Old Chemical Weapons and Related Materiel Reference Guide

4-Inch Stokes Mortars

Prepared for:
U.S. Army Chemical Materials Activity
Recovered Chemical Materiel Directorate
Recovered Chemical Warfare Materiel Integrating Office
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U.S. Chemical Weapons and Related Material Reference Guide

1 Introduction

This document replaces the 1998 *Old Chemical Weapons Reference Guide* (SciTech Services Inc., 1998) sections relating to U.S. chemical munitions and certain materials of interest. This guide is focused on munitions and certain materials of interest that in one or more configuration may contain compounds listed in the schedule of chemicals in the Chemical Weapons Convention (CWC), which are considered chemical warfare materiel (CWM) by the Recovered Chemical Warfare Materiel (RCWM) Program. A limited number of other items are included as they appeared in the 1998 guide. This guide is a compilation of technical information to aid unexploded ordnance (UXO) qualified personnel in the identification of chemical munitions and related materiel. As many munitions with differing fills and fuzing may appear similar, environmental exposure can obscure critical characteristics necessary for positive identification, only individuals with extensive training in munitions identification and functioning should approach, disturb, or handle suspect munitions or certain materials of interest. All others should follow the 3Rs of explosives safety (Recognize, Retreat, Report). The information is also useful to project managers for planning field operations and ultimate disposition of items that are encountered. The information provided here is not inclusive of all possible agent fills, physical characteristics, and explosive train configurations. A few experimental munitions are included in this guide; however, not every configuration has been captured here. This document is based on the best information available at the time of publication.

The information used to compile this guide includes historical documents describing ammunition development and manufacture, technical manuals, munitions specifications, and other related sources.

2 Technical Information - Chemical Agents

A chemical agent, through its chemical properties, produces lethal or other damaging effects on humans. The Department of Defense (DoD) defines chemical agents as a substance that is intended for use in military operations to kill, seriously injure, or incapacitate, through physiological effects (Defense Technical Information Center, 2016, p. 30). Chemical agents have effects that can be immediate or delayed, can be persistent or nonpersistent, and can have significant physiological effects (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. I-1). The chemicals in this guide may be described as chemical agents, chemical warfare agents, or military chemical compounds; however, only those compounds listed in the schedule of chemicals in the CWC (OPCW, 1997) are considered CWM by the RCWM Program.

Chemical agents are classified in groups based on their use: lethal chemical agents (i.e., choking, nerve, blood), blister agents, and incapacitating agents. Other munition fills that were at one time managed by the Chemical Warfare Service (CWS) include riot control agents, smokes, and incendiaries. The chemicals listed in Table 1 are the chemical agent fills in the munitions described in this guide and others that may be encountered in the reference materials. A description of the categories of information provided in the table is presented in the following subsections.

2.1 Chemical Agent Symbols

Chemical agent symbols, or brevity codes, are designed to convey complex information with a few letters. U.S. military chemical agent symbols are generally used in this document to describe the fill of a munition. In some instances, more than one symbol exists because they changed over time. In cases where more than one chemical agent symbol exists, both are provided in the table, with the most common listed first.

2.2 Common Name

Common names, or chemical names, for the chemical fills covered under this guide are provided in Table 1. Often, chemicals have more than one common name, the most common, or the one most often used in description of military munitions, are listed in Table 1.

2.3 Chemical Abstract Service Registration Number

The Chemical Abstract Service (CAS) is a division of the American Chemical Society. The CAS registry is a collection of chemical substance information containing more than 122 million organic and inorganic substances and 66 million sequences and is a global standard for identification. CAS registry covers substances identified from the scientific literature from 1957 to the present, with additional substances going back to the early 1900s. CAS registry numbers are universally used to provide a unique, unmistakable identifier for chemical substances. A CAS # in and of itself has no inherent chemical significance; however, it provides an unambiguous way to identify a chemical substance or molecular structure when there are many possible systematic, generic, proprietary, or trivial names. A CAS # is a numeric identifier that can contain up to ten digits, divided by hyphens into three parts. The digit furthest to the right is a check digit used to verify the validity and uniqueness of the entire number (Chemical Abstract Service, 2016). The CAS #, if available, is listed in Table 1.

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Table 1: Symbols for U.S. Chemical Agents and Other Chemical Warfare Service Chemicals

U.S. Chemical Agent Symbol	Chemical Name/Common Name	CAS #	Classification	Persistent/ Nonpersistent	CWC Schedule	Citations
AC or HCN	Hydrogen cyanide or hydrocyanic acid	74-90-8	Blood Agent	Nonpersistent	3A03	(Department of the Army, 1955, p. 49; Departments of the Army, Navy, and Air Force, 1990, pp. 25-26; OPCW, 1997)
AS	Asbestine suspension	N/A	Simulant	Not Applicable	Not Listed	(Secretary of War, 1942a, p. 22)
BA	Bromoacetone	598-31-2	Riot Control Agent	Persistent	Not listed	(Prentiss, 1937, p. 6; USACE, 2015, pp. 7-32)
BM	Berger Mixture (35.4% Zinc, 41.6% carbon tetrachloride, 9.3% sodium chlorate, 5.4% ammonium chloride, 8.3% magnesium carbonate)	--	Smoke	Not Applicable	Not listed	(SciTech Services Inc., 1998, pp. 1-7; Prentiss, 1937, pp. 7, 242)
BZ	3-quinuclidinyl benzilate	6581-06-2 13004-56-3	Incapacitating Agent	Nonpersistent	2A03	(Department of the Army, 1982, p. Glossary 1; Departments of the Army, Navy, and Air Force, 1990, p. 48; OPCW, 1997, p. 53)
CA* or BBC	Bromobenzyl cyanide or 4-Bromophenylacetylnitrile	16532-79-9 5798-79-8	Respiratory Irritant	Persistent	Not listed	(Departments of the Army, Navy, and Air Force, 1990, pp. 52-53; General Headquarters, American Expeditionary Forces, 1919a, p. 9; War Department, 1944, pp. 164, 172; U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. III-16)
CG	Phosgene or Carbonyl chloride	75-44-5	Choking Agent	Nonpersistent	3A01	(War Department, 1944, p. 164; War Department, 1945b, p. 111; Departments of the Army, Navy, and Air Force, 1990, pp. 14-15; OPCW, 1997)
CK or CC	Cyanogen chloride	506-77-4	Blood Agent	Nonpersistent	3A02	(Department of the Army, 1955, p. 49; Departments of the Army, Navy, and Air Force, 1990, pp. 25, 27-28; OPCW, 1997)

Table 1: Symbols for U.S. Chemical Agents and Other Chemical Warfare Service Chemicals

U.S. Chemical Agent Symbol	Chemical Name/Common Name	CAS #	Classification	Persistent/ Nonpersistent	CWC Schedule	Citations
CL	Chlorine	7782-50-5	Choking Agent	Nonpersistent	Not listed	(War Department, 1944, pp. 164, 819; Departments of the Army, Navy, and Air Force, 1990, pp. 70-71; Secretary of War, 1942b, p. 136)
CN	Chloroacetophenone or 2-Chloroacetophenone	532-27-4	Riot Control Agent	Solid: Persistent Burning mixture: Nonpersistent	Not listed	(War Department, 1944, p. 164; War Department, 1945b, p. 92; Departments of the Army, Navy, and Air Force, 1990, pp. 53-54; Secretary of War, 1942b, p. 92)
CNB	Chloroacetophenone solution: 45% benzene + 10% chloroacetophenone + 45% carbon tetrachloride	--	Riot Control Agent	Persistent	Not listed	(Department of the Army, 1955, p. 50; Departments of the Army, Navy, and Air Force, 1990, p. 56; Secretary of War, 1942b, p. 93)
CNC	Chloroacetophenone solution: 70% chloroacetophenone + 30% chloroform	--	Riot Control Agent	Persistent	Not listed	(Department of the Army, 1955, p. 50; Departments of the Army, Navy, and Air Force, 1990, p. 55)
CNS	Chloroacetophenone solution: 38.4% chloropicrin + 23% chloroacetophenone + 38.4% chloroform	--	Respiratory Irritant	Persistent	3A04	(Department of the Army, 1955, p. 50; Departments of the Army, Navy, and Air Force, 1990, pp. 56-57; Secretary of War, 1942b, p. 93; OPCW, 1997)
CS	2-chlorobenzalmalononitrile or O-chlorobenzylidene malononitrile Compound	2698-41-1	Riot Control Agent	Persistent	Not Listed	(U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. F-1; Bureau of Naval Weapons, 1961, pp. 3-5)
CX	Phosgene oxime or Dichloroformoxime	1794-86-1	Blister Agent	Nonpersistent	Not Listed	(U.S. Army, Marine Corps, Navy, and Air Force, 2005)
DA	Diphenylchloroarsine or Clark I	712-48-1	Respiratory Irritant	Nonpersistent	Not listed	(Department of the Army, 1955, p. 51; War Department, 1945b, p. 95; Departments of the Army, Navy, and Air Force, 1990, pp. 62-63)
DM	Adamsite or diphenylaminechlorarsine 10-chloro-5,10-dihydrophenarsazine	578-94-9	Respiratory Irritant	Nonpersistent	Not listed	(Department of the Army, 1955, p. 50; War Department, 1945b, p. 94; Departments of the Army, Navy, and Air Force, 1990, pp. 65-66)

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Table 1: Symbols for U.S. Chemical Agents and Other Chemical Warfare Service Chemicals

U.S. Chemical Agent Symbol	Chemical Name/Common Name	CAS #	Classification	Persistent/ Nonpersistent	CWC Schedule	Citations
DP	Diphosgene or Trichlormethyl-chloroformate,	503-38-8	Choking Agent	Nonpersistent	Not listed	(War Department, 1944, pp. 164,170)
ED	Ethyldichloroarsine	598-14-1	Blister Agent	Persistent	Not Listed	(War Department, 1944, p. 164; War Department, 1945b, pp. 91, 127)
FM	Titanium tetrachloride	7550-45-0	Smoke	Not Applicable	Not listed	(War Department, 1944, p. 164; Brophy, Miles, & Cochrane, 1959, p. 215)
FS	Sulfur trioxide and chlorosulfonic acid	--	Smoke	Not Applicable	Not listed	(War Department, 1944, p. 164; Brophy, Miles, & Cochrane, 1959, p. 135)
GA	Tabun or Ethyl N,N-dimethylphosphoroamidocyanidate	77-81-6	Nerve Agent	Nonpersistent	1A02	(Department of the Army, 1955, p. 48; Departments of the Army, Navy, and Air Force, 1990, pp. 18-19; OPCW, 1997)
GB	Sarin or Isopropyl methylphosphonofluoridate	107-44-8	Nerve Agent	Nonpersistent	1A01	(Department of the Army, 1955, p. 48; Departments of the Army, Navy, and Air Force, 1990, pp. 19-20; OPCW, 1997)
H or HS*	Sulfur mustard or Levinstein mustard Dichloroethysulfide	505-60-2	Blister Agent	Persistent	1A04	(Prentiss, 1937, p. 150; War Department, 1944, p. 164; Brophy, Miles, & Cochrane, 1959, p. 463; Secretary of War, 1942b, p. 90; OPCW, 1997)
HC	Zinc oxide and hexachloroethane	1314-13-2 67-72-1	Smoke	Not Applicable	Not listed	(War Department, 1944, p. 164; Brophy, Miles, & Cochrane, 1959, p. 463)
HD	Distilled mustard, mustard gas, sulfur mustard, or Bis-(2-chloroethyl) sulfide	505-60-2	Blister Agent	Persistent	1A04	(Department of the Army, 1955, p. 47; Departments of the Army, Navy, and Air Force, 1990, pp. 31-32; OPCW, 1997)
HL	Mustard-lewisite mixture	378791-32-3	Blister Agent	Persistent	1A04	(Departments of the Army, Navy, and Air Force, 1990, pp. 40-41; OPCW, 1997; War Department, 1945a, p. 47)

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Table 1: Symbols for U.S. Chemical Agents and Other Chemical Warfare Service Chemicals

U.S. Chemical Agent Symbol	Chemical Name/Common Name	CAS #	Classification	Persistent/ Nonpersistent	CWC Schedule	Citations
HN-1	Nitrogen mustard (Ethyl S) or Bis-(2-chloroethyl)ethylamine	538-07-8	Blister Agent	Persistent	1A06	(Department of the Army, 1955, p. 47; Departments of the Army, Navy, and Air Force, 1990, pp. 32-34; OPCW, 1997)
HN-2	Nitrogen mustard (Methyl) or Bis-(2-chloroethyl)methylamine	51-75-2	Blister Agent	Persistent	1A06	(Departments of the Army, Navy, and Air Force, 1990, pp. 33-34; OPCW, 1997)
HN-3	Nitrogen mustard (Tri) or Tris(2-chloroethyl)amine	555-77-1	Blister Agent	Persistent	1A06	(Departments of the Army, Navy, and Air Force, 1990, pp. 35-36)
HQ	Mustard-sesquimustard (Q) mixture	505-60-2 3563-36-8	Blister Agent	Persistent	1A04	(Department of the Army, 1967, p. 77; OPCW, 1997, p. 51)
HT	Distilled mustard and T-mixture (60% bis(2-chloroethyl) sulfide (H); 40% bis(2-chloroethyl thioethyl) ether (T))	172672-28-5	Blister Agent	Persistent	1A04	(Department of the Army, 1955, p. 48; Departments of the Army, Navy, and Air Force, 1990, pp. 37-38; OPCW, 1997)
HV or HDV	Thickened mustard or thickened distilled mustard Bis-(2-chloroethyl) sulfide thickened with methyl methacrylate	--	Blister Agent	Persistent	1A04	(Stockhardt, 1945, p. 4; OPCW, 1997)
IM	Incendiary Oil isobutyl methacrylate	97-86-9	Incendiary	Not Applicable	Not listed	(Department of the Army, 1969, p. 48; Department of the Army, 1967, p. 19; Chemical Abstract Service, 2016)
KJ	Stannic chloride or tin tetrachloride	7646-78-8	Choking Agent	Semi-persistent	Not listed	(War Department, 1945a, p. 47; Prentiss, 1937, p. 7.; USACE, 2015, pp. 7-34, 7-35, D10)
L or M-1	Lewisite or dichloro-(2-chlorovinyl)arsine	541-25-3	Blister Agent	Persistent	1A05	(War Department, 1944, p. 164; War Department, 1945b, p. 91; Departments of the Army, Navy, and Air Force, 1990, pp. 38-40; OPCW, 1997; Prentiss, 1937, p. 6)
MD	Methyldichloroarsine	593-89-5	Blister Agent	Nonpersistent	Not listed	(U.S. Army, Marine Corps, Navy, and Air Force, 2005)
MD2	Methyldifluoroarsine	420-24-6	Blister Agent	Nonpersistent	Not listed	(Edgewood Arsenal, 1918)

