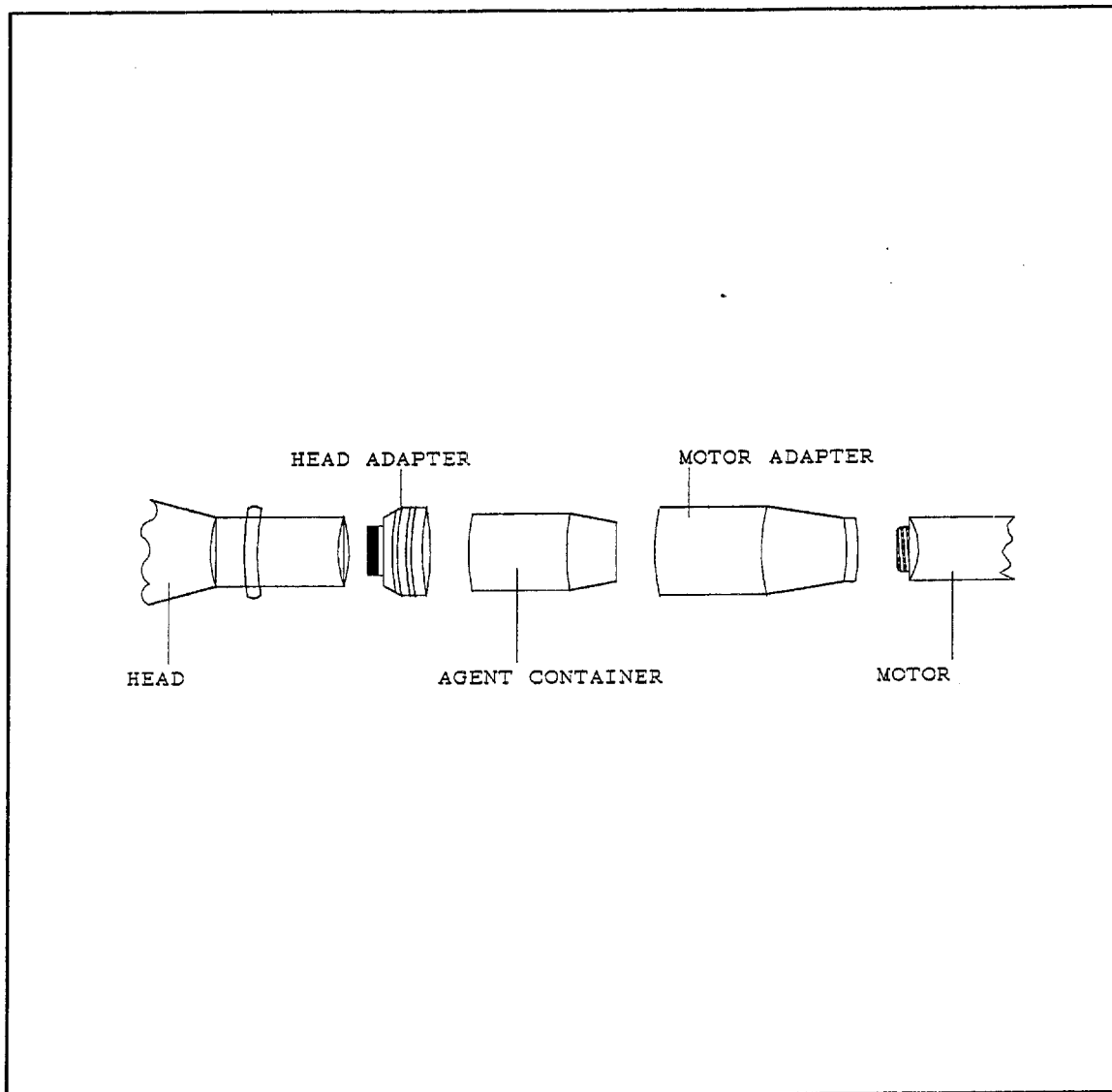
ENGINEERING DATA:

Construction:

aluminum

REFERENCES:

1. Department of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Department of the Navy, 31 March 1961).



Drawing not to scale

Figure 5.3.18-1. Agent Kit, Toxic (GB), 3.5-Inch Rocket, E8 (Ref. 1)

5.3.19 NOMENCLATURE: Chemical Rocket, 5-Inch, Warhead MK 40

TABULATED DATA:

Length: 32.2 inches (818 mm) overall
20 inches (508 mm) projectile with fuze

Diameter: 5.0 inches (127 mm)

Type of Fill and Fill Weight:

GB: 4.8 pounds (2.2 kg)

Total Weight with Fill:

GB: 50.5 pounds (23 kg)

Markings:

The markings on this munition are unknown. During this era the warhead would have been marked with one or three green bands and a yellow band. The rocket motor would have had a brown band.

Description:

This was a spin-stabilized rocket warhead, which was developed to fulfill a Navy requirement for a chemical-filled 5-inch warhead for use in offshore bombardment. To afford inter-changeability with existing 5-inch Naval rockets, the MK 40 was patterned after a standard warhead. The principal modification of this warhead was adaptations for a larger burster, thereby providing for a nominal agent-to-burster ratio of 2:1 for better dissemination of agent in aerosol form and better sealing the burster well within the warhead to minimize leakage. Metal parts of the warhead were designed for use with standard Navy rocket motors and fuzes. Upon impact, the point detonation functioned to set off the auxiliary fuze, which in turn, ignited the burster charge to explode the munition and release the agent.

Explosive Train:

Fuze:

Model no.:	MK 30 Mod 4
Overall length:	4.14 inches (106.43 mm)
Total weight:	1.49 pounds (676.5 g)
Model no.:	Aux AD MK 44 Mod 2
Overall length:	1.82 inches (46.23 mm)
Total weight:	0.47 pound (213.4 g)

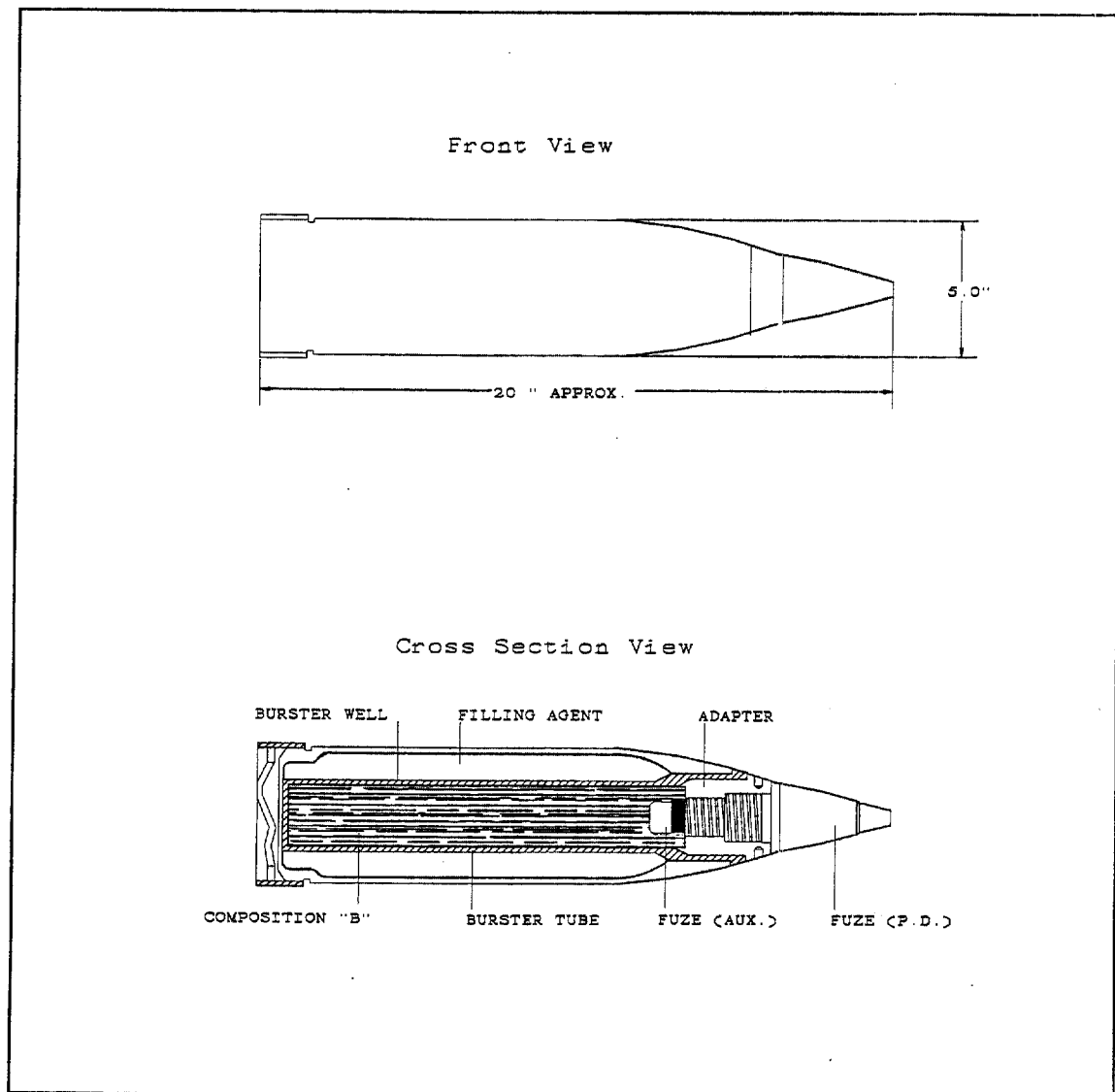
Burster:

Model no.: unknown
Explosive type: composition B
Explosive weight: 2.80 pounds (1.28 kg)

ENGINEERING DATA: unknown

REFERENCES:

1. Department of Defense, Military Handbook, Active Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-145A (Washington, DC: Department of Defense, 1 October 1980) 2-23 and 2-24.
2. Departments of the Army, Navy, and Air Force, Employment of Chemical and Biological Agents, FM 3-10 (Washington, DC: Departments of the Army, Navy, and Air Force, March 1966) 16.
3. Department of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Department of the Navy, 31 March 1961) 4-65 and 4-66.



Drawing not to scale

Figure 5.3.19-1. Chemical Rocket, 5-Inch, Warhead MK 40 (Ref. 3)

5.3.20 NOMENCLATURE: Bomb, Gas (GB), 10-Pound, M125A1

TABULATED DATA:

Length: 12 inches (304.8 mm)

Diameter: 3.63 inches (92.2 mm)

Type of Fill and Fill Weight:

GB: 2.6 pounds (1.18 kg)

Total Weight with Fill:

GB: 8.5 pounds (3.86 kg)

Description:

This bomb was a bomblet type, air-to-surface munition used with the M34A1 cluster. There were 76 bombs clustered in the M34A1 cluster. The bomb consisted of a body, filling, parachute, parachute opening delay, a burster, and fuze. The body was a sheet-metal cylinder with a burster well and fuze at the front end and a parachute at the rear. The parachute opened to 14 inches in diameter and operated by a delay tube fastened to the outside of the body. The delay tube was 0.5 inch diameter by 6.25 inches in length and contains a firing mechanism, delay charge, and explosive charge.

When released from the cluster, the arming bar sprung away from the parachute delay and the firing pin fired the primer. The primer ignited the delay charge, which burned for 3 to 7 seconds, then set off the charge in the parachute delay. The explosion broke the steel cable, freeing the tail cap and removing the restraint from the fuze arming ring. The parachute opened and slowed the decent of the bomb. This deceleration caused the arming ring to fall from the fuze, arming the fuze. On impact, the fuze ignited the burster, which exploded the body releasing the filling.