Table 1: Symbols for U.S. Chemical Agents and Other Chemical Warfare Service Chemicals

U.S. Chemical Agent Symbol	Chemical Name/Common Name	CAS #	Classification	Persistent/ Nonpersistent	CWC Schedule	Citations
MR	Molasses residuum	Not Applicable	Simulant	Not Applicable	Not listed	(War Department, 1945a, p. 47; Secretary of War, 1942a, p. 22)
NC	Chloropicrin and stannic chloride	76-06-2 7646-78-8	Choking Agent	Semi-persistent	3A04	(General Headquarters, American Expeditionary Forces, 1919a, p. 19; War Department, 1945a, p. 47; OPCW, 1997)
NP	Napalm or thickened gasoline with napalm	8031-21-8	Incendiary	Not Applicable	Not listed	(War Department, 1945a, p. 47; Brophy, Miles, & Cochrane, 1959, p. 464)
PD	Phenyldichloroarsine (code may also designate phosgene plus diphenylchlorarsine, which is CWC Schedule 3A04)	696-28-6	Blister Agent	Persistent	Not listed	(War Department, 1944, p. 164; Department of the Army, 1955, p. 163; Departments of the Army, Navy, and Air Force, 1990, pp. 41-42)
PG	Chloropicrin and phosgene	76-06-2 75-44-5	Choking Agent	Semi-persistent	3A01	(General Headquarters, American Expeditionary Forces, 1919a, p. 19; Prentiss, 1937, p. 476; OPCW, 1997)
PS	Chloropicrin or trichloronitromethane	76-06-2	Choking Agent	Persistent	3A04	(War Department, 1944, p. 164; War Department, 1945b, p. 89; Departments of the Army, Navy, and Air Force, 1990, pp. 52, 61; OPCW, 1997)
PT or PT1	Oil and incendiary mixture or thickened fuel	--	Incendiary	Not Applicable	Not listed	(Department of the Army, 1955, p. 53; Departments of the Army and the Air Force, 1957, p. 98; Bureau of Naval Weapons, 1961, pp. 3-8)
PWP	Plasticized white phosphorus	--	Smoke	Not Applicable	Not listed	(Department of the Army, 1967, p. 21; Brophy, Miles, & Cochrane, 1959, p. 464)
Q	Sesquimustard or 1,2-Bis(2-chloroethylthio)ethane	3563-36-8	Blister Agent	Persistent	1A04	(U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. II-76, D-1; OPCW, 1997, p. 51)
SA	Arsine or Arsenic trihydride	7784-42-1	Blood Agent	Nonpersistent	Not listed	(War Department, 1943, p. 8; War Department, 1945b, pp. 5, 8)

Table 1: Symbols for U.S. Chemical Agents and Other Chemical Warfare Service Chemicals

U.S. Chemical Agent Symbol	Chemical Name/Common Name	CAS #	Classification	Persistent/ Nonpersistent	CWC Schedule	Citations
TH3 or Th.	Thermite	--	Incendiary	Not Applicable	Not listed	(War Department, 1944, p. 164; Departments of the Army and the Air Force, 1957, pp. 4, 90; USACE, 2015, pp. 7-33)
VX	O-ethyl S(2-diisopropylamino ethyl) methylphosphonothioate	50782-69-9	Nerve Agent	Persistent	1A03	(Department of the Army, 1969, p. 35; Departments of the Army, Navy, and Air Force, 1990, pp. 23-25; OPCW, 1997; Naval Ordnance Laboratory, 1963, pp. 3-2)
WP	White phosphorus	12185-10-3	Smoke	Not Applicable	Not listed	(War Department, 1944, p. 164; Brophy, Miles, & Cochrane, 1959, p. 466)

Notes:
* Prior to 1943 (War Department, 1943, pp. C-1; Prentiss, 1937, p. 6)
CWC – Chemical Weapons Convention

2.4 Classification

The classifications of the chemical agents and military chemical compounds in Table 1 are based on the mechanism of action (i.e., the route of penetration and the effect on the human body). Chemical agents and military chemical compounds are commonly divided into several categories: chemical warfare agents (e.g., choking agents, nerve agents, blood agents, blister agents (vesicants), incapacitating agents), riot control agents, respiratory irritants, smokes, and incendiaries. The relationships of the various classifications of the chemical agents and military chemical compounds are shown on Figure 1.

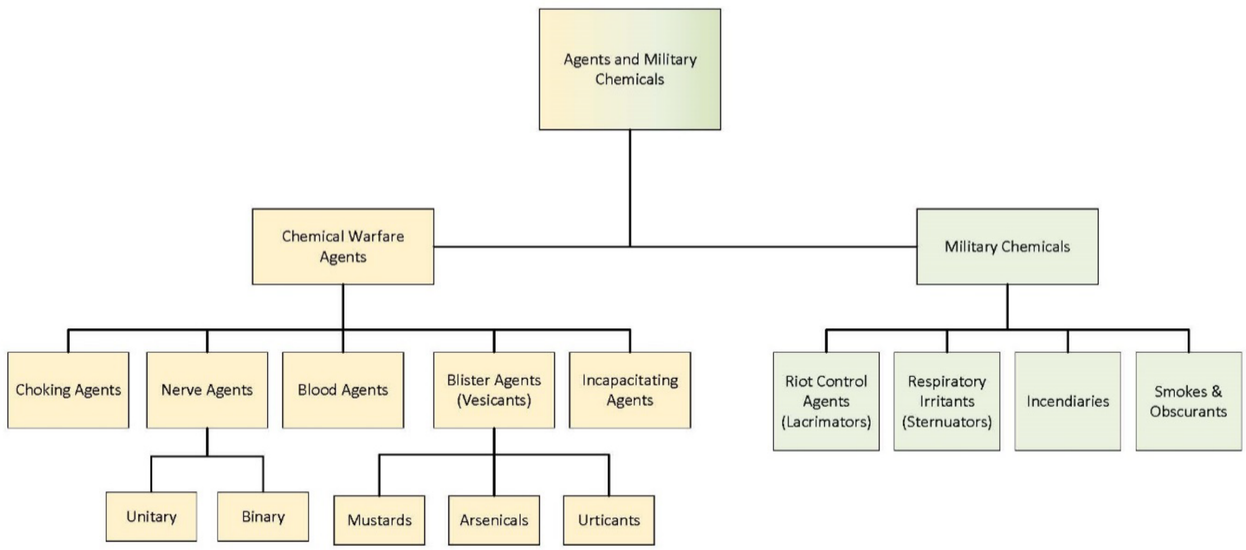

Figure 1: Chemical Warfare Agents and Military Chemicals

2.4.1 Chemical Warfare Agents

Choking Agents

Choking agents, also known as pulmonary agents and lung irritants, are those designed to interrupt normal breathing by causing fluids to build up in the lungs resulting in suffocation. Choking agents cause damage to the lungs, irritation to the eyes and the respiratory tract, and pulmonary edema (commonly known as dryland drowning) (Departments of the Army, Navy, and Air Force, 1990, p. 14; Department of the Army, 1969, p. 38; War Department, 1945b, pp. C-2). Choking agents are chemical agents that attack lung tissue, primarily causing pulmonary edema. They cause irritation to the bronchi, trachea, larynx, pharynx, and nose. Initial symptoms may include tears, dry throat, coughing, choking, tightness of chest, nausea, vomiting, and headache. In extreme cases, membranes swell, lungs become filled with liquid, and death results from lack of oxygen; thus, these agents "choke" an unprotected person. Fatalities of this type are called "dry-land drownings (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. II-9).

Nerve Agents

Nerve agents affect the transmission of nerve impulses in the nervous system; they are extremely toxic and have a rapid effect. Nerve agents can be vapor, aerosol, or liquid (Departments of the Army, Navy, and Air Force, 1990, p. 17; Department of the Army, 1969). In sufficient doses, nerve agents can lead to an inability of the body to sustain breathing (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. I-4). Nerve agents are more toxic than other chemical agents. They may cause effects within seconds and death within minutes. The nerve agents are all liquids, not nerve gas per se. They can be absorbed through any surface of the body and can penetrate ordinary clothing rapidly (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. II-13). Prior to 1945, nerve agents were grouped with blood agents and classified as systemic poisons (War Department, 1945b, pp. C-2). Nerve agents may be deployed in the field as a single compound (unitary agents) or may be designed to mix two nonlethal chemicals (binary agents) while in flight to a target to form chemical agent.

Blood Agents

Blood agents (e.g., cyanogenic agents) are distributed through the blood, generally enter the body via inhalation, and inhibit the ability of blood cells to utilize and transfer oxygen. Prior to 1945, blood agents were classified as systemic poisons (Departments of the Army, Navy, and Air Force, 1990, p. 25; Department of the Army, 1969, p. 38; War Department, 1945b, pp. C-2). Blood agents include hydrogen cyanide or hydrocyanic acid (AC or HCN), cyanogen chloride (CK), and arsine (SA). The cyanogen blood agents, AC and CK, affect the bodily functions by inactivating the cytochrome oxidase system. This poisoning prevents cell respiration and the normal transfer of oxygen from the blood to body tissues. Arsine causes hemolysis of the red blood cells. Cyanogen agents are highly volatile and, therefore, nonpersistent. Exposure at high concentrations causes effects within seconds and death within minutes in unprotected personnel (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. II-31).

Blister Agents

Blister agents, also known as vesicants, act via inhalation and contact with skin. Blister agents are noted for producing reddening and blistering of the skin. Eye exposure results in reddening of the eyes and temporary blindness or permanent effects. Inhaled mustard damages mucous membranes and the respiratory tract. Blister agents are used to produce casualties, to degrade fighting efficiency, and to restrict use of terrain and equipment. Blister agents are chemical agents that act on the eyes, mucous membranes, lungs, skin, and blood-forming organs. The most toxic route of exposure is inhalation/ocular.

The severity of a blister agent burn relates directly to the concentration of the agent, the duration of contact with the skin, and the location on the body. Most blister agents are insidious in action except for lewisite (L or M-1) and phosgene oxime (CX), which cause immediate pain on contact. The blister agents are divided into three groups: mustards, arsenicals, and urticants (Departments of the Army, Navy, and Air Force, 1990, p. 30; Department of the Army, 1969, p. 33; War Department, 1945b, pp. C-2; U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. I-5, II-37).

Mustard agents include the sulfur mustards (mustard [H or HS] and distilled mustard [HD]) and the nitrogen mustards (HN-1, HN-2, and HN-3). Because of their physical properties, mustards are persistent under cool conditions; however, evaporation increases as the temperature increases. It is possible to increase their persistency even more by dissolving them in thickeners (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. II-37).

Arsenical vesicants are organic dichloroarsines. They are respiratory tract irritants and produce lung injury on sufficient exposure. The vapors are irritating to the eyes and the liquid may produce serious eye lesions. Skin damage leading to vesication is produced by sufficient exposure to the vapor or by contact with the liquid. Absorption of vapor or liquid through the skin may lead to systemic intoxication or death (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. II-50).

Urticants are not true vesicants because, unlike mustard and L, they do not produce fluid-filled blisters; rather, they produce solid lesions resembling urticaria. Phosgene oxime is the primary urticant of military interest and has also been classified as a lung poison. It can penetrate garments and rubber much more quickly than other agents. It affects the skin, eyes, and lungs. No other chemical agent produces such an immediately painful onset that is followed by rapid tissue necrosis. The skin lesions, in particular, are similar to those caused by a strong acid. The rapid skin damage renders the skin more susceptible to a second type of agent. Droplets on the skin are potentially lethal (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. II-62).

Incapacitating or Harassing Agents

Incapacitating agents are chemicals that cause physiological or mental effects (or both) that lead to temporary disability. Unlike riot control agents with effects lasting only a few minutes, incapacitating agents produce effects that may last for hours or days after exposure to the agent has ceased (Departments of the Army, Navy, and Air Force, 1990, p. 47). Used in a military context, incapacitation is understood to mean inability to perform one's military mission. Since missions vary, for the purpose of this guide, incapacitation means the inability to perform any military task effectively and implies that the condition was achieved via the deliberate use of a nonlethal weapon.

Incapacitating agents differ from other chemical agents in that the lethal dose is theoretically many times greater than the incapacitating dose. Thus, they do not seriously endanger life except in cases exceeding many times the effective dose, and they produce no permanent injury. Virtually all drugs whose most prominent effects are psychological or behavioral can be classified into four discrete categories: deliriants, stimulants, depressants, and psychedelics. They interfere with the higher functions of the brain such as attention, orientation, perception, memory, motivation, conceptual thinking, planning, and judgment (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. II-64). Incapacitating agents were introduced as a separate category in 1967. Prior to 1967, they were described as "Irritant Agents" (SciTech Services Inc., 1998, pp. 1-11; U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. I-5).