Explosive Train:

Fuze (Nose Fuze):

Model no.:	M196
Overall length:	1.75 inches (44.45 mm)
Total weight:	0.34 pound (154.36 g)
Detonator:	M15A2

Burster charge:

Model no.:	M31
Diameter:	0.5 inch (12.7 mm)
Length:	6.25 inches (158.8 mm)
Explosive type:	tetryl
Explosive weight:	0.55 pound (249.8 g)

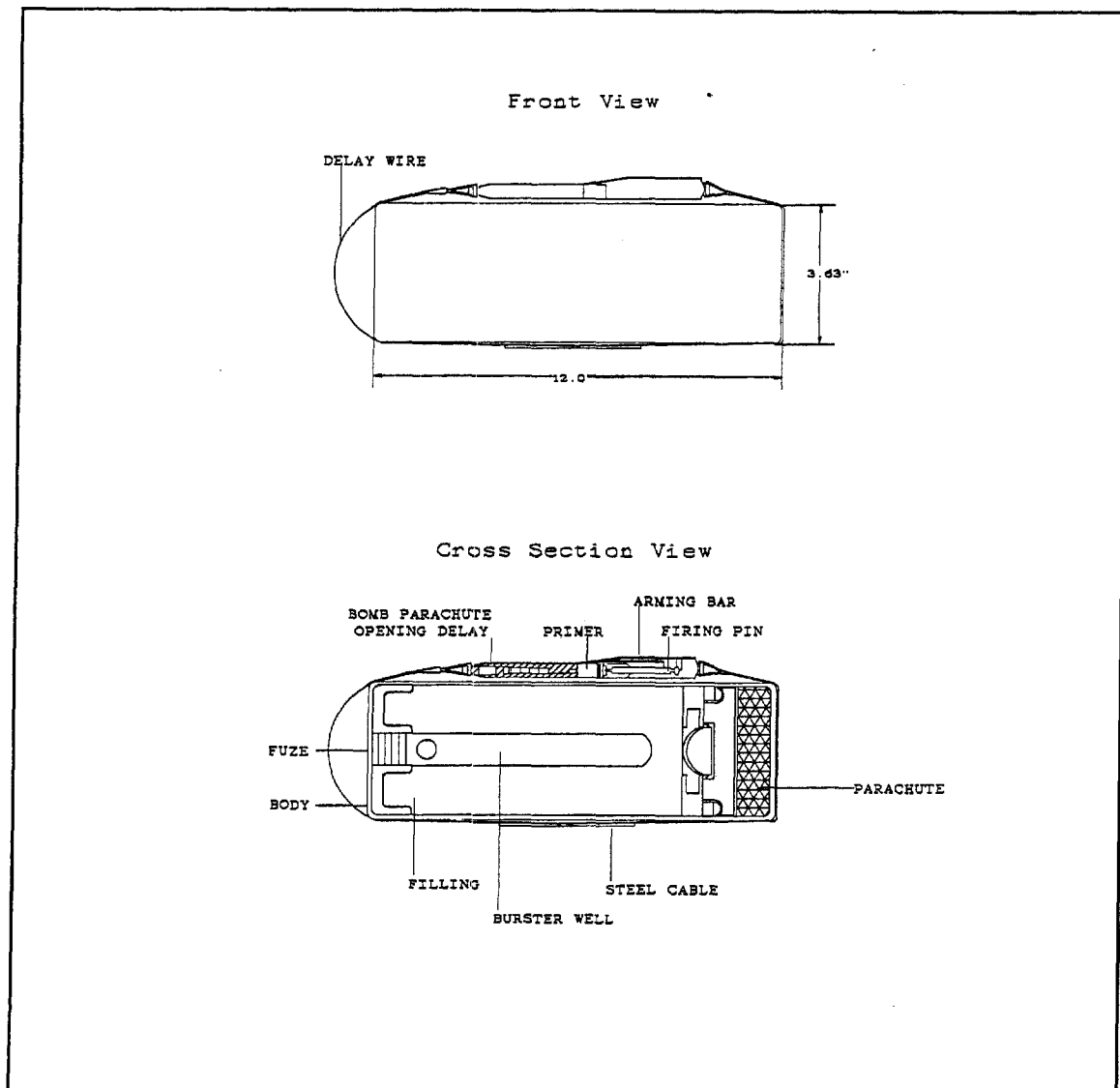
ENGINEERING DATA:

Construction:

Main body: sheet steel with burster well and fuze at forward end tail assembly
parachute

REFERENCES:

1. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).
2. Department of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Department of the Army, 31 March 1961).
3. Department of the Army, Chemical Bombs and Clusters, TM 3-400 (Washington, DC: Department of the Army, May 1957).
4. U.S. Army Materiel Command, Project EAGLE, Phase II, Demilitarization and Disposal of the M34 Cluster at Rocky Mountain Arsenal, Final Phase (N.p.: n.p., February 1973).



Drawing not to scale

Figure 5.3.20-1. Bomb, Gas (GB), 10-Pound, M125A1 (Ref. 3)

5.3.21 NOMENCLATURE: Bomb, Gas, Persistent, 30-Pound, M1

TABULATED DATA:

Length: 32.35 inches (822 mm) overall

Diameter: 4.85 inches (123.2 mm)

Tail: 6.78 inches (172 mm) wide

Type of Fill and Fill Weight:

HS: 9 pounds (4.0 kg) (approximately)

WP: possible fill

Total Weight with Fill:

HS: 29.1 pounds (13.2 kg)

WP: unknown

Markings:

The main body color was gray with two green bands midway between the fuze and lifting plug. The bomb was stenciled with CHEM close to the nose portion. Immediately under that was the numbers and letters 30 LB M1. Immediately after the lifting plug, the fill was stenciled with the lot number.

Description:

This bomb was streamlined in shape. It weighed approximately 29.1 pounds, contained approximately 9 pounds of chemical filler, and was adapted for a nose fuze only. A closing plug was fitted to the adapter to keep the fuze and burster cavities free of foreign matter.

Explosive Train:

Fuze:

Model no.:	MK XIV
Explosive type:	unknown
Explosive weight:	unknown

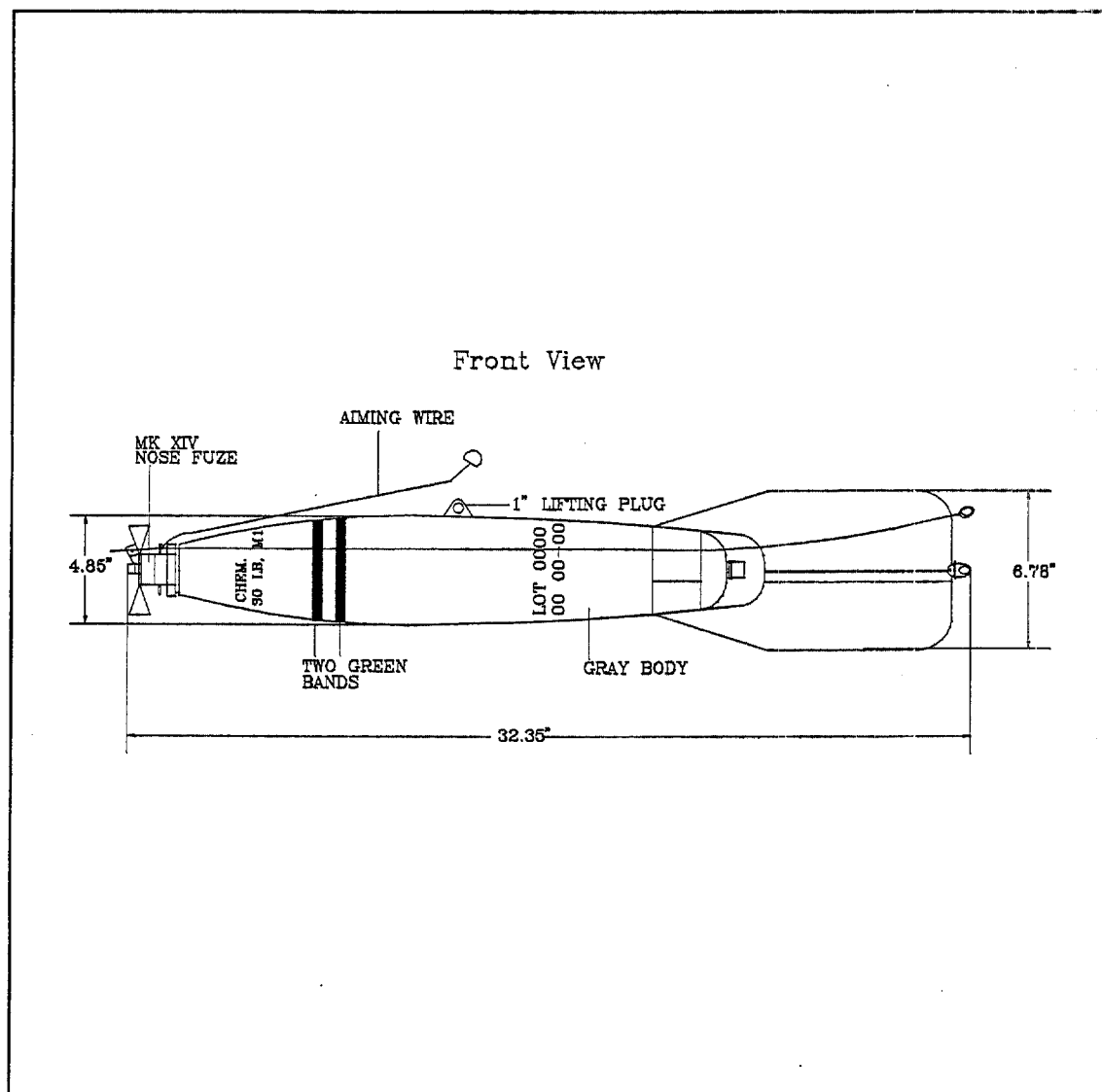
Burster:

Model no.: unknown
Diameter: unknown
Length: unknown
Explosive type: tetryl
Explosive weight: 0.189 or 0.265 pound (85.8 or 120.31 g)

ENGINEERING DATA: unknown

REFERENCES:

1. TM 3-300.
2. Department of Ordnance and Gunnery, Elements of Ordnance (West Point, NY: U.S. Military Academy, 6 January 1938).



Drawing not to scale

Figure 5.3.21-1. Bomb, Gas, Persistent, 30-Pound, M1 (Ref. 2)

5.3.22 NOMENCLATURE: Bomb, Chemical, 100-Pound (H), M47 and M47A2

TABULATED DATA:

Length: 48.9 to 51.9 inches (1,242 to 1,318 mm) overall, 39.5 inches (1,003.3 mm) (body only)

Note: The M47, M47 (smoke, gas, and incendiary), AN-M47A2 all were the same length. With subsequent changes, the welded fins were increased 3 inches in length to give greater stability in flight.

Diameter: 8.1 inches (205.7 mm)

Tail:

Length: 12.9 inches (328 mm)

Width: 10.9 inches (277 mm)

Type of Fill and Fill Weight:

HS: 65 to 68.5 pounds (29.5 to 31.13 kg)

H: 73 pounds (33.2 kg)

WP: 100 pounds (45.5 kg)

PWP: 74 pounds (33.6 kg)

Total Weight with Fill:

H: 94.5 to 98.0 pounds (43.0 to 44.5 kg)

HS: 98 pounds (44.5 kg)

WP: 131 pounds (59.5 kg)

PWP: 105 pounds (47.7 kg)

Markings:

These bombs were painted blue-gray with bands near the center of the body designating the type of filling. The band colors were: green-gas (casualty agent), one band for nonpersistent gas and two bands for persistent gas.

Description:

The predecessor to this munition, the M47A1 bomb, consisted of a cylinder 8.10 inches in diameter and approximately 39.5 inches long, and was composed of 0.0625-inch sheet metal with a hemispherical nose closure and conical tail closure. The bomb was equipped with box-type stabilizing fins with a span of 10.9 inches. A burster well, which extended throughout the length of the bomb case, was screwed

into the adapter in the nose of the bomb. The only difference between the M47A1 and the M47A2 is that the inside of the body is coated with oil (M47A2). In the M47A1, the interior of the body is coated with black acid-proof paint instead of oil.

The design of the M47A2 was refined by: (1) incorporating a vent plug near the nose to relieve gas pressure built up during storage, and (2) sharper threads on the fuze adapter to prevent leakage. Also, the tail fin was increased 3 inches to provide greater flight stability. Subsequent versions of this munition, the M47A3 and M47A4, were never stockpiled.