2.4.2 Military Chemicals

Riot Control Agents

Riot control agents are chemicals that rapidly produce sensory irritation or disabling physical effects in humans, which disappear within a short time. Riot control agents can be divided into lachrymators (eye irritants), sternutators (cause sneezing and upper respiratory track irritation), and vomiting agents (Department of the Army, 1969, p. 40). Generally, riot control agents produce a rapid onset of effects (seconds to several minutes) and they have a relatively brief duration of effects (15 to 30 minutes) once the victim has escaped the contaminated atmosphere and has removed the contamination from clothing. Because tear compounds produce only transient casualties, they are widely used for training, riot control, and situations where long-term incapacitation is unacceptable. When used against poorly equipped forces, these compounds have proven extremely effective. When released indoors, they can cause serious illness or death (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. III-1). Prior to 1967, riot control agents were identified as "Harassing Agents", and prior to 1945 they were classified as irritants, specifically, lachrymators (Department of the Army, 1967; War Department, 1945b, pp. C-2; U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. I-5).

Respiratory Irritant Agents

Respiratory irritant agents were previously called vomiting agents; however, their primary action is irritation of the respiratory tract. The principal respiratory irritants are adamsite (DM), Clark I (DA), and chlorine (Cl). They were originally designed as "mask breakers" during World War I (WW) I. Their intended purpose was to penetrate the canister, forcing troops to remove their masks and be exposed to more toxic materials.

Two characteristics make these compounds different than riot control agents. The first characteristic is that the effects do not appear immediately on exposure or seconds afterwards, but several minutes later. In the absence of symptoms, personnel will not mask immediately; by the time they mask, a significant amount of the compound will have been absorbed. The effects may then cause an individual to unmask. The second characteristic of these compounds is that there may be more prolonged systemic effects—such as headache, mental depression, chills, nausea, abdominal cramps, vomiting, and diarrhea, which last for several hours after exposure. They are dispersed as aerosols, and they produce their effects by inhalation or by direct action on the eyes. When released indoors, they can cause serious illness or death. The protective mask gives adequate protection against field concentrations (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. III-7).

Smokes and Obscurants

Smokes and obscurants are combat multipliers. Their use provides tactical advantages for offensive and defensive operations. Smoke is an aerosol that owes its ability to conceal or obscure to its composition of many small particles suspended in the air. These particles scatter or absorb the light, thus reducing visibility. When the density or amount of smoke material between the observer and the object to be screened exceeds a certain minimum threshold value, the object cannot be seen.

Many types and combinations of smokes are used, but the three basic types of screening smokes are hexachloroethane (HC) smoke, phosphorous smoke, and fog oil smoke. White phosphorous (WP) and HC are hygroscopic; they absorb water vapor from the atmosphere. This increases their diameters and makes them more efficient at reflecting light rays. Fog oils are non-hygroscopic and depend upon vaporization techniques to produce extremely small diameter droplets to scatter light rays. Most smokes are not hazardous in concentrations that are useful for obscuring purposes. However, any smoke can be hazardous to health if the concentration is sufficient or if the exposure is long enough (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. III-16).

Incendiaries

Incendiaries cause maximum fire damage to flammable materials and objects and illuminate. The initial action of an incendiary munition may destroy these materials, or the spreading and continuing of fires started by the incendiary may destroy them (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. III-22).

2.5 Persistence

Persistent agents are able to cause casualties for more than 24 hours after use.

Nonpersistent agents dissipate or lose the ability to cause casualties after 15 minutes.

The terms “persistent” and “nonpersistent” describe the time chemical agents remain in an area and do not classify the agents technically (U.S. Army, Marine Corps, Navy, and Air Force, 2005, pp. I-4). Prior to, and during, WWI a chemical agent was classified as persistent if, when released, it remained able to cause casualties for more than 24 hours to several days or weeks. A semi-persistent agent could persist for more than an hour in the open. A chemical agent was classified as nonpersistent if when released it dissipated and lost its ability to cause casualties after 10 to 15 minutes in the open. After WWI, the semi-persistent category was dropped and agents were considered persistent if the effects lasted for more than 10 minutes in an open field and nonpersistent if the effects lasted for less than 10 minutes (Prentiss, 1937, pp. 116-117). After WWI, the system for marking munitions that contain chemical agents included one colored band for nonpersistent effect agents and two colored bands for persistent effect agents (Bureau of Naval Weapons, 1964, pp. 2-4). Currently, persistent agents are defined as those that, when released, remain able to cause casualties for more than 24 hours and a nonpersistent agent is one that dissipates or loses its ability to cause casualties after 15 minutes (Defense Technical Information Center, 2016).

2.6 Chemical Weapons Convention Schedule

The CWC established the Organisation for the Prohibition of Chemical Weapons (OPCW). The CWC prohibits the production and use of chemical agents and CWM. The CWC organizes certain toxic chemicals and precursors that have, or could play, a role in chemical weapons activity into three “schedules.” The Schedules of Chemicals are ordered to reflect an assessment of the risk posed to the object and purpose of the CWC, the elimination of chemical weapons. Scheduled chemicals, means specific chemicals listed, as well as families of chemicals and any other chemicals meeting the criteria included in the CWC (Bureau of Industry and Commerce, 2004, p. 6). For the purposes of the RCWM Program, only those compounds on the CWC Schedules of Chemicals are potentially considered chemical agents. Table 1 provides the CWC schedule, if applicable, for each chemical listed.

2.6.1 Schedule 1 Chemicals

The Schedule 1 chemicals pose the highest risk to the object and purpose of the CWC. They include nerve agents such as VX and blister agents such as mustard (H/HS). Schedule 1 also includes final stage precursors used in the manufacture of the Schedule 1 chemical agents (OPCW, 1997, pp. 51-52).

The following criteria were taken into account in considering whether a toxic chemical or precursor was included in Schedule 1:

1. It has been developed, produced, stockpiled, or used as a chemical weapon as defined in Article II of the CWC;
2. It poses a high risk to the object and purpose of the CWC by virtue of its high potential for use in activities prohibited under the CWC because one or more of the following conditions are met:
    a. It possesses a chemical structure closely related to that of other toxic chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties;
    b. It possesses such lethal or incapacitating toxicity as well as other properties that would enable it to be used as a chemical weapon;
    c. It may be used as a precursor in the final single technological stage of production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in munitions or elsewhere; and
3. It has little or no use for purposes not prohibited under the CWC.

2.6.2 Schedule 2 Chemicals

The Schedule 2 chemicals include toxic chemicals and precursors possessing properties that would enable them to be used in chemical weapons activities. Schedule 2 chemicals may be produced in large commercial quantities for purposes not prohibited under the CWC (OPCW, 1997, p. 53).

The following criteria were taken into account in considering whether a toxic chemical not listed in Schedule 1 or a precursor to a Schedule 1 chemical or to a chemical listed in Schedule 2, part A, was included in Schedule 2:

1. It poses a significant risk to the object and purpose of the CWC because it possesses such lethal or incapacitating toxicity as well as other properties that could enable it to be used as a chemical weapon;
2. It may be used as a precursor in one of the chemical reactions at the final stage of formation of a chemical listed in Schedule 1 or Schedule 2, part A;
3. It poses a significant risk to the object and purpose of the CWC by virtue of its importance in the production of a chemical listed in Schedule 1 or Schedule 2, part A; and
4. It is not produced in large commercial quantities for purposes not prohibited under the CWC.

2.6.3 Schedule 3 Chemicals

The Schedule 3 chemicals include first generation chemical weapons and other toxic chemicals and precursors that might enable them to be used in chemical weapons activities. The U.S. chemical industry produces Schedule 3 chemicals in large commercial quantities for purposes not prohibited under the CWC (OPCW, 1997, p. 54).

The following criteria were taken into account in considering whether a toxic chemical or precursor, not listed in other Schedules, was included in Schedule 3:

1. It has been produced, stockpiled, or used as a chemical weapon;
2. It poses an otherwise high risk to the object and purpose of the CWC because it possesses such lethal or incapacitating toxicity as well as other properties that might enable it to be used as a chemical weapon;
3. It poses a risk to the object and purpose of the CWC by virtue of its importance in the production of one or more chemicals listed in Schedule 1 or Schedule 2, part B; and
4. It may be produced in large commercial quantities for purposes not prohibited under the CWC.

3 Brief History of Chemical Agents in the United States

Following is a brief history of chemical agent introduction, production, and use in the United States, including chemical munitions and elimination from U.S. stockpile.

The United States' history relating to chemical warfare stretches to before WWI. Once chemical warfare was a battlefield reality, the United States developed several research and development facilities, chemical and filling plants, proving grounds, and chemical training areas, to protect our Military Forces on the battlefield and to ensure they had the capabilities needed to defeat our nation's adversaries. Today, the United States, a signatory to the CWC, is in the process of destroying the last of its chemical munitions stockpile. As such, the United States no longer maintains an offensive chemical warfare capability. The DoD has already remediated several former chemical facilities and training areas located in the United States and continues to do so today. Some of the major events relating to the involvement of the United States in chemical warfare are presented in Table 2.

Table 2: A Selected Timeline of the United States' Involvement

1915	Germany conducted the first successful use of lethal chemicals occurred on a battlefield in Europe; following this, the United States began researching chemical warfare.
1918	U.S. Army established the CWS to create, study, and train soldiers in chemical warfare.
1925	Geneva Protocol, signed by the United States (though not ratified by Senate) and 28 other countries, condemned the use of gas and bacteriological warfare.
1940-1945	The CWS produced approximately 146,000 tons of chemical agents at locations throughout the United States. Research and production of nerve agents began in 1945. Agents produced by the United States during WWII were not used in combat. President Roosevelt established a no first-use policy for chemical weapons.
1960s	Chemical warfare was seen as less than viable in the face of atomic weapons.
1969	President Nixon unilaterally renounced the first-use of lethal or incapacitating chemical weapons.
1972-1976	The United States destroyed a significant portion of its unitary chemical agent stockpile.
1990	The United States ceased binary chemical weapons programs.
1993	The United States and 180 other countries signed the CWC. The U.S. Explosive Destruction System, a mobile system for treating chemical munitions, entered service. First inventory of former U.S. CWM sites was published.
2006	All former U.S. chemical agent production facilities were destroyed.
2007	Revised inventory of former U.S. CWM sites was published.

3.1 Prior to World War I

International efforts to prevent the use of poisonous (toxic) chemicals in land warfare began in the 19th century. The first attempt at an international agreement limiting the use of such weapons was the 1874 International Declaration Concerning the Laws and Customs of War, which included in Article 13(a), a prohibition against poison or poisoned arms. The next attempt was The Hague Convention of 1899. In all, 27 nations, including Austria-Hungary, France, Germany, Great Britain, and Russia, eventually agreed to this provision. In the 20th century, Article 23 of the 1907 Hague Convention on Land Warfare explicitly prohibited the use of “poison or poisoned weapons” in warfare (RCWM Program, 2016).

3.2 World War I (1914-1918)

Despite these international efforts, WWI saw the first large-scale use of toxic chemical weapons in land warfare. French (August 1914) and German (October 1914) forces first used limited quantities of the riot control agents, ethyl bromoacetate and chloroacetone, against entrenched troops. The concentrations achieved in the field were reportedly so small that the use of chemicals went largely unnoticed.

After the use of chlorine gas at Ypres by Germany in 1915, the U.S. Army began studying chemical warfare. Initial research took place at the American University Experiment Station near Washington, District of Columbia (Brophy, Miles, & Cochrane, 1959, pp. 18, 76-77). Today this location is the Spring Valley Site and is being remediated under the Formerly Used Defense Sites Program, part of the larger Defense Environmental Restoration Program.

Determining that chemical warfare was a significant threat to U.S. forces and an offensive weapon that could not be discounted, the Army Ordnance Department assigned chemical defensive methods and chemical weapons production to the CWS. Established 28 June 1918, the CWS (Brophy, Miles, & Cochrane, 1959, p. 13) had seven main divisions:

1. Research- responsible for identification of chemical agents in Washington, D.C.;
2. Gas Defense- responsible for production of gas masks in Long Island City, New York;
3. Gas Offense- responsible for chemical agents and weapons production at Edgewood Arsenal, Maryland;

4. Development- responsible for charcoal production and pilot plant work on mustard agent production;
5. Proving Ground- which was co-located with Training at Lakehurst, New Jersey; and
6. Medical- responsible for the pharmacological aspects of chemical defense.

Nearly two years passed between the first-use of toxic gas at Ypres and the declaration of war by the United States. The United States faced major challenges in establishing large-scale production facilities for chemical agents, chemical-filled shells, and the machinery for filling the shells. In February 1917, the U.S. Bureau of Mines offered assistance to the War Department (predecessor to DoD). One area studied by U.S. Bureau of Mines involved development of large-scale methods for the manufacturing of chloropicrin (PS) and phosgene (CG). In 1917-1918, the CWS built large-scale production plants at Edgewood Arsenal, Maryland (later the Edgewood Area, Aberdeen Proving Ground) and at several contractor-owned facilities.

At Edgewood Arsenal, four plants produced chlorine, PS, H, and CG. There were also three shell-filling plants. The first filled 75-millimeter (mm), 155-mm, 4.7-inch, and Livens projectiles with CG. A second plant filled 155-mm projectiles with H and with PS. The third planned shell-filling plants was not completed before the end of the war.

Edgewood Arsenal produced more than 935 tons of CG, 711 tons of H, 1,163 tons of PS, and an unknown amount of Cl by 1918. Government contractors also produced Cl, PS, L, H, and PS plus CG (PG). Total U.S. toxic chemical agent production in WWI was about 2,500 tons Despite the production, during WWI, the United States did not employ any domestically produced chemical agents or weapons in combat. L was in transit to Europe on 11 November 1918 (the date the Armistice went into effect) and was disposed of in the Atlantic Ocean.

During the war, the Army used foreign-made offensive chemical weapons and delivery systems. American forces fired both British and French chemical rounds from 75-mm, 4.7-inch, 155-mm, and larger-caliber guns; most were French shells filled with CG and H, and British shells filled with H and L (RCWM Program, 2016).

3.3 Inter-War Years (1919-1939)

After 1919, all CWS Divisions except Headquarters moved to Edgewood Arsenal, which continued research and development, stockpiling of chemical agents and munitions, training, and testing. Chemical agents and munitions unused during WWI became the basis of the Army’s stockpile.

On July 1, 1920, the CWS became a permanent part of the Regular Army, and began to standardize chemical agents, defensive measures, and the means of delivery.

In 1928, the CWS selected seven chemical agents and smoke/obscurants for military use: H, methyldichloroarsine (MD), DM, chloroacetophenone (CN), titanium tetrachloride (FM), WP, and zinc oxide and HC. Of lesser importance were Cl, PS, L, and CG. In 1937, Edgewood Arsenal rehabilitated the H production line from WWI produced an additional 154 tons of H. Concurrently, the CWS upgraded the Edgewood Arsenal CG plant and standardized CG as a primary chemical agent.

During the 1920s and 1930s, the CWS stockpiled Livens projectors and cylinders as well as Stokes mortars. In addition, the Army manufactured chemical agent-filled shells for 75-mm, 105-mm, and 155-mm artillery pieces. In 1924, the United States standardized the design of the Livens Projector and the 4-inch Stokes chemical mortar. A weapons system includes the projectile and the delivery system used to fire them (RCWM Program, 2016).

Figure 2: Soldiers Deploying Livens Projectors

During the inter-war years, the Army's involvement with chemical agents and munitions was restricted to research, development, testing, evaluation, and training. In 1928, the United States introduced the model M1 4.2-inch Chemical Mortar. The M1 mortar projectiles could be filled with any one of several compounds including high explosive (HE) (trinitrotoluene [TNT]), a chemical agent (e.g., HD) and smoke/obscurant (e.g., WP) variants.

Having seen the importance of aviation during WWI, the CWS developed the M1 30-pound chemical bomb. This bomb, never used in combat, held about 10 pounds of chemical agent. In 1933, the CWS developed the M10 Spray Tank. This tank held 320 pounds of H, 470 pounds of L, or smoke/obscurants. Likewise, the use of mine warfare led to the standardization of the M1 Chemical Land Mine in 1933. This mine held nearly 10 pounds of H and used a detonating cord to burst the can and disseminate the agent (RCWM Program, 2016).

3.4 World War II (1939-1945)

Partly a response to the war in Europe, 1940 and 1941 saw a major expansion of CWS infrastructure in the United States. The CWS built new arsenals in Huntsville, Alabama; Pine Bluff, Arkansas; and Denver, Colorado, and established the Dugway Proving Ground in western Utah.

Between 1940 and 1945, the CWS produced approximately 146,000 tons of chemical agents at locations throughout the United States. The expansion of chemical agent stockpiles included a corresponding increase in the number of delivery systems. The U.S. Army began the war with 44 each 4.2-inch chemical mortars. Demands for these versatile mortars grew rapidly as dedicated chemical mortar battalions were incorporated into the standard Army divisional structure. Concurrently, there were needs for improvements in accuracy, durability, ease in manufacturing, and maximum range. The first redesigned mortar was the M1A1; the next generation was the M2 4.2-inch mortar. During the war, the CWS procured more than 8,000 M2 chemical mortars for chemical mortar battalions. Although the mortar could fire H-filled shells, and more than 450,000 H-filled shells were produced, none were used in combat by U.S. forces.

Field Artillery units had 75-mm, 105-mm, and 155-mm shells filled with H or L for the standard artillery cannon and howitzers of the time. For the Army Air Force, the CWS produced 100-pound H-filled bombs; 500-pound CG or CK bombs; 1,000-pound CG, CK, or AC bombs; and the M33 spray tank holding 750 to 1,120 pounds of H or L.

The CWS also developed detection capabilities: the M4 HS Vapor Detector Kit, the M5 liquid detector paint, the M6 liquid detector paper, and the M7 detector crayon. The M9 Chemical Agent Detector Kit was a milestone. Produced in 1943, the M9 kit had a sampling pump, four bottles of reagents, and six clips of detector tubes. It could detect arsenicals (e.g., L), H, and CG, using simple color-based tests.

Drawing on the experience of WWI and the efforts in the inter-war years to institute international agreements prohibiting use of chemical weapons, early in the war, President Roosevelt established a no-first-use policy for chemical weapons. The Axis nations wisely chose not to initiate wide-scale chemical warfare against the Allied powers. Thus, none of the U.S. chemical weapons were used on the battlefield during the war (RCWM Program, 2016).

3.5 Post-war Years (1946 - 1960)

The end of World War II in 1945 triggered a massive demobilization of the U.S. Armed Forces. By early 1946, the CWS was demobilized to pre-war levels. The Army did continue some Technical Services, including the CWS, as part of the post-war Regular Army. One recognition of the need for a chemical warfare organization with the Army was Public Law 607, enacted on 2 August 1946, changing the name of the CWS to the U.S. Army Chemical Corps.

In the post-war period, the Chemical Corps concentrated on maintaining the existing stockpiles from WWI and WWII, and on producing new chemical agents (e.g., the organophosphate nerve agent – sarin [GB]), decontamination equipment, delivery systems, and detection systems. One of the first tasks undertaken was to evaluate the capabilities of the German and Japanese chemical warfare programs.

In the aftermath of the war in Europe, the Allies found the vast stockpile of German chemical weapons, some 296,100 tons. In response, the Continental Committee on Dumping agreed that America, Britain, France, and the Soviet Union would destroy the German chemical weapons in any convenient manner. The limited choices of the day were expending significant resources to build facilities specifically designed to destroy CWM; burial on land; open burning of the chemical agents and munitions; or sea disposal. The environmental understanding of the day, coupled with the desire to keep the CWM from potential enemies and to go home after six long years of war that encompassed the world, resulted in selection of sea disposal as the most efficient and effective alternative (RCWM Program, 2016).

3.6 Chemical Warfare’s Decline as a Viable Military Option (1960-1980)

With the advent of atomic and thermonuclear weapons, the U.S. military began shifting emphasis away from chemical weapons.

Although the Army maintained the Chemical Corps, and continued development of both defensive and offensive measures, the aging stockpile of artillery shells, bulk containers, and rockets began to require demilitarization and disposal. The options for disposal remained limited. In the 1960s, under Project EAGLE, the Army developed incineration and neutralization systems, and, in the 1970s, destroyed 3,000 tons of H and 4,000 tons of GB at Rocky Mountain Arsenal, Colorado (RCWM Program, 2016).

3.7 End of United States Development of Chemical Warfare (1980-Present)

In the early 1980s, the Army developed binary chemical weapons to modernize the aging chemical weapons stockpile. Designed to mix two nonlethal chemicals while in flight to a target to form chemical agent, binary chemical weapons development helped move the Soviet Union into arms reduction negotiation and the signing of a bilateral agreement in 1990. This agreement led to the CWC, an international treaty signed by more than 180 countries that mandates the elimination of CWM and former chemical weapons production facilities.

In 1997, the U.S. Senate ratified the CWC, subject to a series of specific limitations. Complete details on the U.S. ratification, the implementing statutes and regulations, and the requirements for reporting and verification are available at the U.S. CWC Website.

From 1990 to 2000, when Johnston Atoll Chemical Agent Disposal System destruction operations ceased, the United States destroyed more than 400,000 chemical rockets, projectiles, bombs, ton containers, and mines containing GB, H, and VX. This represented about four percent of the U.S. chemical agent stockpile. The Johnston Atoll Chemical Agent Disposal System facility was closed and decommissioned permanently in 2003 (RCWM Program, 2016).

4 Basic Types of Munitions and Containers

Chemical agents were used in many munitions and containers.

a. Bombs (e.g., clusters)
b. Bomblets
c. Chemical Agent Identification Sets (CAIS)
d. Dispensers
e. Grenades
f. Mines
g. Miscellaneous types
    i. Bulk Containers
    ii. Cylinders
    iii. Drone Weapon Systems
    iv. Spray Tanks
h. Missiles
i. Mortars
j. Projectiles
k. Rockets

5 U.S. Marking System

The importance of color marking of ammunition to facilitate identification was recognized during WWI. Subsequently, the United States painted and marked munitions with visual aids for identification of the item and fill. Ammunition markings include a color code and stenciled or stamped markings, which provide information necessary for complete identification of the ammunition (e.g., model, fill) (Office of the Chief of Gas Service, 1918, p. M 1). The marking system for chemical munitions changed over time (Department of the Army, 1969, p. 4). U.S. markings during WWI are provided in Table 3. Table 4 shows the U.S. system of marking for chemical munitions from WWI through 1924, Table 5 covers 1925 through 1960, Table 6 covers 1960 to 1976, and Table 7, covers post 1976.

To identify a particular ammunition design, a model designation was assigned at the time it was classified as an adopted type. This model designation became an essential part of the nomenclature and is part of the marking of the item. Prior to WWI, the year in which the design was adopted (preceded by an M) was used as the model designation; for example, M1914 (because chemical weapons were not developed until WWI, this is not applicable to the munition but may apply to fuzes). From WWI to 1 July 1925, it was the practice to assign mark numbers; that is, the word “mark”, abbreviated “Mk,” which was followed by a Roman numeral. The first modification of a model was indicated by the addition of MI to the mark number, the second by MII, etc. However, the use of Roman numerals was discontinued, and all records began using Arabic numerals (Kaye, 1978, p. M 146).

The present system of model designation consists of the letter “M” followed by an Arabic numeral, for example, “M1.” Modifications are indicated by adding the letter “A” and the appropriate Arabic numeral. Thus, “M1A1” indicates the first modification of an item for which the original model designation was “M1” (Kaye, 1978, p. M 146). Wherever a “B” suffix appears in a model designation, it indicates an item of alternative or substitute design, material, or manufacture (Kaye, 1978, pp. M-18). To continue with the previous example, there is a 155-mm M105 shell and a modification designated M105B1. The M105 round had a flat base in the inner cavity M105B1 had a hemispherical base. Certain items standardized for use by both Army and Navy are designated by the letters “AN” preceding the model designation.

A munition with an “E,” “T,” or an “X” preceding the “M” or following the number designation indicates that the munition is in development or experimental (Kaye, 1978, pp. M146-147) (U.S. Army Combined Arms Support Command, 2011, pp. 3-4). When the experimental item has been modified, the letter (e.g., E, T, X) and the number of the modification are added to the end of the designation. For example, XM67E2 would indicate the second experimental modification of XM67 (U.S. Army Combined Arms Support Command, 2011, pp. 3-4).

Chemical munitions manufactured after WWI and before January 1961 follow the Five-Element Marking System (Bureau of Naval Weapons, 1964, pp. 2-4). Using this marking system, chemical munitions are identified by a background color of gray and were circumscribed with one or two bands to indicate the duration of effectiveness. One band circumscribed about the center of the munition indicated a nonpersistent effect agent; two bands indicated a persistent effect agent (Department of the Army, 1969, p. 4). Green markings on a gray background signified toxic chemical agents, red markings indicated irritant agents, purple indicated incendiaries, and yellow indicated smokes. A descriptive word such as gas, smoke, or incendiary indicated the general nature of the agent. A chemical agent symbol (e.g., GB, VX, HD) indicated the exact filling (Department of the Army, 1967, p. 21).

In 1972, the military standard was modified again and brought more changes in color-coding. “Toxic Chemical Agents” were coded with dark green bands and black markings instead of using green for everything. “Riot Control Agents” were re-identified as “Irritants,” and black was used for markings instead of red. White replaced light red for markings on smoke munitions containing WP and plasticized white phosphorus (PWP) (RCWM Program, 2016).

In 1976, another change to the military standard occurred (Table 7). It introduced several changes which simplified color-coding. All “Toxic Chemical Agents” were grouped together and color-coded as one type of fill, without regard to toxicity or persistency. Chemical symbols were used to provide the exact identification of a particular fill. “Riot Control Agents” (previously identified as “Irritant Agents”) and “Incapacitating Agents” received similar treatment. Only one colored band was used for each type of fill, whereas up to three colored bands had been used previously. This standard also applied to chemical munitions manufactured or renovated after 6 May 1976. Since the manufacture of unitary chemical agents and chemical munitions were terminated in 1968 this standard likely applies only to renovated munitions containing unitary chemical agents; however, the United States began production of binary chemical weapons in the 1980s and in 1990 the United States agreed to end its production and that these would be marked with the new standard (RCWM Program, 2016).