Explosive Train:

Nose Fuze:

Model no.:	AN-M126 (alternate) AN-M159 (preferred)
Overall length:	3.12 inches (79.2 mm) (AN-M126) 3.24 inches (82.3 mm) (AN-M159)
Total weight:	1.16 pounds (526.69 g) (AN-M126) 0.65 pound (295.1 g) (AN-M159)
Other fuzes used:	M108 AN-M47

Booster Charge:

Model no.:	unknown
Explosive type:	small tetryl column with AN-M159 fuze
Explosive weight:	unknown

Vane:

Span (in inches):	3 inches (76.2 mm) (AN-M126) 3 inches (76.2 mm) (AN-M159)
Number:	two

Burster:

Model no.:	M4
Diameter:	1.13 inches (28.7 mm)
Length:	37.94 inches (962.6 mm)
Explosive type:	tetryl
Explosive weight:	1.5 pounds (681 g)
Explosive type:	TNT
Explosive weight:	1.5 pounds (681 g)

Alternate Bursters:

Model no.: AN-M12
Explosive type: 50% mixture of black powder and magnesium
Explosive weight: unknown
Model no.: AN-M13
Explosive type: TNT and tetryl pellets at each end
Explosive weight: unknown

ENGINEERING DATA:

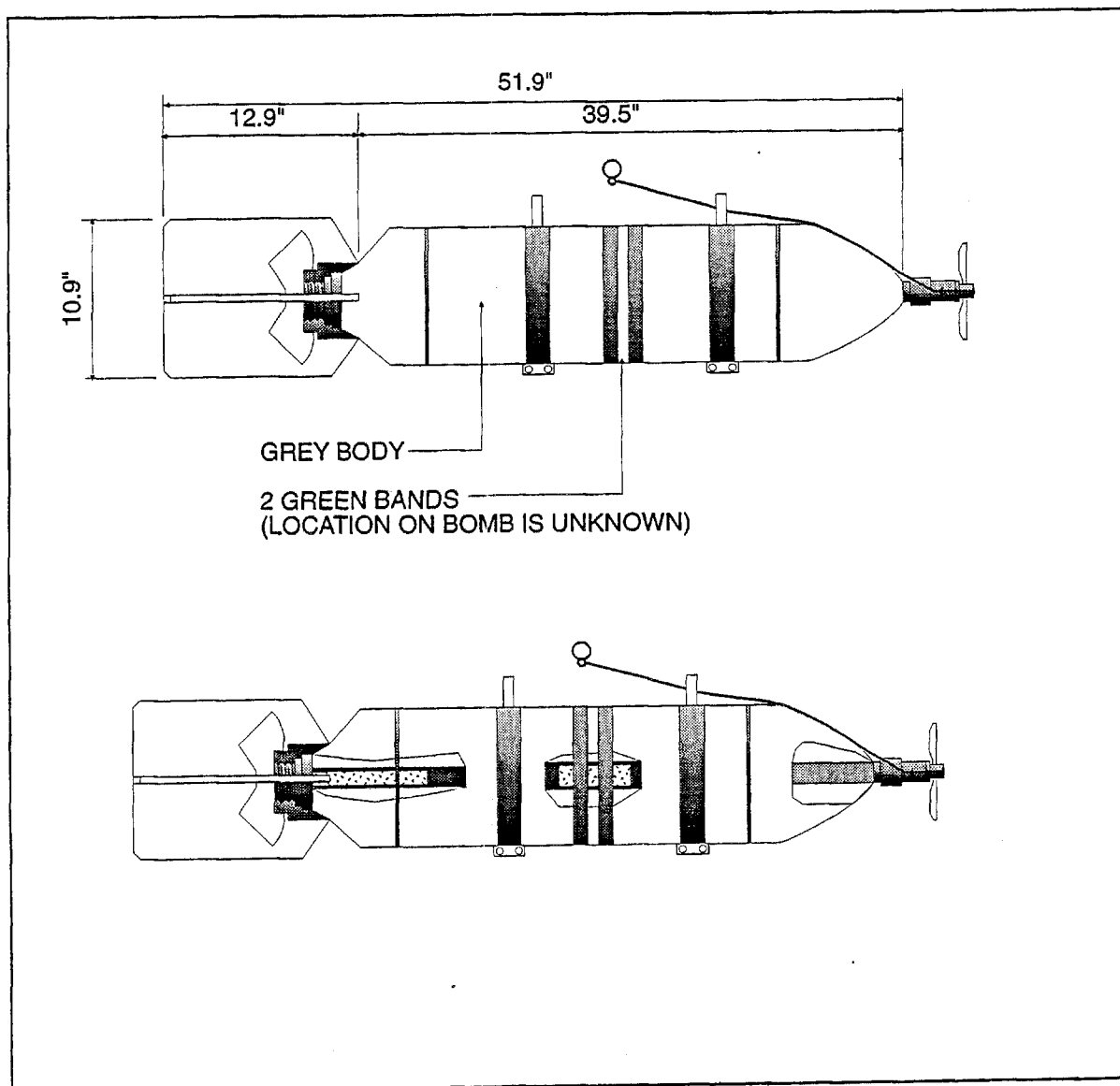
Construction:

Material: sheet steel
Wall thickness: 0.06 inch (1.52 mm) (M47A2); 0.03 inch (0.76 mm) (M47)
Tail length: 10.9 inches wide by 12.9 inches long (276.8 by 327.66 mm)
four vanes in truncated cone with box-type struts

REFERENCES:

1. Chief of the Bureau of Naval Weapons, Aircraft Bombs, Fuzes, and Associated Components, NAVWEPS OP 2216 (N.p.: n.p., August 1960) vol. 2.
2. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982) 2-67, 2-68, 2-103, 2-104, 2-167, 2-168.
3. Headquarters, Department of the Army, Office of the Chief Chemical Officer, Chemical Corps Safety Directive No. 385-17, General Instructions for Disposal of Bulk Chemical Agents and Munitions, CML C SD-385-17 (Washington, DC: Department of the Army, n.d.) 31 through 33.
4. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics (Washington, DC: Department of the Navy, 1 September 1945) 92 and 93.
5. Chemical Corps Technical Committee Action, Item 19301 (Aberdeen Proving Ground, Edgewood Arsenal, MD: n.p., 10 December 1942) 42 through 50.
6. NAVWEPS OP 2212 Vol. 1. Aircraft Bombs, Fuzes and Associated Equipment (N.p.: n.p., n.d.) 10-12 to 10-17.

7. Department of the Army, Employment and Characteristics of Air Chemical Munitions, FM 3-6 (N.p.: Department of the Army, October 1946).
8. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics, Land Mines, Firing Devices (Washington, DC: Department of the Navy, 1 June 1944) 92 and 93.
9. Chemical Corps Technical Committee Action Item 2085 (N.p.: n.p., 1 March 1950) D-1 and D-3.



Drawing not to scale

Figure 5.3.22-1. Bomb, Chemical, 100 Pound (H), M47 and M47A2 (Ref. 7)

5.3.23 NOMENCLATURE: Bomb (Navy), 100-Pound, MK 42

TABULATED DATA:

Length: 39.43 inches (1,001.5 mm) (overall)
27.7 inches (704 mm) (length of body)

Diameter: 8 inches (203 mm)

Fin Span: 11 inches (279.4 mm)

Type of Fill and Fill Weight:

HS: 40.5 pounds (18.4 kg)

Total Weight with Fill:

HS: 92 pounds (41.8 kg)

Markings:

The main body color was olive drab with two green bands 0.5 inch wide and 0.5 inch away from aft of the nose.

Description:

The body of the bomb was constructed as a steel tube, swaged at the aft end. An adapter screwed into the nose and was threaded to receive the fuze. A burster tube, containing TNT, ran along the center line of the bomb body. The aft end of the burster tube was counterlevered near the end of the bomb. The aft end of the body was closed by a male baseplate, which was threaded so the tail assembly could be fitted.

The bomb was equipped with two suspension lugs 14 inches apart and equidistant from the center of gravity. One lug on the opposite side of the bomb was located at the center of gravity.

The tail assembly, 9.46 inches long and 11 inches wide, was made of sheet steel. The tail was the box type with four fins secured by a locking nut.

Explosive Train:

Nose Fuze:

Model no.: AN-MK 219
Overall length: 5.5 inches with booster (139.7 mm)
Total weight: 4.1 pounds (1.86 kg)

Burster:

Model no.: unknown
Diameter: unknown
Length: unknown
Explosive type: Granulated TNT
Explosive weight: 7.5 pounds (3.4 kg)

ENGINEERING DATA:

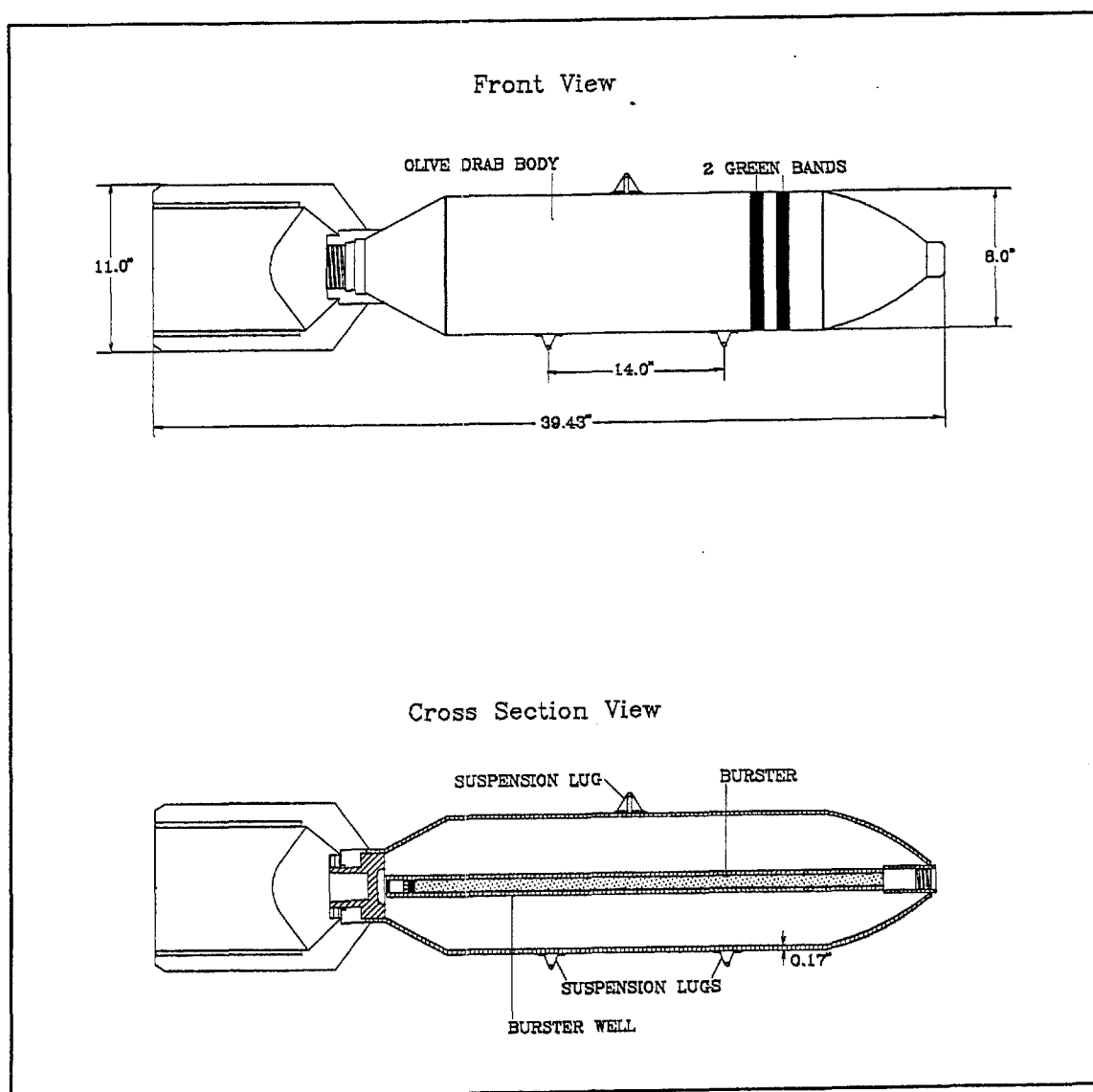
Construction:

Wall thickness: 0.17 inch (4.32 mm)
Material of wall: steel
Length of tail: 9.46 inches (240.28 mm)
Width of tail: 11 inches (279.4 mm)
Material of tail: sheet steel
Construction of tail: box type, four fins

REFERENCES:

1. Department of the Navy, Bureau of Ordnance, U.S. Explosive Ordnance, OP 1664 (Vol. 2) (Washington, DC: Department of the Navy, 28 May 1947) 425.
2. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).
3. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics, Land Mines, Firing Devices (Washington, DC: Department of the Navy, 1 June 1944).
4. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics (Washington, DC: Department of the Navy, 1 September, 1945).

5. The War Department, Technical Manual (TM) 9-1984, Disposal of American and Allied Bombs and Fuzes (Washington, DC: n.p., 12 November 1942) 78 and 79.



Drawing not to scale

Figure 5.3.23-1. Bomb (Navy), 100 pound, MK 42 (Ref. 1, 5)

5.3.24 **NOMENCLATURE: Bomb, Chemical (Gas), 115/125-Pound, E-46, E52, M70, M70A1, and M113**

TABULATED DATA:

Length: 48.7 to 51.5 inches (1,237 to 1,308 mm)
 40.4 inches (1,026 mm), body only

Diameter: 8 inches (203 mm)

Fin Span: 11 inches (279.4 mm)

Type of Fill and Fill Weight:

Note: The difference in bomb types is that the M70A1 is filled with HD, and the M70, with H. Both bombs are identical except for fill, and the fact that the M70 has no interior phenolic varnish coating. The E-46 and E-52 are modifications of the M70; however, the nature of the modification is unknown.