Table 3: U.S. Markings WWI

Type of Fill		Chemical	1st Band	2nd Band	3rd Band	Body	Stencil
GAS	Nonpersistent (toxic and lethal)	DA	White	None	None	Gray	SPECIAL GAS
		CG	White	White	None	Gray	SPECIAL GAS
		PD	White	White	White	Gray	SPECIAL GAS
	Semi-persistent (penetrative and suffocant)	PS	Red	White	None	Gray	SPECIAL GAS
		NC	Yellow	Red	White	Gray	SPECIAL GAS
		PG	White	Red	White	Gray	SPECIAL GAS
	Persistent (lachrymatory and vesicant)	BA	Red	None	None	Gray	SPECIAL GAS
		CA	Red	Red	None	Gray	SPECIAL GAS
		HS	Red	Red	Red	Gray	SPECIAL GAS
Smoke	Solid (WP)	WP	Yellow	None	None	Gray	SPECIAL SMOKE
	Liquid (FM)	FM	Yellow	Yellow	None	Gray	SPECIAL SMOKE
Incendiary (e.g., thermite)		Th.	Purple	None	None	Gray	SPECIAL INCEND

Notes:
BA - bromoacetone
CA - bromobenzyl cyanide
DA - Clark I
CG - phosgene
FM - titanium tetrachloride
HS - sulfur mustard
NC - chloropicrin and stannic chloride
PD - phosgene plus diphenylchlorarsine
PG - chloropicrin plus phosgene
PS - chloropicrin
Th - thermite
WP - white phosphorous
Citations:
(General Headquarters, American Expeditionary Forces, 1919a, p. Figure 3; General Headquarters, American Expeditionary Forces, 1919b, p. 21; Fries & West, 1921, p. 28; Prentiss, 1937, pp. 116-117, 126-127, Table IV)

Table 4: U.S. Markings World War I through 1924

Type of fill	1st Band	2nd Band	3rd Band	Body	Black Stencil
BA	Red	None	None	Slate Gray	SPECIAL-GAS/GAS
CA	Red	Red	None	Slate Gray	SPECIAL GAS
CG	White	White	None	Slate Gray	SPECIAL-GAS/GAS/C.G.
CL	None	None	None	Slate Gray	Chlorine
DA	White	None	None	Slate Gray	SPECIAL GAS / GAS
FM	Yellow	Yellow	None	Slate Gray	FM SMOKE/SPECIAL SMOKE
FS	Yellow	None	None	Slate Gray	FS SMOKE
HS	Red	Red	Red	Slate Gray	SPECIAL-GAS
KJ	None	None	None	Slate Gray	KJ
NC	White	Red	Yellow	Slate Gray	GAS
PD	White	White	White	Slate Gray	SPECIAL GAS / GAS
PG	White	Red	White	Slate Gray	SPECIAL-GAS
PS	White	Red	None	Slate Gray	SPECIAL GAS/P.S.
Thermite	Purple	None	None	Slate Gray	SPECIAL INCENDIARY THERMITE/Th.
VX	White	None	None	Slate Gray	SPECIAL-GAS
WP	Yellow	None	None	Slate Gray	SPECIAL-GAS/SMOKE/ SPECIAL – SMOKE/W.P.

Citations:
(General Headquarters, American Expeditionary Forces, 1919a, p. Fig 3; Prentiss, 1937, pp. 116-117, 126-127, Table IV)

Table 5: U.S. Markings 1925 through June 1960

Fill	1st Band	2nd Band	Body	Stencil	Citation
AC/HCN	Green	None	Gray	AC GAS or HCN Gas	(Prentiss, 1937; War Department, 1945b, p. 7; Department of the Army, 1955, p. 66)
AS	Green	Green	Gray	AS	(War Department, 1945b, p. 155)
BA	Green	Green	Gray	BA GAS	(Prentiss, 1937, p. Table IV; War Department, 1945b, p. 128)
CA/BBC	Red	Red	Gray	CA GAS	
CG	Green	None	Gray	Green marking CG GAS	(Prentiss, 1937; Secretary of War, 1942b, pp. 89, 111; War Department, 1945b, p. 111; Department of the Army, 1955, p. 66)
CK	Green	None	Gray	Green marking CK GAS	(War Department, 1945b, p. 5; Department of the Army, 1955, p. 66)
CL	Green	None	Gray	Green marking CL gas	(Prentiss, 1937; Secretary of War, 1942b, pp. 88, 92; War Department, 1945b, pp. 88, 105, 130)
CN	Red	None	Gray	CN GAS	
CNB	Red	None	Gray	CNB GAS	(Secretary of War, 1942b, p. 93; War Department, 1945b, p. 132)
CNC	Red	None	Gray	CNC GAS	(Department of the Army, 1955, p. 50)
CNS	Red	None	Gray	CNS GAS	(Secretary of War, 1942b, p. 93; War Department, 1945b, p. 131)
DA	Red	None	Gray	DA GAS	(Prentiss, 1937; War Department, 1945b, pp. 94-95, 136, 138)
DM	Red	None	Gray	DM GAS	
ED	Green	Green	Gray	ED Gas	(Prentiss, 1937; War Department, 1945b, pp. 91, 127, 144-145)
FM	Yellow	None	Gray	FM SMOKE	
FS	Yellow	None	Gray	FS SMOKE	
GB	Green	None	Gray	GB GAS	(Department of the Army, 1955, p. 66)
H/HS	Green	Green	Gray	H or HS GAS	(Prentiss, 1937; Secretary of War, 1942b, p. 90; Department of the Army, 1955, pp. 47, 66)

Table 5: U.S. Markings 1925 through June 1960

Fill	1st Band	2nd Band	Body	Stencil	Citation
HC	Yellow	None	Gray	HC SMOKE	(Prentiss, 1937; War Department, 1945b, p. 146)
HD	Green	Green	Gray	HD GAS	(Department of the Army, 1955, pp. 47, 66)
HS	Green	Green	Gray	HS gas	(Secretary of War, 1942b, p. 90; War Department, 1945b, pp. 90, 122)
HN1	Green	Green	Gray	HN GAS	(Department of the Army, 1955, p. 47)
HT	Green	Green	Gray	HT GAS	(Department of the Army, 1955, p. 48)
L or M-1	Green	Green	Gray	L GAS or M-1 gas	(Prentiss, 1937; Secretary of War, 1942b, pp. 91, 126; Department of the Army, 1955, p. 48)
MR	Green	Green	Gray	MR	(War Department, 1945b, p. 153)
NP	Purple	None	Gray	NP INCEND.	(Department of the Army, 1955, p. 66)
PD	Greed	Green	Gray	PD Gas	(War Department, 1945b, p. 7)
PS	Green	Green	Gray	PS GAS	(Prentiss, 1937; War Department, 1945b, pp. 89, 116)
SA	Green	None	Gray	SA GAS	(War Department, 1945b, p. 5)
TH	Purple	None	Gray	TH INCEND.	(Prentiss, 1937; Department of the Army, 1955, pp. 66, 149)
WP	Yellow	None	Gray	WP SMOKE	(Prentiss, 1937; War Department, 1945b, p. 149; Department of the Army, 1955, p. 66)
PT1	Purple	None	Gray	INCEND	(Department of the Army, 1955, p. 66)
PWP	Yellow	None	Gray	PWP Smoke	

Table 6: U.S. Markings after 27 June 1960 through 1976

Type of Fill		1st Band	2nd Band	3rd Band	Body	Stencil
Toxic Chemical Agents (Casualty)	Nonpersistent Agents (e.g., AC, CG, CK)	Green	None	None	Gray	"GAS," Chemical symbol
	Persistent Agents (e.g., H, HD, HT)	Green	Green	None	Gray	
	All Nerve Agents (e.g., GA, GB, VX)	Green	Green	Green	Gray	
Incapacitating Agents	Persistent Agents (e.g., BZ)	Red	Red	None	Gray	"GAS" Chemical symbol
Riot Control Agents	Nonpersistent Agents (e.g., CN, CNB, CS, DM)	Red	None	None	Gray	"Riot," Chemical symbol
Incendiaries (e.g., TH)		None	None	None	Light red	"Incendiary" Brevity Code
Smokes	All except WP and PWP (e.g., FM, FS)	None	None	None	Light green	"Smoke" Brevity Code
	WP and PWP	None	None	None	Light green	"Smoke" "WP" or "PWP"
Explosive Components	High Explosive	Yellow, this in an additional marking band on chemical munitions				
	Low Explosive	Brown, this in an additional marking band on chemical munitions				
Citations: (Department of the Army, 1967, pp. 21-28; Bureau of Naval Weapons, 1964, pp. 2-4)						

Table 7: U.S. Markings 1976 and Later

Fill	1st Band	Body	Stencil	Citation
Toxic Chemical Agents	Dark Green	Gray	Dark Green	(Departments of the Army, Navy, and Air Force, 1976, pp. 9-12; Department of Defense, 2009, pp. 23-24)
Incapacitating	Violet	Gray	Violet	
Riot Control	Dark Red	Gray	Dark Red	
Binary Nerve Agent	Broken Dark Green	Gray	Dark Green	
Smoke (WP)	None	Light Green	Light Red	
Smoke (other than WP)	None	Light Green	Black	
High Explosive	Yellow band is applied when a HE burster is present.			
Low Explosive	Brown band is applied when a low explosive is present.			

6 Bomb

A bomb is a type of ammunition designed to be dropped from an aircraft in flight. It usually consists of a metal container filled with explosives or chemicals, a device for stabilizing its flight so that it can be aimed accurately, a mechanism for exploding the bomb at the target, and such safety devices as may be necessary to make it reasonably safe to carry. The metal container, called the bomb body is usually streamlined with a rounded (ogival) nose and a tapered tail. The stabilizing device is attached to the tail end of the body prior to development and generally consists of a sheet metal fin assembly. The mechanism for exploding the charge is called a fuze and is generally placed in the nose or in the tail end of the body. Two or more fuzes are occasionally used in the same bomb for different effects: for flexibility in use or to increase functioning reliability. Safety devices are provided in the fuze and are protected by sealing wires, cotter pins, etc. An arming wire is substituted for the sealing wire and/or cotter pin when the bomb is readied for use.

6.1 Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X

Figures

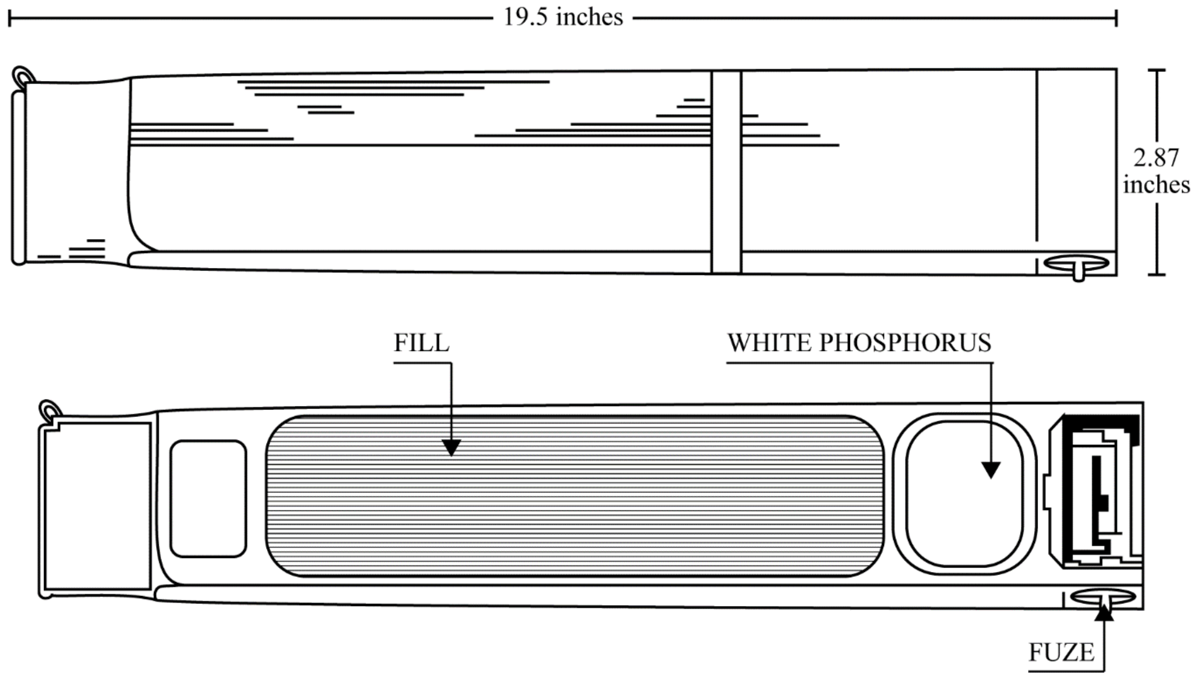

Figure 3: Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X - Line Drawing

Figure 4: Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X - Photograph

Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X

Specifications

Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X - Specifications and Other Data		**Citation**
Historical Name	6-Pound Chemical Bomb, E1 (M69)	1 (p. x)
Type	Bomb	1 (p. 1), 2 (p. 29), 3 (p. 11)
Size	6-pound	1 (p. 1), 4 (p. 36)
Conflict	Post WWII	4 (p. 36-37)
Service	Army, Navy	4 (p. 36-37), 5 (p. 13-14)
Diameter	2.87 inches (7.21 centimeters [cm])	1 (p. 2), 2 (p. 11)
Length	19.5 inches (49.53 cm)	1 (p. 2), 2 (p. 11), 5 (p. 13-14)
Other Engineering Data	The 6-pound chemical bomb E1 was standardized as the M69 after the first series of tests. The M69 was used in the M19 cluster.	1 (p. 1), 3 (p. 31)
Body Construction Material	The body is cold rolled steel with a thickness of 0.042-inches.	2 (p. 11), 4 (p. 37)
Propellant	70 grams EC smokeless propellant powder	1 (p. 2), 2 (p. 31)
Spec/PD No	MIL-B-11643 (AN-M69)	5 (p. 13)
B/M Dwg	C14-5-229 (ANM69)	5 (p. 13)
Federal Stock Number (FSN)	1325-142-0653 (AN-M69)	5 (p. 13)

General Use and Description

The E1, later designated M69, was developed to establish new methods of disseminating chemical agents. The M69 incendiary was initially developed as the Bomb, Incendiary, Oil, 6-1b. [pound], M56 but another item (a large demolition bomb) was also designated M56 and to avoid confusion the M56 was redesignated Bomb, Incendiary, Oil, 6-lb., M69 (1 p. 18), (6).