H: 60 pounds (27.3 kg) (10 percent void)
HD: 59.8 to 61.75 pounds (27.2 to 28.1 kg) (5 percent void)
GA: 45 pounds (24.45 kg)
CK: unknown
HS: 57.1 pounds (26.0 kg)
L: 83.0 pounds (37.7 kg)
WP: possible fill

Total Weight with Fill:

H: 128 to 145.49 pounds (58.2 to 66.1 kg)
HD: 147.14 pounds (66.9 kg)
GA: unknown
CK: unknown
HS: 122.5 pounds (55.7 kg)
L: unknown
WP: unknown

Markings:

The main body color was gray background with two green bands on the central portion of the bomb body. Weight, type, filling, model number, and lot number were stencilled in green on the bomb body. No color code markings were available for the GA and CK agents in sources reviewed.

Description:

The M70 family of bombs was an aerial bomb that was fin-stabilized and cylindrical in shape with an ogive nose and conical tail section. The bomb was equipped with a burster well running, axially, the entire length of the bomb and forming the press-fit closure for the filling aperture, which was at the nose or ogive of the bomb. The burster well was also threaded to facilitate the installation of the nose fuze after the burster had been inserted into the burster well.

The tail assembly consisted of four fins welded to a sleeve, which was secured by a locking nut threading into the tail closing block.

Explosive Train:

Nose Fuze:

Model no.:	AN-M158
Overall length:	3.69 inches (93.73 mm)
Total weight:	1.02 pounds (463 g)
Model no.:	AN-M110A1, M110, and AN-M111 (alternatives) AN-M103A1

Tail Fuze:

M100 series

Burster:

Model no.:	M10
Length:	length of interior of body 36 inches (914.4 mm)
Explosive type:	tetryl
Explosive weight:	0.5 pound (227 g)

ENGINEERING DATA:

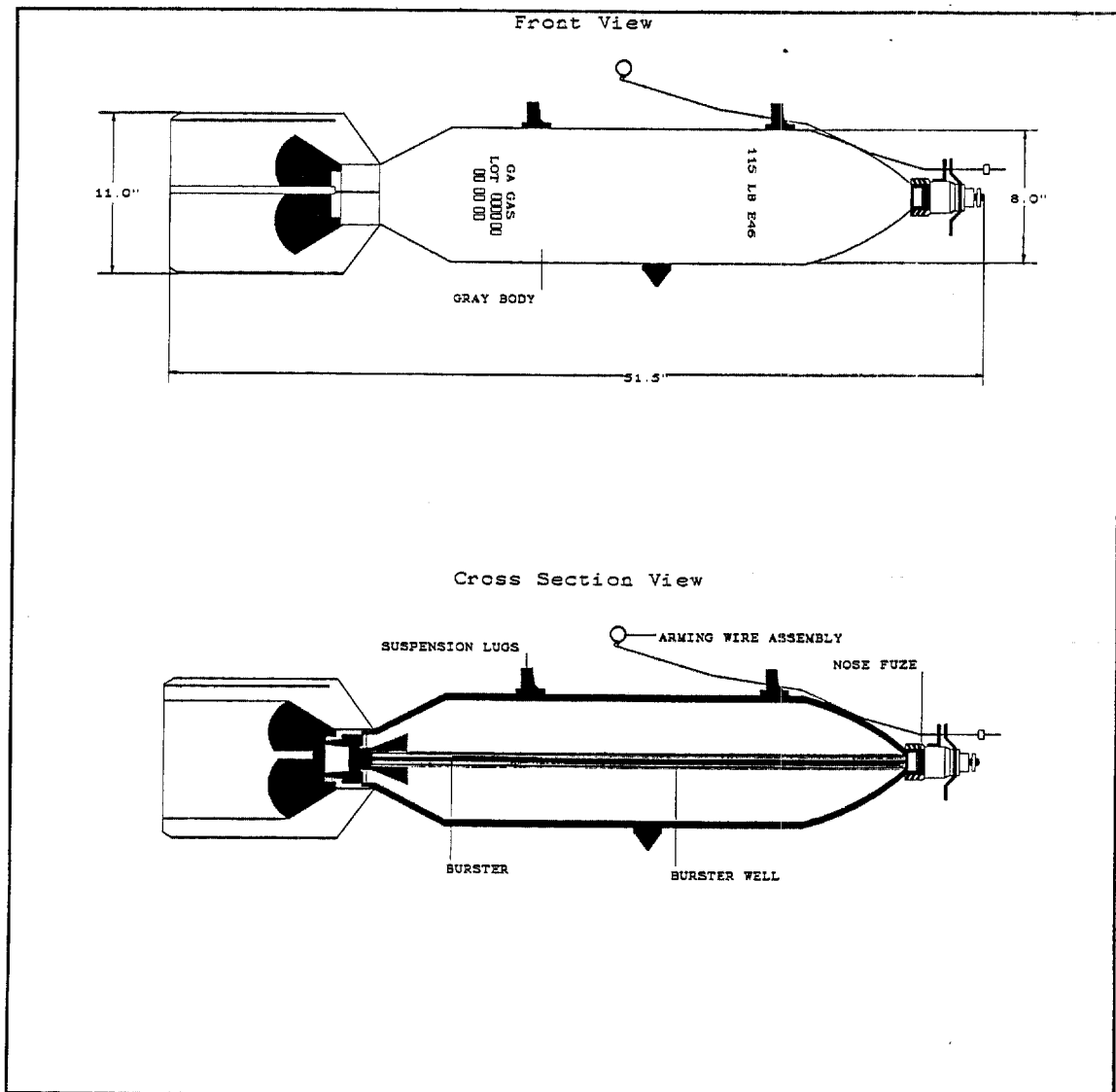
Construction:

Main body:	seamless steel tubing
Fin assembly:	5.6 pounds (2.54 kg), M102, M102A1, AN-M103 AN-M103A1 12.9 inches (327.7 mm) long by 10.9 inches (276.9 mm) wide, sheet metal and four vanes
Wall thickness:	0.125 inch (3.16 mm) to 0.224 inch (5.69 mm) burster well runs length of body

REFERENCES:

1. Department of the Navy, Bureau of Ordnance, U.S. Explosive Ordnance, OP 1664 (Vol. 2) (Washington, DC: Department of the Navy, 28 May 1947) 420 and 421.
2. Chief of the Bureau of Naval Weapons, Aircraft Bombs, Fuzes, and Associated Components, NAVWEPS OP 2216 (N.p.: n.d., 1 August 1960) vol. 2.
3. Department of the Navy, Chief of the Bureau of Naval Weapons, Miscellaneous Chemical Munitions, Description and Operation, NAVWEPS OP 2217 (1st Revision) (Washington, DC: Department of the Navy, n.d.).
4. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolete, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of the Navy, 1 October 1982).
5. Headquarters, Department of the Army, Office of the Chief Chemical Officer, Chemical Corps Safety Directive No. 385-17, General Instructions for Disposal of Bulk Chemical Agents and Munitions, CML C SD-385-17 (Washington, DC: Department of the Army, n.d.).
6. Department of the Army, Chemical Bombs and Clusters, TM 3-400 (Washington, DC: Department of the Army, May 1957) 106 and 41 through 43.
7. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics (Washington, DC: Department of the Navy, 1 September 1945).
8. Arthur B. Gregg, 1st LT, Cml. C., and Bertrand C. Kriete, 1st LT, Cml. C., Technical Division Memorandum Report No. 1277, Preliminary Tests of the 125-Pound Chemical Bomb, T3 (N.p.: n.p., 5 November 1946).
9. Department of the Army, Characteristics of Offensive and Defensive Chemical and Biological Material, Pamphlet 71-2 (N.p.: Department of the Army, June 1964).
10. Departments of the Army, Navy, and Air Force, EOD Procedures for Chemical and Biological Munitions (Indian Head, MD: Department of the Army, Navy, and Air Force, 3 December 1962).

11. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics, Land Mines, Firing Devices (Washington, DC: Department of the Navy, 1 June 1944).



Drawing not to scale

Figure 5.3.24-1. Bomb, Chemical (Gas), 115/125-Pound, E-46, E52, M70, M70A1, and M113

**5.3.25 NOMENCLATURE: Bomb, Chemical, 500-Pound (CG, CK, and AC)
AN-M78**

TABULATED DATA:

Length: 59.25 inches (1,505 mm) overall
46.7 to 48 inches (1,186 to 1,219 mm) body only

Diameter: 14.18 inches (360 mm)

Fin Span: 18.94 inches (481 mm) (diagonal)

Empty Weight: 260 pounds (118 kg)

Type of Fill and Fill Weight

CG: 205 pounds (93 kg)
CK: 165 pounds (75 kg)
AC: 100 pounds (45.5 kg)

Total Weight with Fill:

CG: 488 pounds (221.8 kg)
CK: 448 pounds (203.6 kg)
AC: 383 pounds (174 kg)

Markings:

The main body color was gray with a single green band at the nose, one green band at the middle, and one green band at the tail end identifying the bomb as a nonpersistent gas bomb. Bomb nomenclature and lot number were stenciled on the body in green.

Description:

The 500-pound AN-M78 bomb was an aerial bomb that was fin-stabilized and cylindrical in shape with an ogive nose and conical tail. The body of the bomb was a one-piece, cast steel construction with a burster well extending the entire length of the bomb. The burster well was threaded at the forward end to receive the nose fuze and at the aft end to receive the adapter booster and tail fuze. The base plug consisted of a special forging welded to the case containing the M1 needle valve. An AN-M1 needle valve was installed in the baseplate.

A standard box-type fin assembly was screwed to the bomb by a locking nut, which threaded to the base plug.

Explosive Train:

Nose Fuze:

Model no.: AN-M103 series
Overall length: 7.23 inches (183.6 mm)
Total weight: 3.7 pounds (1.68 kg)

Tail:

Model no.: AN-M101A1, M101A2, M161
Overall length: 12.2 to 12.6 inches (309.9 to 315 mm)
Total weight: 2.9 pounds (1.3 kg)
Model no.: M175
Overall length: 25.29 inches (642.4 mm)
Weight: 3.65 pounds (1.65 kg)

Burster:

Model no.: AN-M15
Diameter: 2.5 inches (63.5 mm)
Length: length of interior of bomb
Explosive type: mix of tetryl and TNT
Explosive weight: 2.5 pounds (1.14 kg)

ENGINEERING DATA:

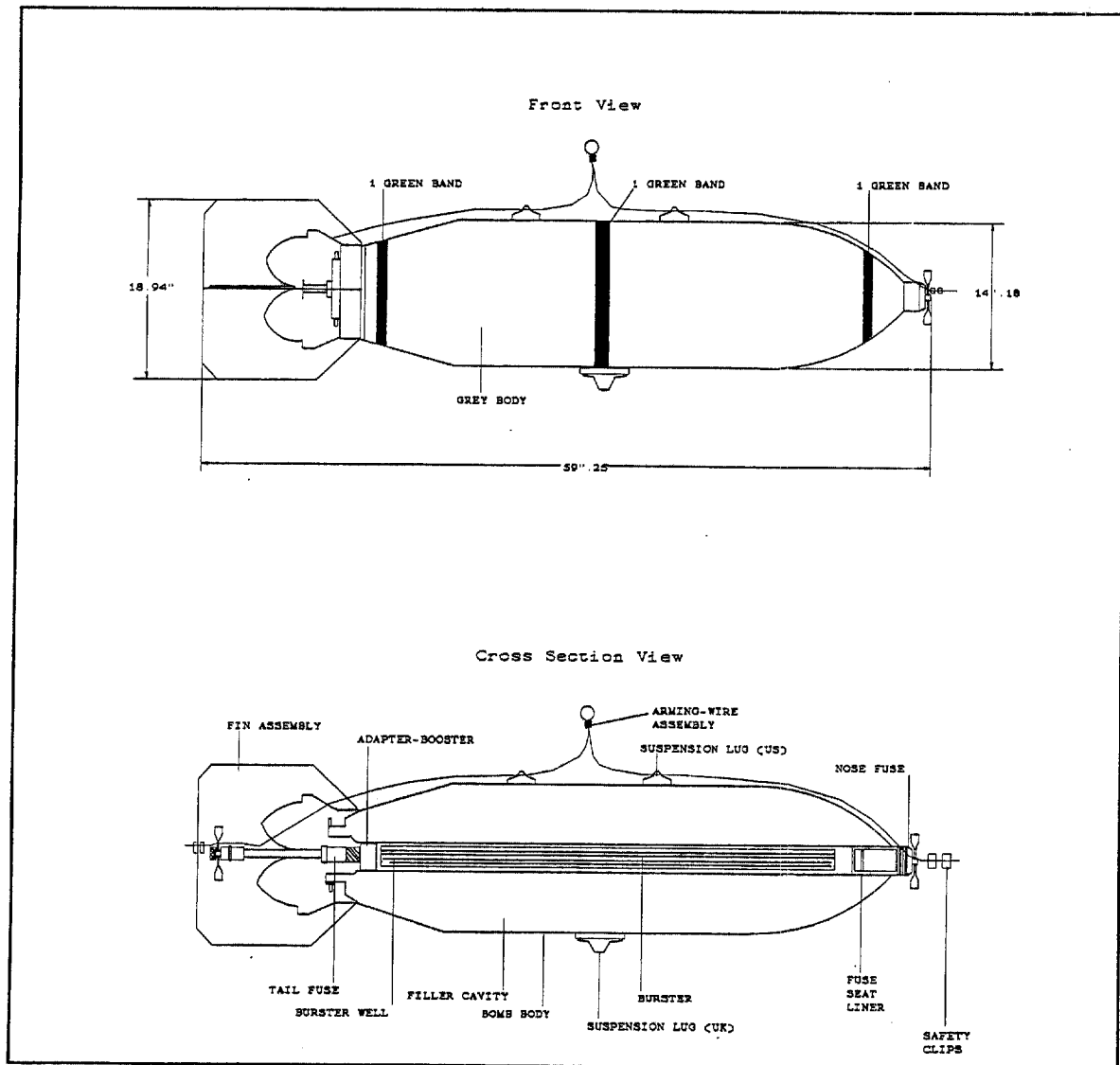
Construction:

Main body: forged steel
Fin assembly: length 13.9 inches (353 mm)
width 18.9 inches (480 mm)
Wall thickness: 0.3 inch (7.62 mm)

REFERENCES:

1. Department of the Navy, Bureau of Ordnance, U.S. Explosive Ordnance, OP 1664 (Washington, DC: Department of the Navy, 28 May 1947) vol. 2, 434.
2. Chief of the Bureau of Naval Weapons, Aircraft Bombs, Fuzes, and Associated Components, NAVWEPS OP 2216 (N.p.: n.p., August 1960) vol. 1.

3. Department of the Navy, Chief of the Bureau of Naval Weapons, Miscellaneous Chemical Munitions, Description and Operation, NAVWEPS OP 2217, Revision 1 (Washington, DC: n.p., n.d.).
4. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).
5. Headquarters, Department of the Army, Office of the Chief Chemical Officer, Chemical Corps Safety Directive No. 385-17, General Instructions for Disposal of Bulk Chemical Agents and Munitions, CML C SD-385-17 (Washington, DC: Department of the Army, n.d.).
6. Department of the Army, Chemical Bombs and Clusters, TM 3-400 (Washington, DC: Department of the Army, May 1957).
7. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics, Land Mines, Firing Devices (Washington, DC: Department of the Navy, 1 June 1944).
8. Chief of the Bureau of Naval Weapons, Characteristics of Biological and Chemical Munitions and Delivery Systems, NAVWEPS Report 8566 (N.p.: n.p., July 1966).
9. Department of the Army, Navy, and Air Force, EOD Procedures for Chemical and Biological Munitions (Indian Head, MD: n.p., 3 December 1962).



Drawing not to scale

Figure 5.3.25-1. Bomb, Chemical, 500 pound (CG, CK, and AC) AN-M78 (Ref. 3, 4)

5.3.26 NOMENCLATURE: Bomb, Chemical, 1000-Pound, AN-M79

TABULATED DATA:

Length: 69.5 inches (1,765 mm) overall
51 to 53.6 inches, (1,295 to 1,361 mm) body only

Diameter: 18.8 inches (477.5 mm)

Empty Weight: 485 pounds (220.5 kg)

Type of Fill and Fill Weight:

AC: 195.01 to 200 pounds (88.6 to 90.9 kg)
CG: 415.01 to 417 pounds (188.6 to 189.5 kg)
CK: 315 to 351.01 pounds (143.2 to 159.6 kg)

Total Weight with Fill:

AC: 717.0 to 728.0 pounds (325.9 to 330.1 kg)
CG: 927.0 to 948.0 pounds (421.4 to 430.9 kg)
CK: 873.0 to 884.0 pounds (396.8 to 401.8 kg)

Markings:

The main body color was gray with one or two colored bands around the central portion of the body to indicate the type of filler used.

Description:

The body of the AN-M79 was one-piece cast steel and had a steel burster well 2.5 inches in diameter, running axially through it. The burster well expanded in both the nose and baseplate before welding, which eliminated decomposition of chemical fillers due to the presence of crevices. The baseplate differed from that of the standard general purpose bomb in that it was forge-welded to the case and contained the M1 needle valve. It also had a 1.25-inch filling hole closed by a soft iron gasket, a hard steel gasket plug, and a threaded closing plug. The M16 booster was used in the burster well and consists of a waterproof fiber tube filled with 4.45 pounds of tetryl.

The AC- and CG-loaded bombs were equipped with a 1.75-inch diameter threaded stainless steel plug containing a sampling valve installed in the base plugs. The valve body contained a spindle valve bearing against a 0.25-inch seat, and had an outlet hole threaded for a 3/8-inch pipe plug. The valve body was seated on a soft iron washer on a shoulder, and held in place by a threaded steel bushing, which was

screwed down on top of the valve body. This valve was used for tests on the AC filler every 60 days or just prior to shipment, or surveillance tests on the CG filler, as directed.

Explosive Train:

Nose Fuze:

Model no.:	M103 series
Overall length:	7.23 inches (183.6 mm) (approximately)
Total weight:	3.7 pounds (1.68 kg) (approximately)
Model no.:	AN-M168 (VT)
Overall length:	10.02 inches (254.5 mm)
Total weight:	4.5 pounds (2.05 kg)

Note: An M184 is used with M129 tail fins. Booster for AN-Mk 219.

Model no.:	unknown
Explosive type:	tetryl
Explosive weight:	0.9 ounce (25.5 g)

Tail Fuze:

Model no.:	AM-M101A1 series
Overall length:	12.26 inches (311.4 mm)
Total weight:	2.9 pounds (1.32 kg)

Burster:

Model no.	AN-M16
Diameter:	2.5 inches (63.5 mm)
Length:	length of interior of bomb
Explosive type:	tetryl
Explosive weight:	4.45 pounds (2.02 kg)

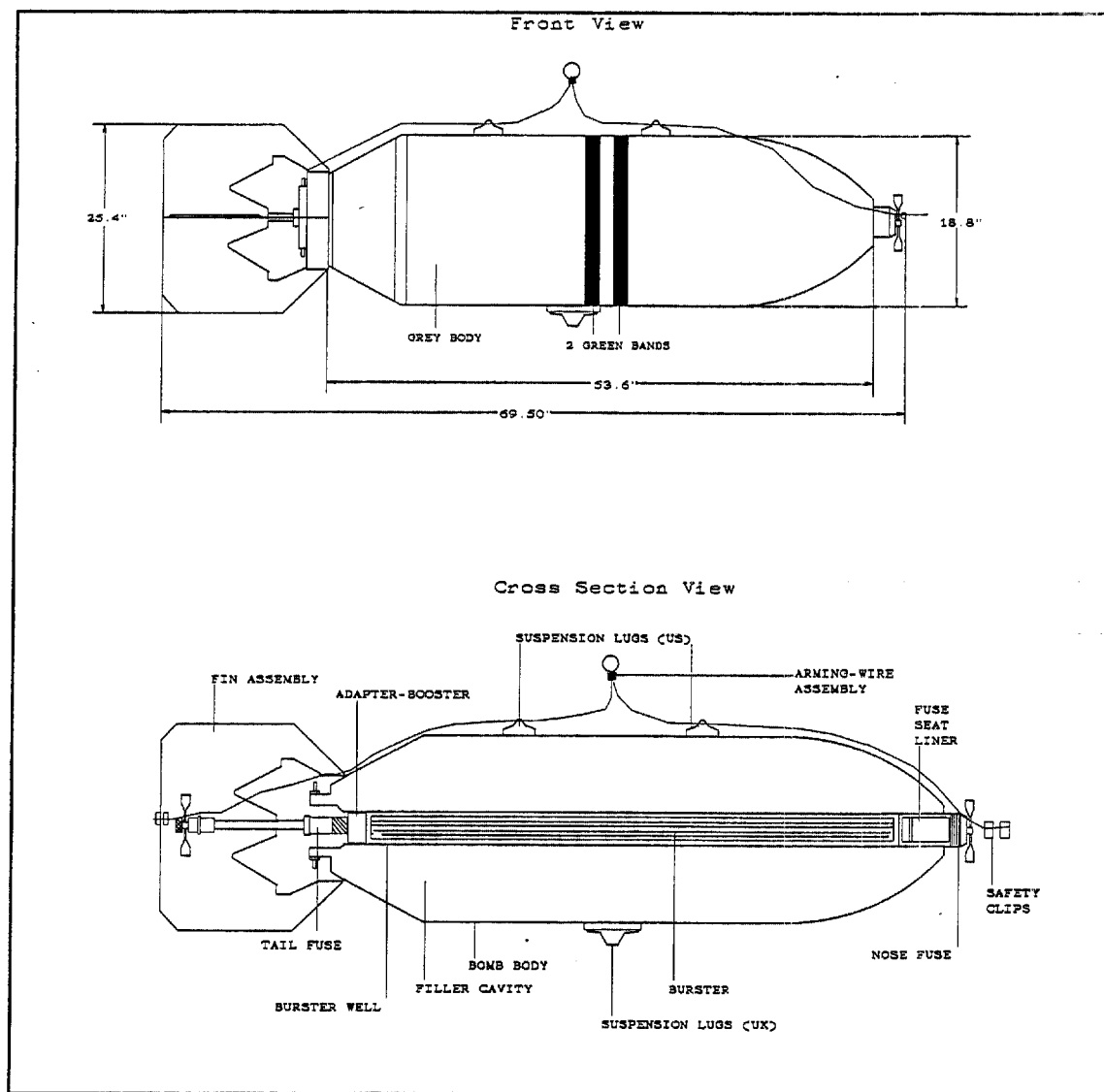
ENGINEERING DATA:

Construction:

Main body:	cast steel
Fin assembly:	length, 18.5 inches (469.9 mm)
	width, 25.4 inches (645.16 mm)
Wall thickness:	0.38 inch (9.65 mm)

REFERENCES:

1. Department of the Navy, Bureau of Ordnance, U.S. Explosive Ordnance, OP 1664 (Washington, DC: Department of the Navy, 28 May 1947) vol. 2.
2. Chief of the Bureau of Naval Weapons, Aircraft Bombs, Fuzes and Associated Components, NAVWEPS Report OP 2216 (N.p.: n.p., August 1960) vol. 1.
3. Department of the Navy, Chief of the Bureau of Naval Weapons, Miscellaneous Chemical Munitions, Description and Operation, NAVWEPS OP 2217 Revision 1 (Washington, DC: n.p., n.d.).
4. Fedoroff, Basil T., and Oliver E. Sheffield, Encyclopedia of Explosives and Related Items, PATR 2700 (Picatinny Arsenal, Dover, NJ: n.p., 1969) vol. 4.
5. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982).
6. Headquarters, Department of the Army, Office of the Chief Chemical Officer, Chemical Corps Safety Directive No. 385-17, General Instructions for Disposal of Bulk Chemical Agents and Munitions, CML C SD 385-17 (Washington, DC: Department of the Army, n.d.).
7. Department of the Army, Chemical Bombs and Clusters, TM 3-400 (Washington, DC: Department of the Army, May 1957).
8. Department of the Navy, U.S.N.B.D., United States Bombs and Fuzes, Pyrotechnics, Land Mines, Firing Devices (Washington, DC: Department of the Navy, 1 June 1944).
9. Chief of the Bureau of Naval Weapons, Characteristics of Biological and Chemical Munitions and Delivery Systems, NAVWEPS Report 8566, (N.p.: n.p., July 1966).
10. Department of the Navy, Bureau of Ordnance, Non-persistent Gas Munitions, Ordnance Pamphlet No. 1030 (Washington, DC: Department of the Navy, 22 December 1943).



Drawing not to scale

Figure 5.3.26-1. Bomb, Chemical, 1000-Pound, AN-M79 (Ref. 7)

5.3.27 NOMENCLATURE: Bomb, Chemical, 1000-Pound, T2

TABULATED DATA:

Length: 69.5 inches (1,765 mm), overall

Diameter: 18.9 inches (480 mm)

Type of Fill and Fill Weight:

CG: unknown

AC: unknown

H: unknown

L: unknown

Total Weight with Fill:

unknown

Markings:

The main body color was blue-gray with one green band in the middle of bomb on the upper portion of the bomb (closest to the fuze). The mark 1,000 LB was stenciled below the bomb designation T2, half-way down the body with LOT 4094-1 and the alpha-numeric designation of E.A. G-43. Below this designation was the type of fill (CG GAS). On the aft end of the bomb body cubic measurements for the bomb were given (17.7 CU. FT).