The bomb body was a hexagonal case with a nose cup welded to the forward end. The nose cup, fuze and powder charges were sealed off from the rest of the case by an impact diaphragm.

During development, both a 5-pound chemical bomb E1, and a 6-pound chemical bomb E1 were tested. The diaphragm on the 5-pound E1 was 0.025 inches thick. The diaphragm on the 6-pound E1 was 0.008 inches thick.

The body is of a rounded hexagonal shape with the fuze in the side near the blunt end. The tail consists of gauze streamers about 4.5-inches in length (1 p. 1), (4 p. 37).

Explosive Train

The spring-loaded safety plunger ejected from of the fuze upon release from the cluster, arming the fuze. On impact, the striker overcame its spring and detonated the primer cap, which ignited a lead-coated spitter fuse. The spitter fuse burned from three to five seconds and ignited the booster charge, which in turn ignited the ejector charge. The combustion blew off the tail cup and ejected the filler. The M69 differs from the AN-M69X chiefly in that it does not carry an explosive charge. Fragments of the M69X filler burn from 8 to 20 minutes after ejection from the bomb case (1), (2 p. 11-12), (7 p. 719-720).

Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X

Fuzing

Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X - Fuzing		
Fuze	**Note**	**Citation**
M1	Inertia type impact bomb	2 (p. 57), 4 (p. 37), 5 (p. 13)
M2	Inertia type impact bomb	4 (p. 37), 5 (p. 14)
Modified E1 charge	Inertia type impact bomb fuze booster with 0.5-gram EC propellant powder	1 (p. 2)

Booster, Adapter-Booster, or Burster

Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	0.003 pounds	Black powder/EC (smokeless powder)	Booster charge. Weight range 1 gram/0.5 grams.	1 (p. 4-5)

Fills

Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
HS	3.31-4.25	1.50-1.92	Information Not Available (N/A)	N/A	-	1 (p. 2, 3)
IM (incendiary oil	2.60	1.18	7.20	3.27	M69X	7 (p. 719-720)
MR (molasses residuum)	5.00	2.26	N/A	N/A	-	1 (p. 3)
NP (napalm)	2.00-2.10	0.91-0.95	5.50-6.10	2.50-2.77	AN-M69, AN-M69A1 and AN-M69X.	2 (p. 30), 5 (p. 13-14), 7 (p. 720-721)

Shipping/Packing

This bomb was normally packed in M19 clusters. There were 14 AN-M69 bombs per M12 100-pound cluster and 38 AN-M69 and AN-M69A1 bombs per M19 500-pound cluster (2 p. 31), (5 p. 13-14).

Key Dates

Bomb, 6-pound, M69 (E1), AN-M69, AN-M69A1, M69X - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1942	Chemical Corps Technical Committee (CCTC) 529 (M56 [AN-M69] Incendiary)	8
Standardized	1945	CCTC 1268, 1306 (M69X Incendiary)	9, 10
Classified	1952	CCTC 2479 (AN-M69A1, Incendiary - Standard)	10

Sources

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6.2 Bomb, 10-pound, E49

Figures

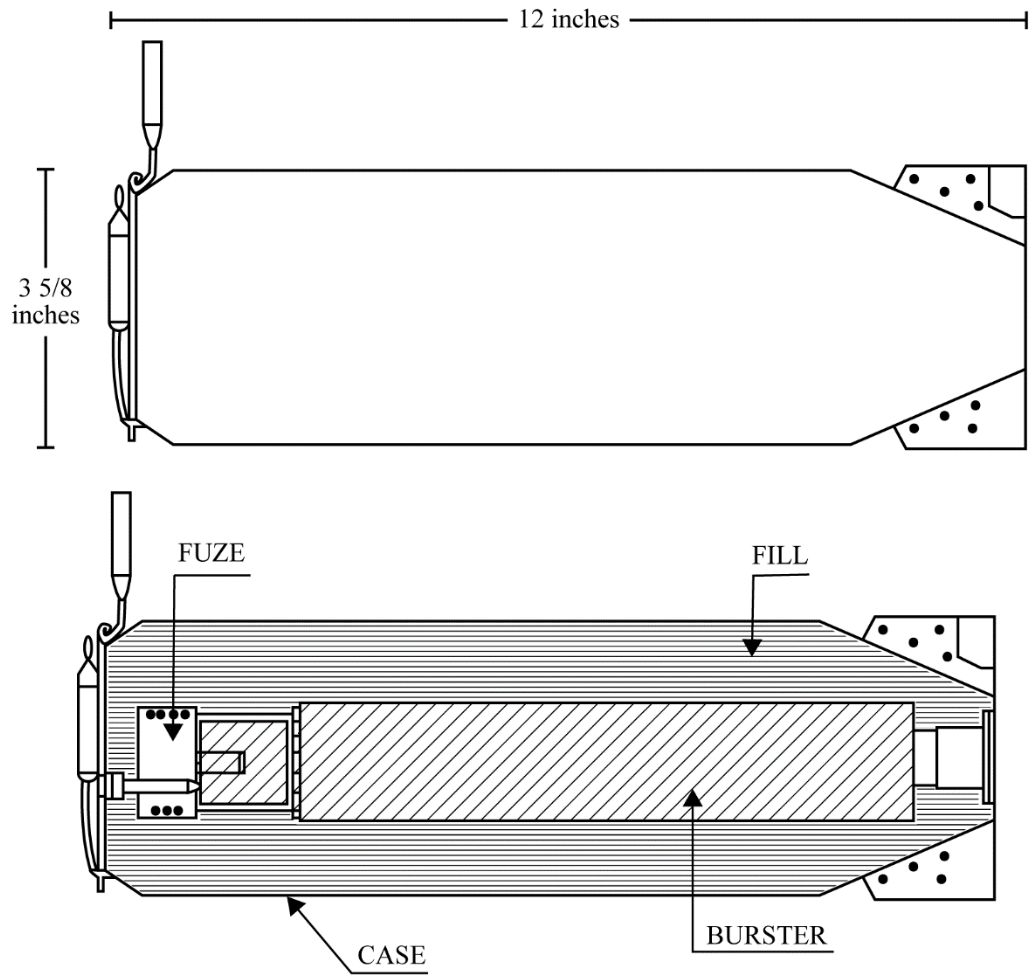

Figure 5: Bomb, 10-pound, E49 - Line Drawing

Specifications

Bomb, 10-pound, E49 - Specifications and Other Data		Citation
Historical Name	E49, 10-Pound, Chemical Gas, Persistent	1 (p. 39, Appendix A)
Type	Bomb	2, 3 (p. 15), 4 (p. 15)
Size	10-pound	1 (p. 39, Appendix A), 2, 3 (p. 15)
Conflict	Post WWII	1 (p. 39, Appendix A)
Service	Air Force	2
Diameter	3.625 inches (9.21 cm)	5 (p. i)
Length	12 inches (30.48 cm)	5 (p. i)
Other Engineering Data	The E49 was used in the E100 1,000-pound cluster.	1 (p. 39, Appendix A)
B/M Dwg	314-5-3067	-

Bomb, 10-pound, E49

General Use and Description

The E49 was designed as a small clusterable bomb for the employment of persistent chemical agents. The design was intended to overcome issues identified with the E5 series, EK-series and E29 bombs (5 p. i).

The E49 10-pound bomb was referred to as the "Child Bomb", so named because the bomb was small and the components could be grouped together to form a cluster. Each 10-pound bomb could be grouped with other bombs to form a large cluster bomb. Child bombs were named solely for the size of the bomb, not for its intended purpose. The E49 was a stabilized small tail ejection type bomb for persistent agents with overall dimensions suitable for efficient stowage in 1,000-pound clusters. The bomb weighed approximately 10 pounds when filled with mustard (1 p. 39, Appendix A), (5 p. i).

Explosive Train

Early design envisioned an impact type fuze with adequate safety features to prevent instantaneous arming of the bombs after released from the cluster. The fuze T729E1 was recommended for consideration (5 p. 13).

Fuzing

Available references did not include information regarding fuzes for this item.

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Bomb, 10-pound, E49 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
HS	3.20	1.45	10.0	4.53	-	1 (p. 39-40, Appendix A)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The E49R1 was designed for use in the E100 1,000-pound cluster bomb. There were 76 E49R1 bombs arranged in four banks of 19 bombs in each cluster (1 p. 39-40, Appendix A), (5 p. 13).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

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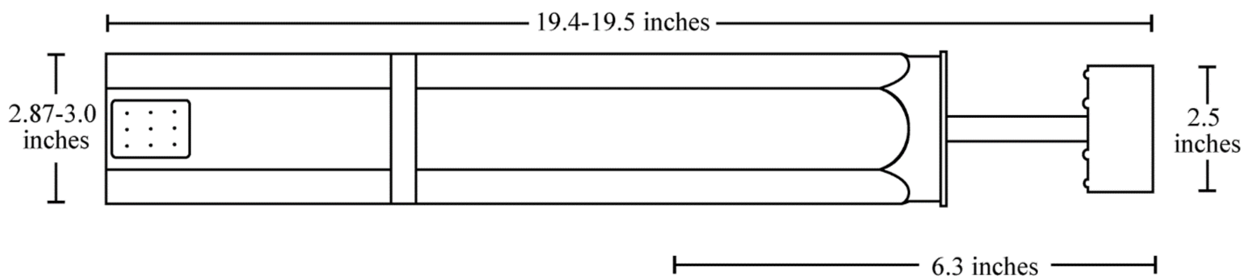
6.3 Bomb, 10-pound, M74 (E5), M74A1

Figures



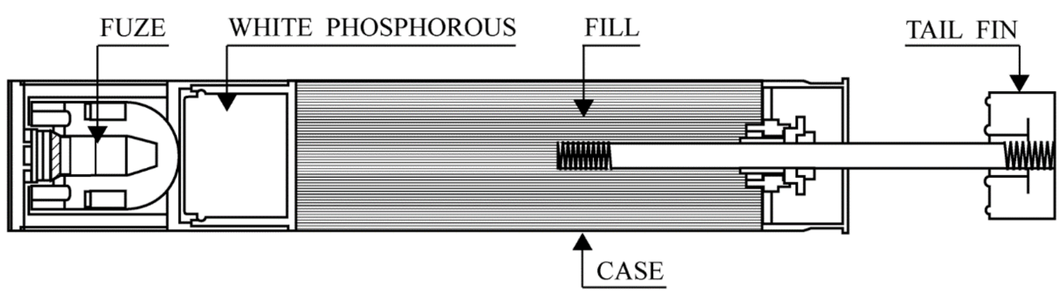


Figure 6: Bomb, 10-pound, M74 (E5), M74A1 - Line Drawing

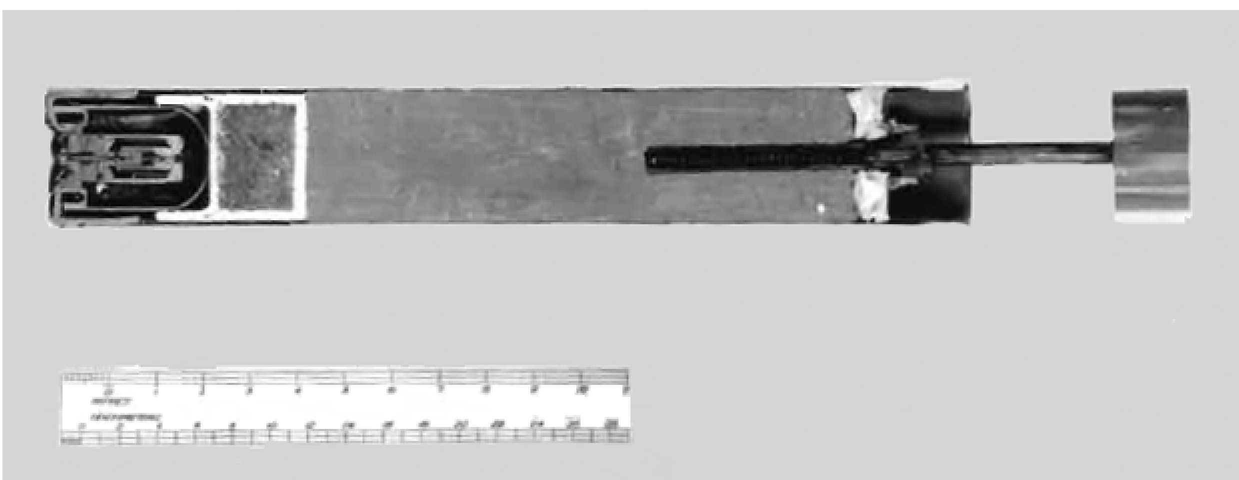


Figure 7: Bomb, 10-pound, M74 (E5), M74A1 - Photograph - Cross Section

Bomb, 10-pound, M74 (E5), M74A1

Specifications

Bomb, 10-pound, M74 (E5), M74A1 - Specifications and Other Data		Citation
Historical Name	Bomb, Chemical, 10-LB., E5	1 (p. cover)
Type	Bomb	2 (p. 416), 3 (p. 4-16)
Size	10-pound	3 (p. 4-16)
Conflict	Cold War, WWII	3 (p. 4-16), 4 (p. 1)
Service	Air Force, Navy	2 (p. 416), 3 (p. 4-16)
Diameter	Body: 2.87-3.0 inches (7.29-7.62 cm) across flats	3 (p. 4-16), 5 (p. 416)
Length	Body: 19.4-19.5 inches (49.28-49.53 cm) Tail: 6.3 inches (16 cm)	2 (p. 416), 3 (p. 4-16), 6 (p. 2-39)
Width	Tail: 2.5 inches (6.35 cm)	2 (p. 417), 6 (p. 2-39)
Other Engineering Data	During development, the bombs were designated as the E5 series. The H-filled bomb was developed as the E5R8. The M74 was used with cluster E29 and adapter E6R2, clusters E48 and E61 with adapter M23. The E61 cluster could hold 38 bombs totaling 750 pounds.	1 (p. 1), 2 (p. 417)
Body Construction Material	Sheet steel	2 (p. 416)

General Use and Description

The M74 (E5) was designed to provide a chemical offensive capability (3 p. 4-16).