Description:

The T2 1000-pound chemical bomb was essentially an AN-M65 1000-pound general purpose bomb modified for chemical filling. It had a bursting charge sufficient to break the body into a few large pieces and disperse the filler, and it was adapted for both a nose and a tail fuze. The modifications included two filling holes and a test hole in the side of the body, and a full length burster well extending down the axis of the bomb. The filling holes were closed with 0.5-inch standard pipe plugs, and the test hole was closed with a 0.5-inch standard pipe plug. The threads on the filling and test hole plugs were tinned with solder to ensure a tight seal. The test hole was used when the bomb was inspected after manufacture by the application of 1000 pounds per square inch of hydraulic pressure internally, and later as a vent hole when the bomb was filled through one of the filling holes. The filling holes were located diametrically opposite the two double-suspension lugs; that is, on a fore-and-aft line through the single British-type suspension lug. The test hole was midway between the aft filling hole and single suspension lug. The aft filling hole was unnecessary, subsequent to the manufacture of the T2 bombs, and has been plugged and welded to minimize the possibility of leakage. The burster well was a 2.25-inch outside diameter by 0.25-inch

wall steel tube welded into the tail plug of the bomb and the nose of the bomb. The tail plug was screwed into the bomb and welded. The box-type fin assembly was the same type used with the AN-M65, 1000-pound general purpose bomb.

Only the AC-loaded bombs were equipped with a special plug containing a sampling valve in place of the forward 1.25-inch plug in the side of the bomb. The valve was approximately flush with the surface of the bomb and has a 0.25-inch spindle and an outlet with one-eighth inch standard pipe threads. The outside threads of the valve were tinned with solder before installation of the valve. The valve was used for special surveillance tests on the AC filler every 60 days or just prior to shipment.

Explosive Train:

Nose Fuze:

Model no.:	AN-Mk 219
Overall length:	5.5 inches (139.7 mm)
Total weight:	4.1 pounds (1.86 kg)
Model no.:	AN-M103A1
Overall length:	7.23 inches (183.64 mm)
Total weight:	3.7 pounds (1.68 kg)

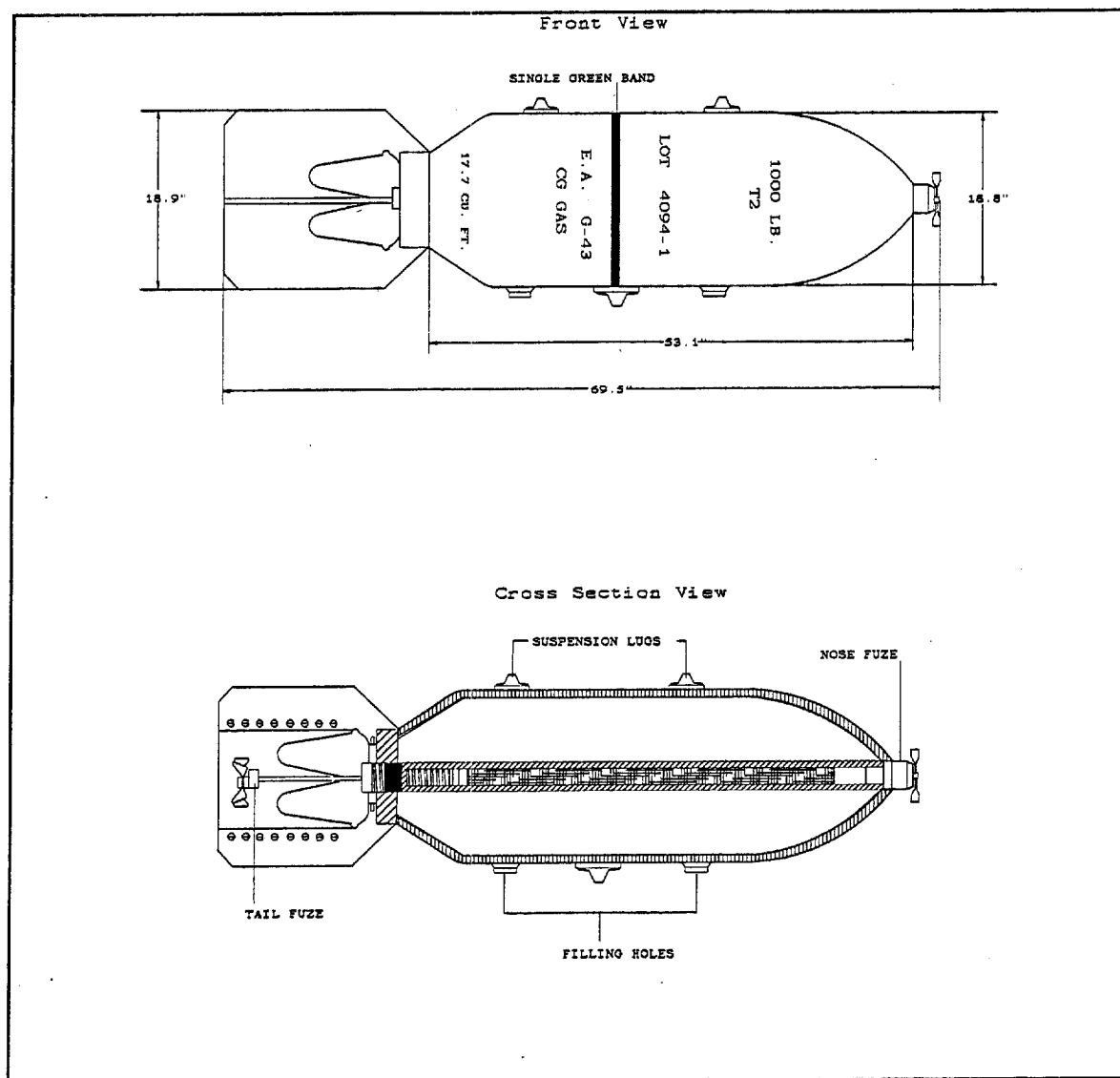
ENGINEERING DATA:

Construction:

Burster well:	2.25 inches (57.15 mm) outer diameter by 0.25-inch (6.35-mm) wall steel tube
Wall thickness:	0.5 inch (12.7 mm)

REFERENCES:

1. Department of Defense, Military Handbook, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146 (Washington, DC: Department of Defense, 1 October 1982) 2-257 to 2-258 and 2-247 to 2-248.
2. Department of the Navy, Bureau of Ordnance, Non-persistent Gas Munitions, Ordnance Pamphlet No. 1030 (Washington, DC: Department of the Navy, 22 December 1943).
3. Fedoroff, Basil T. and Oliver E. Sheffield, Encyclopedia of Explosives and Related Items, PATR 2700 (Picatinny Arsenal, Dover, NJ: n.p., 1969) vol. 4.



Drawing not to scale

Figure 5.3.27-1. Bomb, Chemical, 1000-Pound, T2 (Ref. 2)

5.3.28 NOMENCLATURE: Chemical Bomblet, M139

TABULATED DATA:

Length: N/A

Diameter: 4.5 inches (114.3 mm)

Type of Fill and Fill Weight:

GB: 1.3 pounds per bomblet (0.59 kg)

Total Weight with Fill:

GB: 2.4 pounds per bomblet (1.09 kg)

Each warhead has a different number of M139 bomblets. The following are the quantities of bomblets per weapon system:

M206 Little John Rocket	52 each
M212 Sergeant Missile	329 each
M190 Honest John Rocket	368 each

Markings:

There were three green stripes and one yellow stripe across the steel saturn band of the bomblet.

Description:

The M139 (E130R2) chemical bomblet was a spherical bomblet constructed from aluminum. The outer spherical surface contained six driving vanes that caused the bomb to rotate when released from the warhead at high altitudes. The rotation or spin effects from the bomb armed the fuze, which was located in a burster charge, located concentrically with the outer spherical surface. The fuze was an all-ways impact fuze that required a rotational speed of 1800 revolutions per minute to arm. The bomb was constructed in two hemispheres to facilitate the loading of the fuze and burster. A stainless steel ring was used to clamp and retain the two hemispheres together.

Explosive Train:

Fuze:

Model no.:	M912
Explosive type:	spin-to-arm type
Total weight:	unknown

Booster Charge:

Model no.: unknown
Explosive type: RDX pellet
Explosive weight: 0.0022 pound (1 g)

Burster:

Model no.: unknown
Diameter: spherical
Explosive type: Composition B
Explosive weight: 0.16 pound (72.64 g)

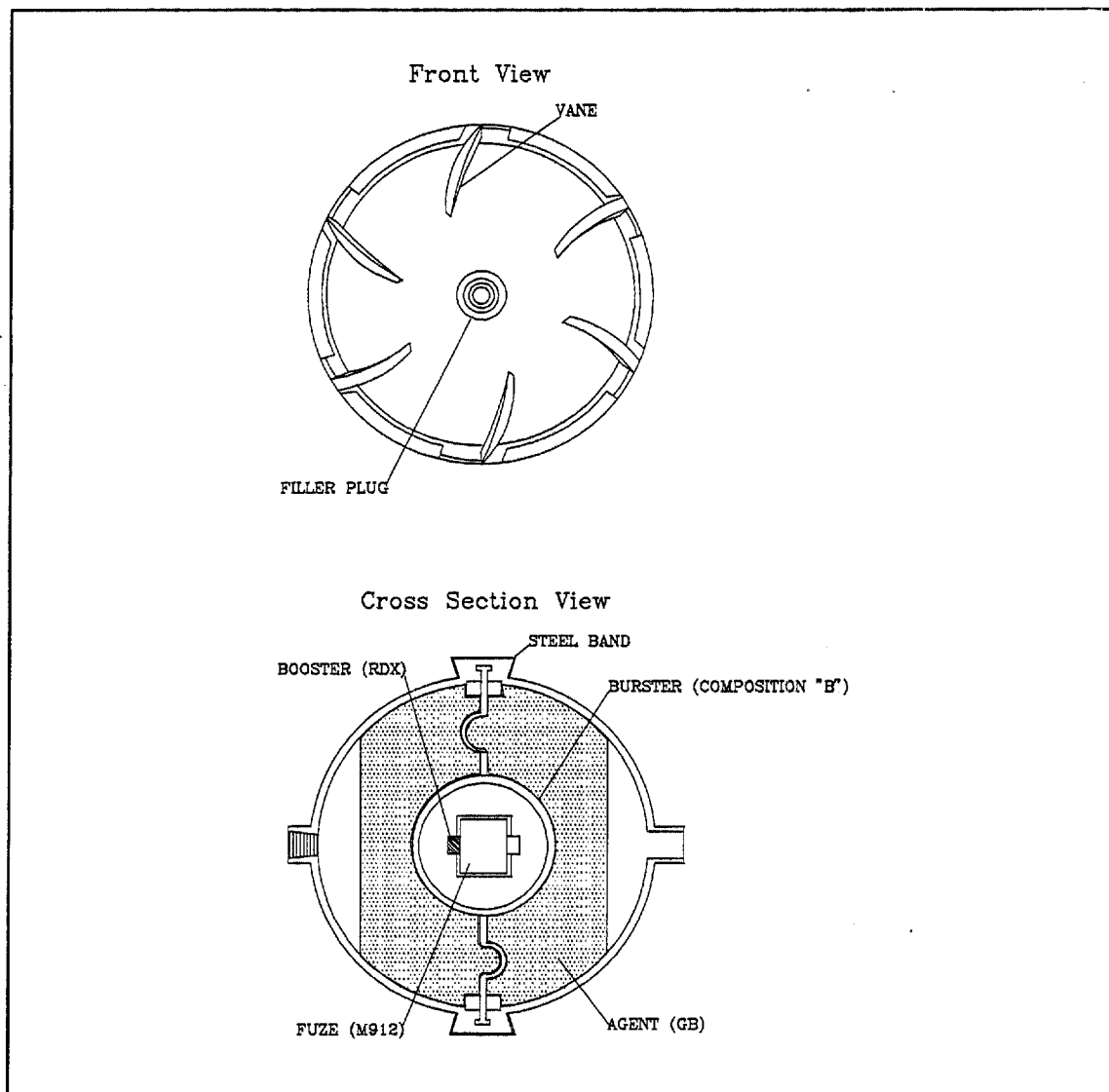
ENGINEERING DATA:

Construction:

Two hemispheres constructed of 6061T6 aluminum

REFERENCES:

1. Departments of the Army, Navy, and Air Force, Employment of Chemical and Biological Agents, FM 3-10 (Washington, DC: Departments of the Army, Navy, and Air Force, 31 March 1966) 16.
2. Departments of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Departments of the Army, Navy, and Air Force, 31 March 1961) 4-5 through 4-6.
3. Office of the Project Manager for Chemical Demilitarization, Expanded Project EAGLE Disposal of GB in Honest John Warheads/M139 Bomblets at Rocky Mountain Arsenal (Aberdeen Proving Ground, MD: n.p., September, 1975) v and vi.