It was a 10-pound tail ejection type incendiary bomb of the same size and shape as the AN-M69 six-pound oil incendiary. The bomb was hexagonal in shape. It had a telescope type tail that was ejected under spring pressure when the bomb was released from the cluster. The M3 all-ways acting fuze screwed into the nose along the long axis of the bomb. A sheet steel, leak proof casing extended the entire length of the bomb. A nose cup fit into the front of the casing. It had a dome that housed the fuze.

In bombs filled with oil and incendiary mixture (PT or PT1) or NP, a small chemical container, located immediately behind the dome, was filled with WP to aid in ignition and produce smoke. The PT1 or NP was enclosed in a cheesecloth sack. In bombs filled with WP, the filling was enclosed in impregnated paper tubes inside the casing.

A tail cup fit inside the rear end of the casing. A threaded hub inside this cup retained a well extending five inches into the body of the bomb. This well held the tail sleeve of the fin when the tail was compressed for clustering (3 p. 4-16), (5 p. 416), (7 p. 1).

Explosive Train

When the bombs were released, the arming pin was forced out by its spring, permitting the safety pin to enter the cavity in the striker. Impact forced the striker and sleeve together, which would pierce the percussion primer that would initiate the delay charge (magnesium black powder) and, subsequently, the fuze powder in the booster cup. A small chemical container, located immediately behind the dome of the nose cup, was filled with WP to aid ignition of the incendiary composition, and produce smoke (2 p. 417), (3 p. 4-16), (5 p. 416), (6 p. 2-40).

Bomb, 10-pound, M74 (E5), M74A1

Fuzing

Bomb, 10-pound, M74 (E5), M74A1 - Fuzing		
Fuze	**Note**	**Citation**
M142	All-ways acting	2 (p. 416), 7 (p. 2)
M142A1	Screwed into the nose cup	2 (p. 416), 6 (p. 2-39), 7 (p. 1)
M197	Used with M74A1	3 (p. 4-17), 6 (p. 2-39)
M3	-	2 (p. 416)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Bomb, 10-pound, M74 (E5), M74A1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
H	N/A	N/A	N/A	N/A	H was used in development of the E5R8.	1 (p. 11, 27), 2 (p. 417)
HT (distilled H and T-mixture)	N/A	N/A	N/A	N/A	Experimental	1 (p. 25)
L	N/A	N/A	N/A	N/A	Experimental	1 (p. 25)
NP	1.80	0.81	7.50	3.40	-	2 (p. 416), 4 (p. 22), 8 (p. 716-719)
PT	2.75	1.24	8.50	3.85	Filled as PT-1 with a 6-ounce WP ignition charge.	2 (p. 416), 3 (p. 4-17), 6 (p. 2-39)
WP	N/A	N/A	N/A	N/A	The E5 bomb with a WP filling was rejected.	1 (p. 27), 2 (p. 417)

Shipping/Packing

The bombs were normally assembled in clusters and the clusters were packed in suitable containers (8 p. 719).

Miscellaneous Information

The M74A1 was identical to the M74, except M74A1 had an M197 fuze instead of the M142A1, and was used with the M35 cluster rather than the M31 cluster.

The M74 was used with cluster E29 and adapter E6R2, clusters E48 and E61 with adapter M23. The bomb was designed to be carried in the cluster E61, which would hold 38 bombs totaling 750 pounds (1 p. 1), (2 p. 416), (3 p. 4-17), (6 p. 2-40).

Bomb, 10-pound, M74 (E5), M74A1

Key Dates

Bomb, 10-pound, M74 (E5), M74A1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Procured	1943	CCTC 740 E5 Limited Procurement	9 (p. 26)
Standardized	1944	CCTC 1157 M74 PT1 standard and NP-fill substitute standard	10 (p. 1)
Obsoleted	1948	CCTC 1866 M74 Specification for IM or NP fill Cancelled	11
Cancelled	1948	CCTC 1830 Cancellation of Classification of Bomb, Chemical, E5 as Limited Procurement Type	9 (p. 28)
Standardized	1958	CCTC 3408 M74A1 (PT1-filled – Standard – Air Force and M74 PT1-filled – Limited Standard – Air Force)	12 (p. 106)

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6.4 Bomb, 10-pound, Ejection Airburst, EK-3 (EK-1)

Figures

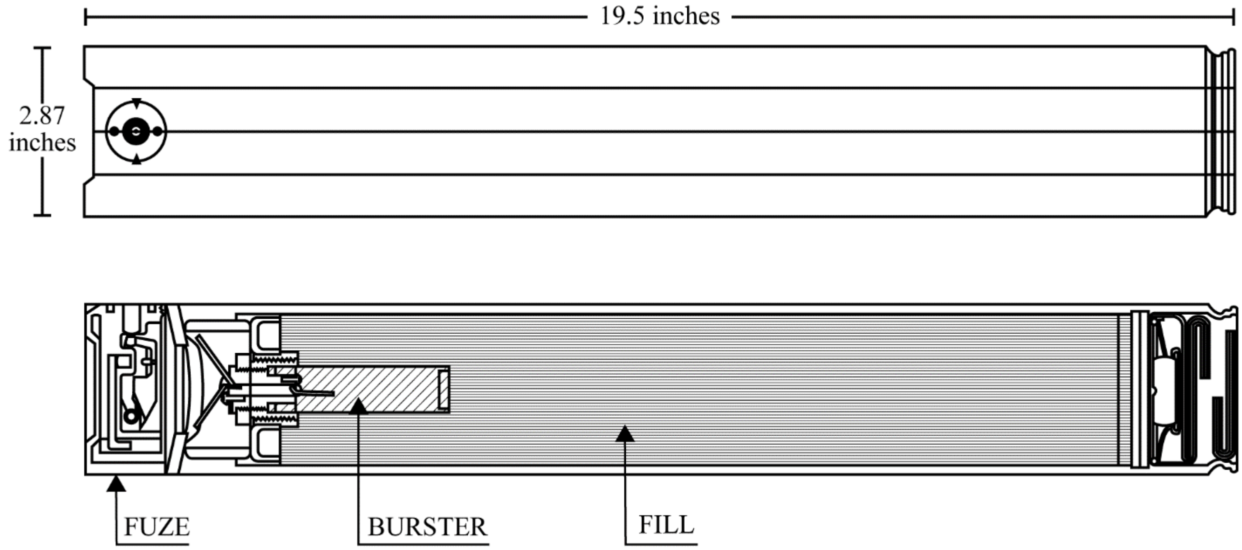

Figure 8: Bomb, 10-pound, Ejection Airburst, EK-3 (EK-1) - Line Drawing

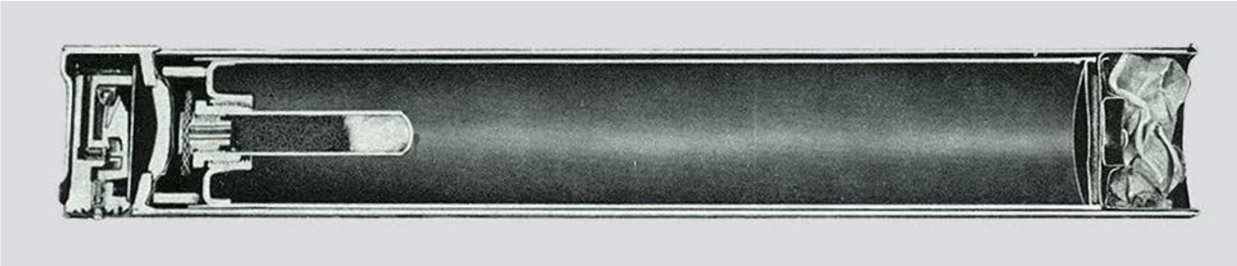

Figure 9: Bomb, 10-pound, Ejection Airburst, EK-3 (EK-1) - Photograph - Cross Section of EK-1 Bomb

Specifications

Bomb, 10-pound, Ejection Airburst, EK-3 (EK-1) - Specifications and Other Data		Citation
Historical Name	Vesicant Spray Bomb, EK-3 (EK-1)	1
Type	Bomb	2 (p. 1), 3 (p. 8)
Size	10-pound	1
Conflict	Post WWII	1
Diameter	2.87 inches (7.28 cm)	1, 4
Length	Outer case: 19.5 inches (49.53 cm)	1, 4
Other Engineering Data	During development, the EK-3 was known as the EK-1, which was a modified M69 bomb. The EK-3 was designed for use with the M4 or E22R2 adapter.	1
Body Construction Material	Sheet steel	1
Propellant	The propellant was A-4 black powder packed 10.5 grams in a nitrocellulose container. Two containers were used in each bomb.	1, 4 (p. 2)

Bomb, 10-pound, Ejection Airburst, EK-3 (EK-1)

General Use and Description

This bomb was designed to meet the needs for a base ejection airburst bomb for the dispersal of liquid agents (1), (2).

The bomb was developed from a modified hexagonal M69 bomb case to give improved dispersion of H by adding an inner canister, which was ejected upon impact, and burst at a height of 100 to 250 feet.

The modified M69 bombs were designated EK-1. The delay fuze used in the EK-1 bomb consisted of a holder and a short length of safety fuze, held in place by means of two screws and half-washers. A piece of Navy No. 1 quick match was fastened to both ends of the fuze, and the ends were covered with a mixture of collodion and Type II fuze powder.

The design of the EK-1 bomb was modified to increase the strength of the inner case and to facilitate its commercial manufacture. This model was designated EK-3.

A stamped nose plate replaced the flat nose plate so the assembly could be copper brazed. The tail cup was soft soldered in place, so that tail ejection of the agent would occur.

A compressed black powder train was initially used as a fuze for the EK-3 but later, a short length of lead covered spitter fuze was substituted for the loose powder and was pressed into the holder. The ends of the powder train were exposed and one end was coated with a booster mixture.

It was apparent from impact tests that the EK-1 and EK-3 were not suitable due to the inner case deformation upon impact. Subsequently, a round bomb was decided upon (1), (3 p. iii), (4 p. 1, 2).

Explosive Train

Upon impact, the inner case would be ejected to a height of 100-250 feet where the delay fuze would initiate the burster charge and would disseminate the chemical filler (1), (2).

Fuzing

Bomb, 10-pound, Ejection Airburst, EK-3 (EK-1) - Fuzing		
Fuze	**Note**	**Citation**
M1	-	4 (p. 2)
Not designated	Inner case -delay	1
Not designated	Outer case -impact	1, 2

Booster, Adapter-Booster, or Burster

Bomb, 10-pound, Ejection Airburst, EK-3 (EK-1) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	0.02 pounds	Smokeless ball powder Type II black powder	Smokeless ball powder (8.5 grams), plus either Type II black powder (0.5 grams) or of Navy No.1 quick match (2 inches)	1

Fills

Bomb, 10-pound, Ejection Airburst, EK-3 (EK-1) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
H	3.18	1.44	N/A	N/A	Filler was dyed with 0.5% Oil Red dye.	2 (p. I), 3 (p. 8), 4 (p. 2)
HD	3.37	1.52	8.85	4.01	Weight is for EK-1.	1, 2
HV/HDV (thickened distilled mustard)	3.18	1.44	N/A	N/A	Filler was dyed with 0.5% Oil Red dye.	1, 4 (p. 2)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The EK-3 was used with quick opening cluster (M4-adapter-14 bombs) or 500-pound aimable cluster (E22R2 adapter- 38 bombs) (2 p. 1).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Kallal, R.J., & Davis, R.W., & Johnstone, H.F. 1945. Office of Scientific Research and Development, OSRD No. 6300, Development of a Small Base Ejection Air-Burst Bomb for Dispersing Liquid Agents. Office of Scientific Research and Development.
2. The Technical Staff 9769 (TSU) CWS Mobile Unit. 1946. Mobile Unit Memorandum Report, MR #5, The Tactical Usefulness of the EK3 and EK4 Bombs. Filled HD and HDV, as Compared with Ground Functioning Munitions, Namely the E5 and M47A2 Bombs. Chemical Warfare Service.
3. Berlin, A.S., & Kline, S.Q. 1948. Technical Command Report, TCR 12, Preliminary Investigation of 10-lb. Bomb for Persistent Agents. Technical Command.
4. Stockhardt, Jay S., Captain. 1945. Technical Command Informal Report, TCIR 302, Vesicant Spray Bomb, EK-3 Filling and Clustering. Chemical Warfare Service.