Drawing not to scale

Figure 5.3.28-1. Chemical Bomblet, M139 (Ref. 3)

5.3.29 **NOMENCLATURE: Bomblet, Spherical, 3.4-Pound, M134 (GB)**

TABULATED DATA:

Length: N/A

Diameter: 4.5 inches (114.3 mm)

Type of Fill and Fill Weight:

GB: 1.1 pounds (0.5 kg)

Total Weight with Fill:

GB: 3.4 pounds (1.5 kg)

Markings:

There are no markings for this munition.

Description:

The M134 (E130R1) is a steel spherical bomblet with a cylindrical burster and fuze well located concentric with the axis of the bomblet. Located on each end, the cylindrical burster is an all-ways type impact fuze. Installed around the outer spherical surface of the bomblet is a plastic cover, which contains nine driving or spinning vanes that causes the bomblet to rotate when released from a warhead at high altitudes. Rotation of the bomblet arms the fuze. Detonation of the bomblets occur on ground impact subsequently releasing the agent.

Explosive Train:

Fuze:

Model no.:	M911 centrifugal arming, all-ways impact (two used)
Overall length:	N/A
Total weight:	unknown

Auxiliary Booster Charge:

Model no.:	M135
Explosive type:	RDX
Explosive weight:	unknown

Burster:

Model no.: M33
Diameter: unknown
Length: N/A
Explosive type: tetryl
Explosive weight: 0.18 pound (81.7 g)

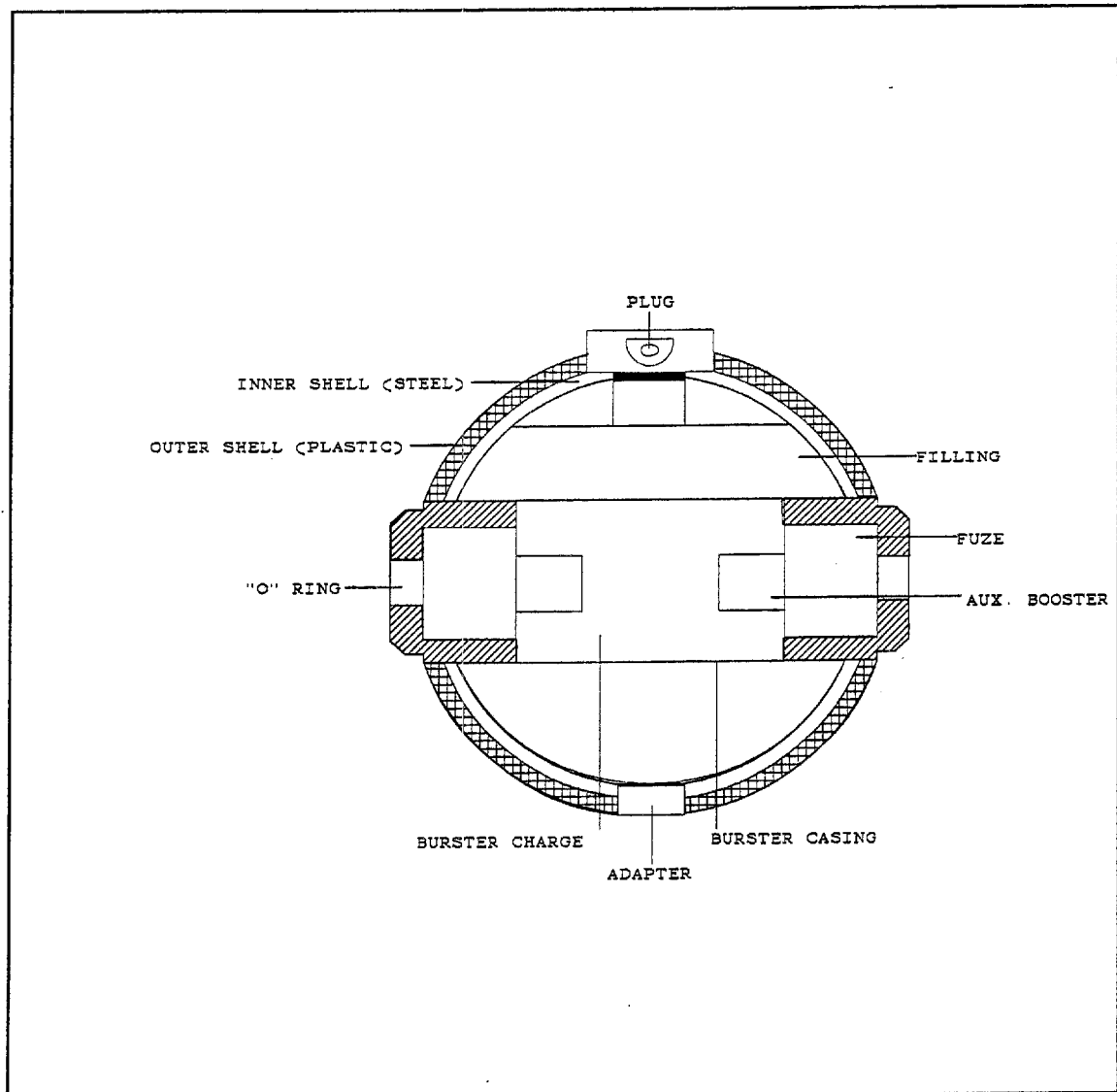
ENGINEERING DATA:

Construction:

Outer casing: plastic
Inner shell: steel

REFERENCES:

1. Department of the Navy, Bureau of Naval Weapons, Fourth Consolidated Report of BW/CW Study (Washington, DC: Department of Defense, 31 March 1961) 4-11 and 4-12.



Drawing not to scale

Figure 5.3.29-1. Bomblet, Spherical, 3.4 pounds, M134 (GB) (Ref. 1)

5.3.30 NOMENCLATURE: Bomblet, Nonpersistent, E139 (GB)

TABULATED DATA:

Length: 2.250 inches (57.15 mm)

Diameter: 2.5 inches (63.5 mm)

Type of Fill and Fill Weight:

GB: 0.263 pound (0.12 kg)

Total Weight with Fill:

GB: 0.67 pound (0.30 kg)

Markings:

The E139 bomblet was experimental and was not type-classified. However, the bomblet was used for experimental flight testing and was painted red with identification marking as in the following example:

01A001 through 01A203

01 - E27 warhead section Lance flight test number

A - section letter in which the bomblet was clustered

001 - bomblet number

Each Lance (E27 chemical warhead section) contained six longitudinal sections in which the bomblets were clustered marked A through F. Inclusive each segment contained approximately 189 bomblets except section A, which contained 203 bomblets. Production bomblets used for filling the tactical warhead section was to be marked in accordance with MIL-STD-709.

Description:

The E139 bomblet was a 2.5-inch diameter by 2.25-inch long, self-dispersing, cylindrical munition weighing 0.67 pound. It contained 0.263 pound of toxic agent GB and a 0.0265-pound tetryl burster charge. It was constructed of two extruded cylindrically shaped cups of 0.043-inch thick 6061-T6 aluminum alloy, which were welded together near the center. There was a 0.137-pound hard-lead band wrapped in a groove around the body midsection for rotational inertia effects. One end of the bomblet contained a filling opening that was sealed after filling with a pressed double ball closure. The other end had an accessible fuze and a burster well. The burster assembly consisted of an 11.3-gram tetryl pellet (0.98 by 0.671 inch) encased in polyethylene, the M219 grenade fuze, a steel compression spring, an aluminum disk, and a snap ring retainer. A sleeve of 0.020-inch thick 6061 aluminum alloy that had

six integrally extruded longitudinal driving vanes, which were pressed onto the cylindrical body. In flight, these vanes would induce the bomblet to spin about its longitudinal axis to arm the M219E1 fuze (2400 to 3200 rpm), as well as to create an aerodynamic lifting force on the bomblet for dispersion. The armed fuze would fire on ground impact, thereby detonating the bomblet burster and disseminate the GB agent in fine aerosol and vapor form, producing casualties via the respiratory route. The E27 warhead section contained 1137 E139 bomblets.

Explosive Train:

Fuze:

Model no.: M219 grenade, explosive - unknown

Burster:

Model no.: unknown
Diameter: 0.98 inch (24.9 mm)
Length: 0.671 inch (17.04 mm)
Explosive type: tetryl
Explosive weight: 0.4 ounce (11.3 g)

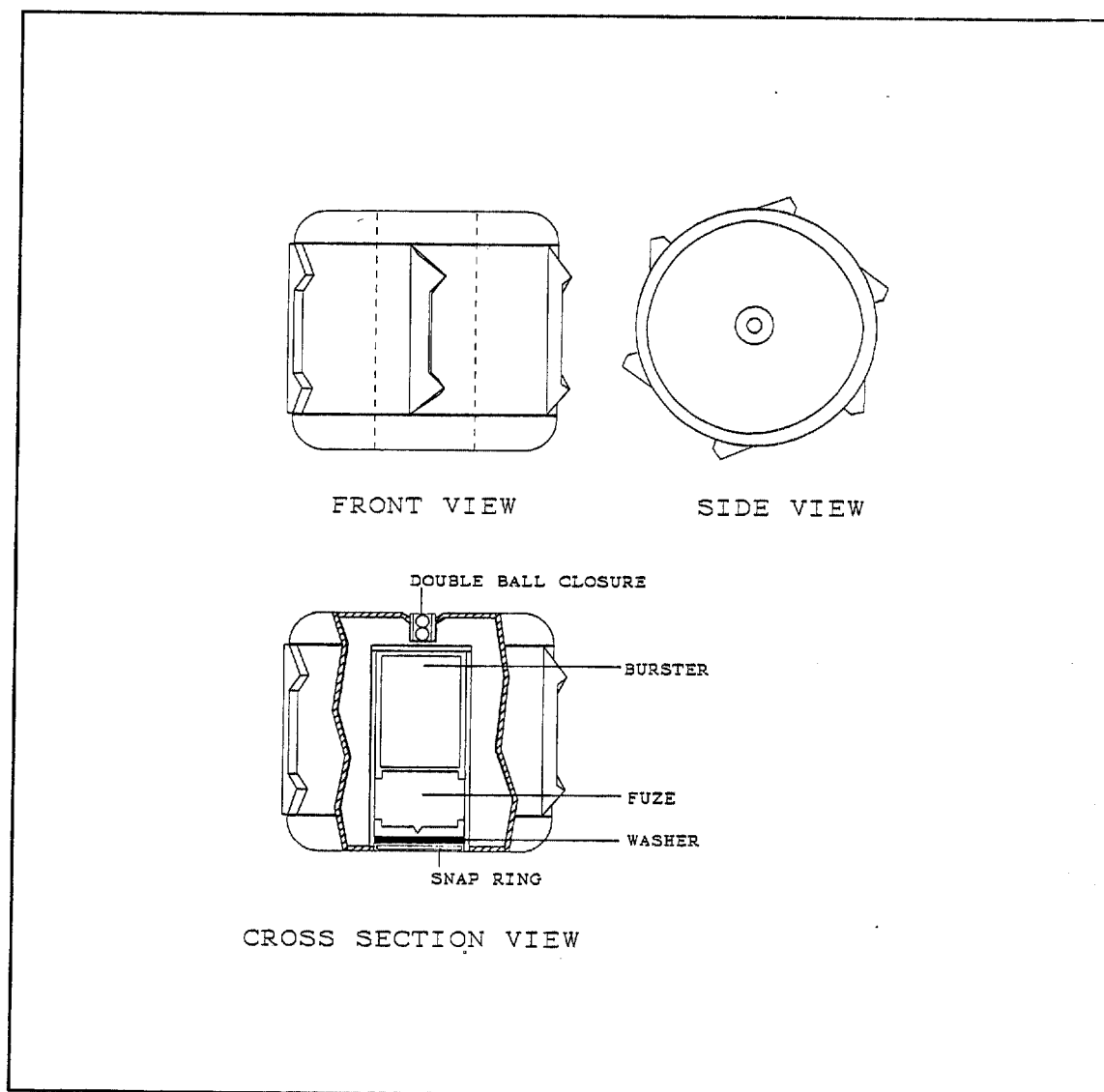
ENGINEERING DATA:

Construction:

Two extruded cylindrical cups welded to form the bomblet. The cups were 6061T6 aluminum alloy.

REFERENCES:

1. Operator, and Organizational maintenance, warhead section, E27 MGM-52 (Lance) Guided Missile, MP 1365-12 (N.p.: n.p., April 1966) 15.
2. Operational Tests of E27 Chemical Warhead section for the Lance missile, Report No. EATR 4572 (N.p.: n.p., August 1972) 10.



Drawing not to scale

Figure 5.3.30-1. Bomblet, Nonpersistent, E139 (GB) (Ref. 1)

5.3.31 NOMENCLATURE: Bomblet, Chemical, BLU/50/B

TABULATED DATA:

Length: 2.50 inches (635 mm)

Diameter: 1.25 inches (317 mm)

Type of Fill and Fill Weight:

BZ: 16 grams

Pyrotechnic mixture: 24 grams

Total Weight with Fill:

0.13 pound (59 g)

Markings:

unknown

Description:

The bomblet is approximately the size of a D flashlight cell. The outer shell was composed of ABS plastic and was held in place by Lexan plastic end plates. The bomb contained a central ignition tube, which ignited the contents of the canister.

After expulsion from the cluster, the bomblet had a 5-to-6-second pyrotechnic delay fuze that activated the BZ-pyrotechnic mix and separated the fuze from the top of the BLU-50/B. This exposed a small orifice in a rubber disk through which BZ was expelled, causing the bomb to skitter while on the ground, and in the air after impact with the ground. The BLU 50/B disseminated BZ for approximately 17 seconds.

The BLU 50/B was designed to be ejected from the SUU-13/A dispenser. The combination of BLU 50/Bs and the dispenser was designated the CBR-16A/A dispenser system. The SUU-13/A was capable of holding 1,280 BLU 50/B bomblets.

Explosive Train:

None

Fuze:

Model: Unknown (pyrotechnic delay fuze only)

Burster:

None

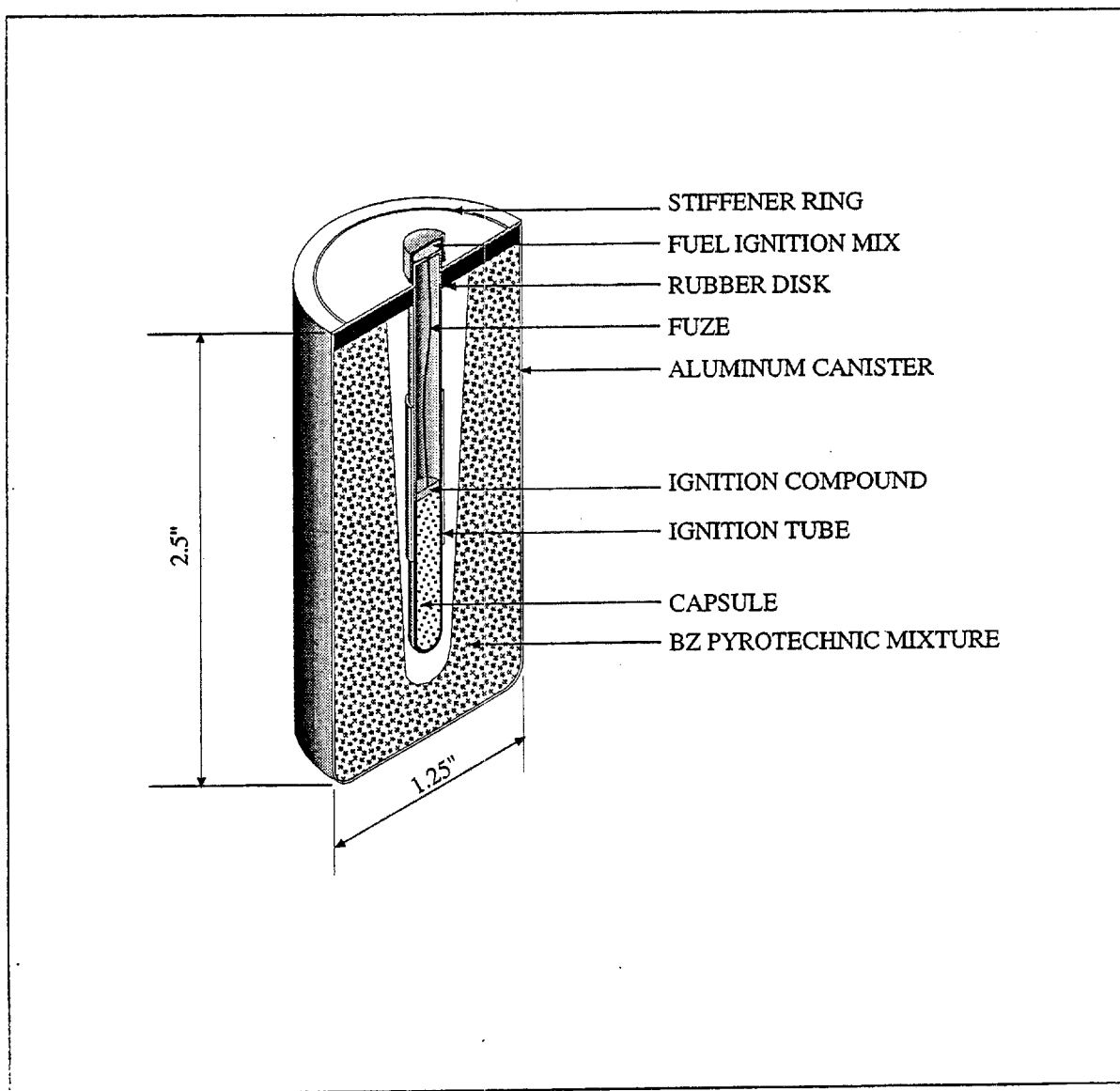
ENGINEERING DATA:

Construction:

Main body: thin aluminum canister

REFERENCES:

1. Department of the Army, Characteristics of Offensive and Defensive Chemical and Biological Material, DA Pamphlet No. 71-2 (Washington, DC: Department of the Army, August 1967).
2. Naval Ordnance Laboratory, Characteristics of Biological and Chemical Munitions and Delivery Systems, NAVWEPS Report 8566 (White Oak, Silver Spring, Maryland: Naval Ordnance Laboratory, 1 July 1966) AD 377-819.
3. Air Force Systems Command, Elgin AFB, Florida, USAF Chemical and Biological Munitions Characteristics, ATL-TR-65-72 (Elgin AFB, Florida: U.S Air Force, October 1965) AD 366-824.
4. E. B. Niccume and H. C. Washmuth, Cluster Weapons and Dispensers for Air-Launched Munitions, JTOG-ALNNO (China Lake, California: Naval Weapons Center, January 1969) AD 500-036L.



Drawing not to scale

Figure 5.3.31-1. Bomblet, Chemical, BLU/50/B

5.3.32 NOMENCLATURE: Land, Mine, Chemical, 1-Gallon

TABULATED DATA:

Length: 6.56 inches (166.6 mm)

Width: 4.123 inches (104.7 mm)

Height: 10.56 inches (268.2 mm)

Type of Fill and Fill Weight:

HD: 9.9 pounds (4.5 kg)

Total Weight with Fill:

HD: 11 pounds (5.0 kg)

Markings:

The color of the 1-gallon chemical landmine was green with two green bands. After filling, appropriate symbols and markings were stenciled on the side. For mustard gas, HD-GAS or H-GAS, filling plant designation (in green), date of filling, lot number, and two stripes denoting a persistent casualty gas.

Description:

The 1-gallon chemical landmine was a rectangular 1-gallon can, 6.56 inches wide, 4.123 inches deep, and 10.56 inches high, fitted with a carrying handle and a threaded cap. The cap was lined with a gasket of cork or rubber and faced with lead foil. Two short wires were soldered to the side of the can for use when attaching a burster. Detonating cord was used to burst the can and disseminate the agent. The mine was filled in the field with persistent agents. The authorized filling was HD.

Explosive Train:

The explosive train consisted of the M3 burster, an 8-foot length of detonating cord and a nonelectric detonator.

Burster:

Model no.	nonelectric detonator and detonating cord
Length:	detonating cord - 8 feet (2.42 m)
Explosive type:	PETN

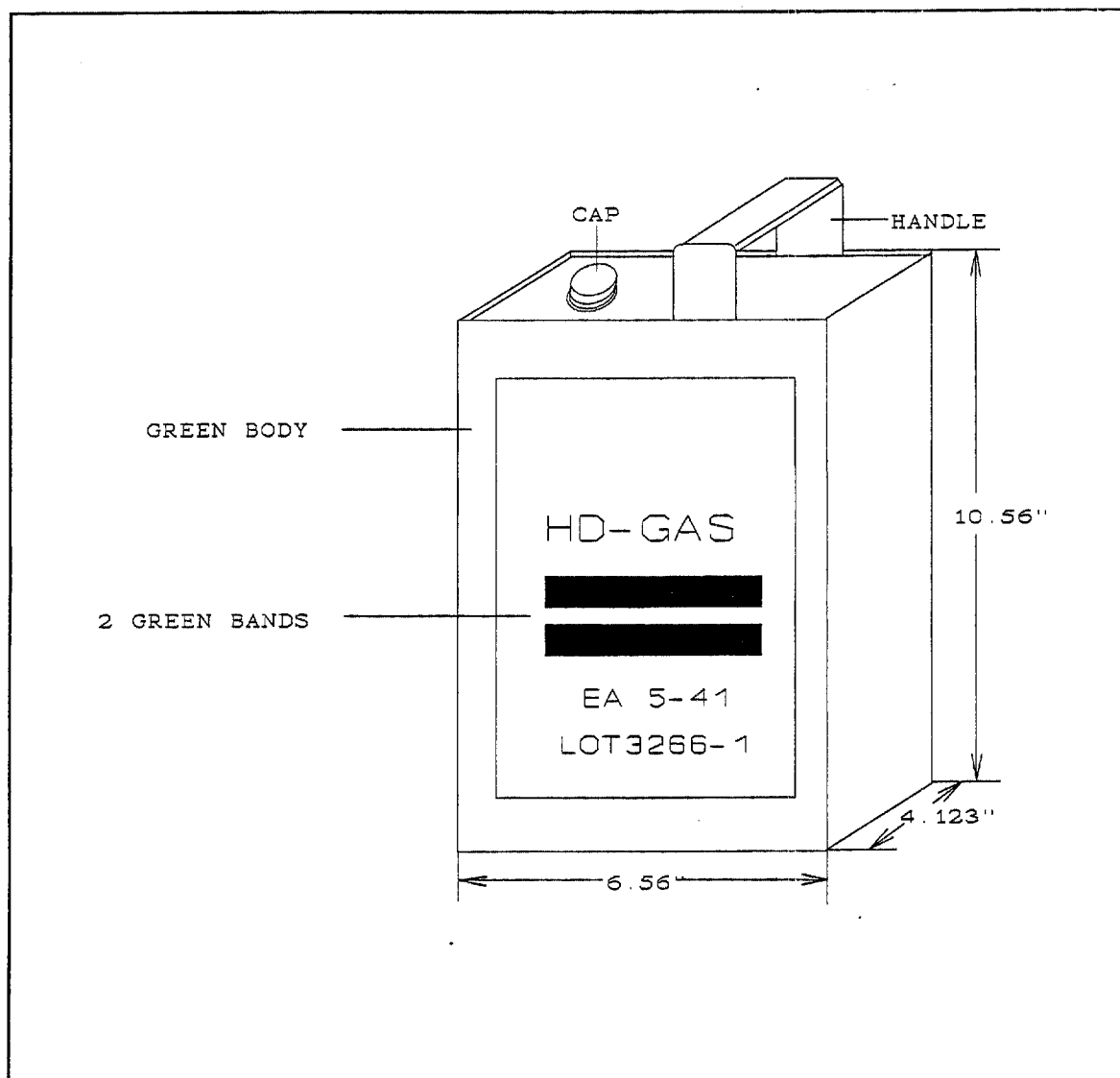
ENGINEERING DATA:

Construction:

Main body: Thin sheet metal

REFERENCES:

1. Headquarters, Department of the Army, Chemical Weapons and Defense Equipment, TM 750 - 5 - 15 (Washington, DC: Department of the Army, February 1967) 64.
2. Headquarters, Department of the Army, Land Mines, TM 9 - 1345 - 200 (Washington, DC: Department of the Army, 1964) 100 and 101.
3. Chemical Corps School, Miscellaneous Chemical Munitions, Design Section, Tentative TM 3-300 (Aberdeen Proving Ground, Edgewood Arsenal, MD: n.p., March 1948) 141 through 148 and 151.



Drawing not to scale

Figure 5.3.32-1. Land, Mine, Chemical, 1-Gallon (Ref. 1)