6.5 Bomb, 10-pound, Ejection Airburst, EK-4 (EK-2)

Figures

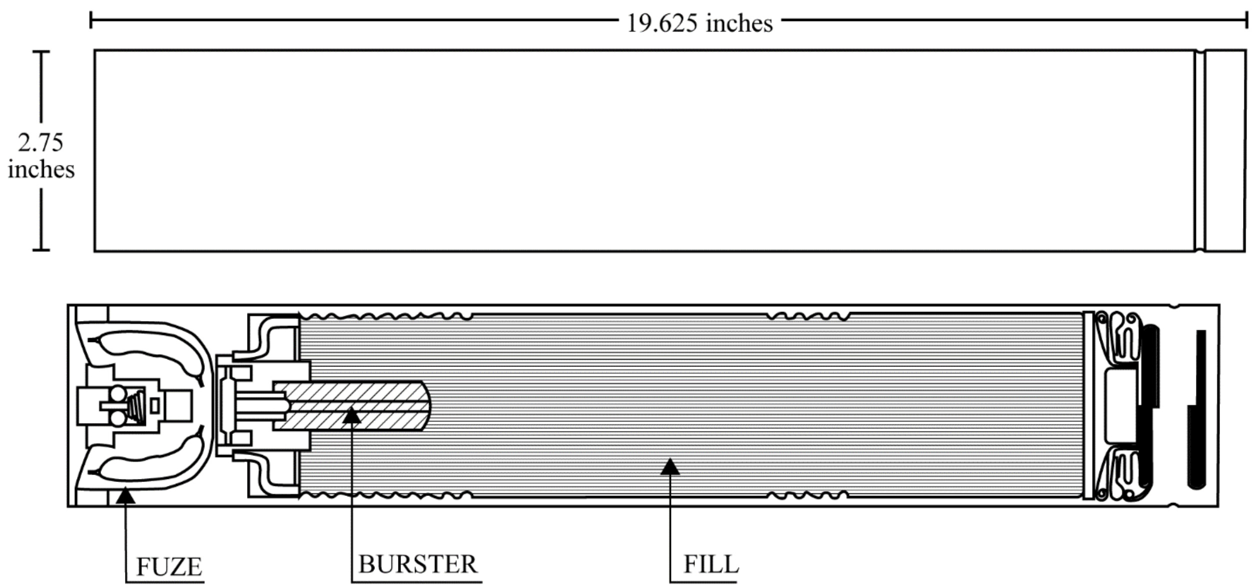

Figure 10: Bomb, 10-pound, Ejection Airburst, EK-4 (EK-2) - Line Drawing

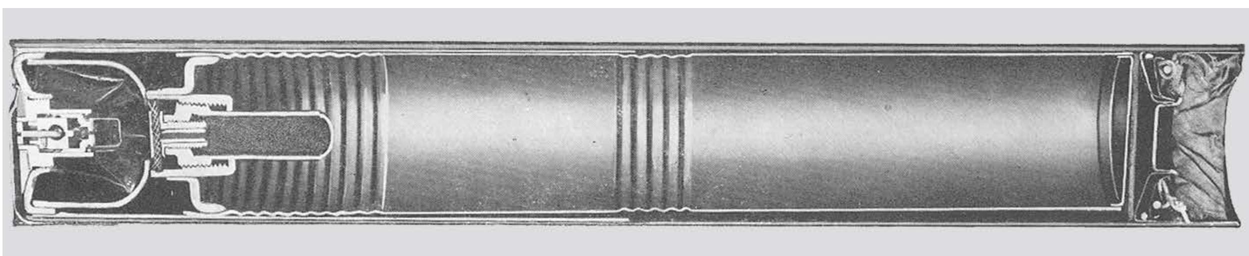

Figure 11: Bomb, 10-pound, Ejection Airburst, EK-4 (EK-2) - Photograph - Cutaway View

Specifications

Bomb, 10-pound, Ejection Airburst, EK-4 (EK-2) - Specifications and Other Data		**Citation**
Historical Name	Vesicant Spray Bomb EK-4 (EK-2)	1
Type	Bomb	1
Size	10-pound	1
Conflict	Post WWII	1
Diameter	Inner Case: 2.56 inches (6.51 cm) Outer Case: 2.75 inches (6.99 cm)	1
Length	Inner Case: 14.875 inches (37.78 cm) Outer Case: 19.625 inches (49.85 cm) Sleeve: 9.5 inches (24.13 cm)	1
Other Engineering Data	During development, this bomb was known as the EK-2. The EK-2 was designed for use with the M4 or E22R2 adapter.	1
Body Construction Material	Sheet metal	1
Propellant	Four oval shaped cellulose nitrate bags, each containing 4.5 grams to 5 grams of glazed Grade A No.4 black powder.	1

Bomb, 10-pound, Ejection Airburst, EK-4 (EK-2)

General Use and Description

The EK-2 bomb was developed to meet the needs for a base ejection airburst bomb for the dispersal of liquid agents (1), (2).

Improvement of the EK-3 bomb required that the entire unit be strengthened. The EK-2 round bomb was therefore developed because of its greater strength and ease of manufacture. The first-round model was designated EK-2, and was constructed by hand and tested by firing the bomb from a mortar and by dropping them from an airplane. The EK-2 used an inertia type fuze, which was made safe by inserting an arming pin between two steel balls and the firing pin. This fuze went through several modifications until it resulted in the fuze used in the EK-4 bomb. These models showed improvement over the EK-3 bomb and the development was continued until functioning was acceptable. This model was designated EK-4.

The EK-4 consists of an inner case made from 2-9/16 inches outer diameter, 20-gauge, steel tubing. A stamped cup containing an impact collar and the filling hole is copper brazed in the nose of the case. The tail cup is also copper brazed in place. This cup has a circular groove stamped in it so that the thickness of the remaining metal is slightly less than half of the wall thickness of the case. The groove weakens the cup to ensure that it would blow open at this point. A compressed black powder train was initially used as the delay fuze for the EK-4 but later, a short length of lead covered spitter fuze was substituted for the loose powder and was pressed into the holder. The ends of the powder train were exposed and one end was coated with a booster mixture.

The outer case has a stamped nose cup containing the threaded hole where the fuze is copper brazed in place. A dome-shaped diaphragm absorbs some of the impact of the inner case and provides a chamber for the powder bags. Four oval shaped powder bags are used to eject the inner case.

Three cloth streamers, each 40 inches long and three inches wide, are used to stabilize the bomb while falling. The streamers are hemmed and threaded onto a wire ring which is fastened to a similar ring with three nylon shroud lines ten inches long. These shroud lines increase the effectiveness of the streamers and permit the use of a shorter streamer (1).

Explosive Train

Upon impact, the impact fuze initiated the ejection charge. The ejection charge consisted of smokeless ball powder, plus either 0.5 grams of Type II black powder or 2 inches of Navy No. 1 quick match. The inner case was ejected 125 to 450 feet above the ground. When the delay fuze burned down, the burster was initiated, which spread the agent (1), (2).

Fuzing

Bomb, 10-pound, Ejection Airburst, EK-4 (EK-2) - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Inner case- delay	1
Not designated	Outer case- impact	1, 2

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Bomb, 10-pound, Ejection Airburst, EK-4 (EK-2) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
HD	2.67	1.21	8.40	3.81	Filler was dyed with 0.5% Oil Red dye. Weight is for EK-2.	1, 2
HV	2.80	1.27	N/A	N/A	Filler was dyed with 0.5% Oil Red dye.	1

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

Used with quick opening cluster (M4-adapter-14 bombs) or 500-pound Aimable cluster (E22R2 adapter-38 bombs) (2).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Kallal, R.J., & Davis, R.W., & Johnstone, H.F. 1945. Office of Scientific Research and Development, OSRD No. 6300, Development of a Small Base Ejection Air-Burst Bomb for Dispersing Liquid Agents. Office of Scientific Research and Development.

2. The Technical Staff 9769 (TSU) CWS Mobile Unit. 1946. Mobile Unit Memorandum Report, MR #5, The Tactical Usefulness of the EK3 and EK4 Bombs. Filled HD and HDV, as Compared with Ground Functioning Munitions, Namely the E5 and M47A2 Bombs. Chemical Warfare Service.

6.6 Bomb, 30-pound, M1

Figures

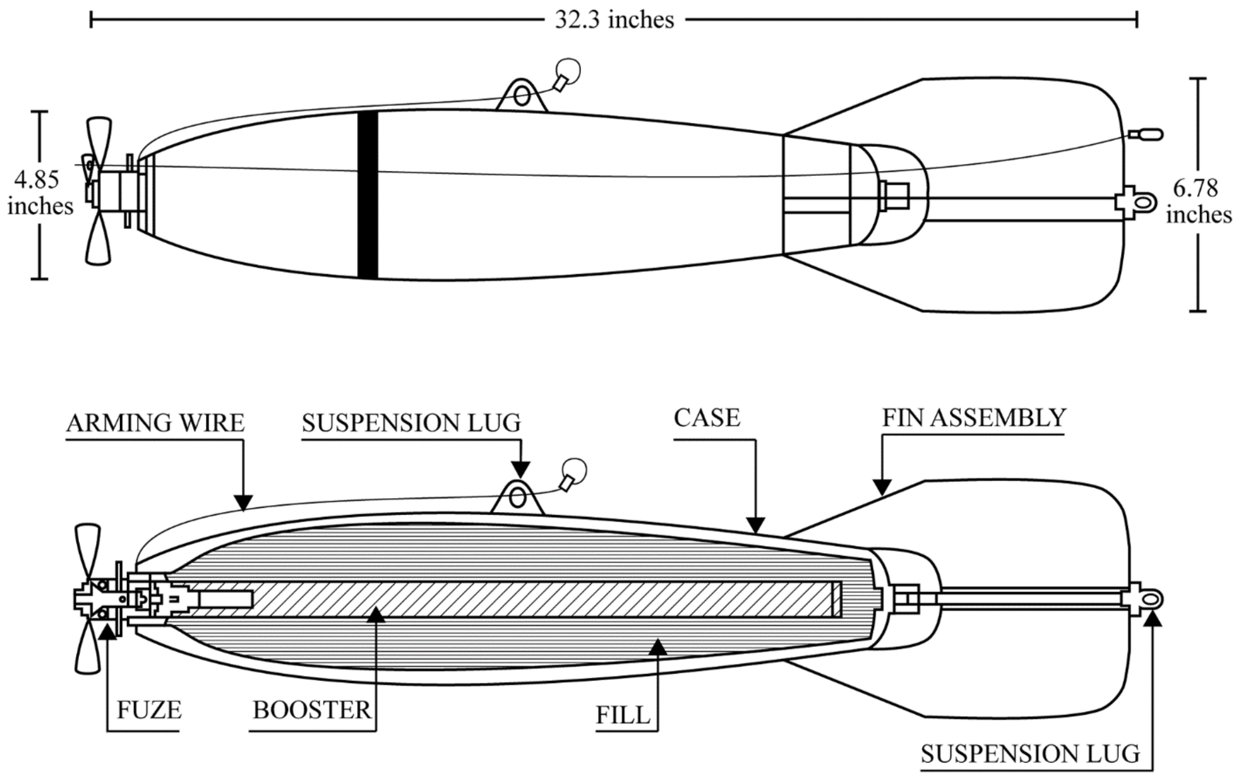

Figure 12: Bomb, 30-pound, M1 - Line Drawing

Specifications

Bomb, 30-pound, M1 - Specifications and Other Data		**Citation**
Historical Name	Bomb, Gas, Persistent, HS, 30-Pound, M1	1 (p. 86)
Type	Bomb	2 (p. 669)
Size	30-pound	1 (p. 86)
Conflict	WWII	2 (p. 669)
Diameter	Body: 4.85 inches (12.3 cm)	1 (p. 88)
Length	Overall: 32.3 inches (82.3 cm)	1 (p. 88)
Width	Fin: 6.78 inches (17.2 cm)	1 (p. 88)
Other Engineering Data	Wire, arming assembly, piece mark 82-3-234N was used. A single lug was 7.85 inches from the base of the tail fin assembly and 10 inches from the nose.	1 (p. 86-87)
Body Construction Material	Seamless steel tubing	2 (p. 669)
B/M Dwg	82-0-20	1 (p. 86), 3

General Use and Description

The 30-pound M1 chemical bomb was developed to meet the requirement for a bomb case strong enough to withstand "safe dropping" on normal soil from a height of 7,000 feet. It was intended to produce such an irritating physiological effect upon enemy personnel so as to make them ineffective (1 p. 86), (2 p. 669).

Bomb, 30-pound, M1

The M1 bomb was made by swaging a length of seamless steel tubing to a streamlined shape, fully closed at the tail end. A full length burster well was assembled to the nose end of the body by means of pipe threads that sealed the bomb against leakage of the filler. A full length burster of tetryl was used.

The two authorized fills for the M1 were H and WP (1 p. 86-87), (2 p. 669).

Explosive Train

Available references did not provide this information.

Fuzing

Bomb, 30-pound, M1 - Fuzing		
Fuze	**Note**	**Citation**
MK XIV	Nose- used with MK IIB or MK IIC instantaneous primer-detonator	1 (p. 86), 2 (p. 669)

Booster, Adapter-Booster, or Burster

Bomb, 30-pound, M1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M100 Burster assembly	0.26 pounds	Tetryl	Used with H fill	1 (p. 86), 4
M101 Burster assembly	0.19 pounds	Tetryl	Used with WP fill	1 (p. 86)

Fills

Bomb, 30-pound, M1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CNS (chloroacetophenone solution)	9.86	4.47	32.0	14.5	Experimental	3 (p. 104), 4
FM	11.8	5.35-5.36	N/A	N/A	-	5 (p. 14)
HS	8.31-9.00	3.76-4.08	29.1	13.1	-	1 (p. 86), 2 (p. 669)
WP	12.3-13.2	5.57-5.98	32.7	14.8	-	1 (p. 86), 2 (p. 669), 4

Shipping/Packing

The M1 was packaged two per crate with two each of the Mk. XIV nose fuze, the MK. IIB primer detonators, M101 booster, and the 82-3-234N arming wire assembly. Each bomb displaced 2.27 cubic feet. Each M1 (including components) weighed 84 pounds if H/HS filled or 90 pounds of WP filled (1 p. 87, 107), (3 p. 103-105).

Key Dates

Bomb, 30-pound, M1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1926	Ordnance Committee Meeting (OCM) 5812 (Persistent gas-fill)	6
Standardized	1928	OCM 7209 (WP-fill)	7
Standardized	1940	OCM 15601 (M1 changed to Limited Standard)	8 (p. 70)

Sources

1. Secretary of War. 1942. Technical Manual, TM 9-1980, Bombs for Aircraft. War Department.
2. War Department. 1944. Technical Manual, TM 9-1904, Ammunition Inspection Guide. U.S. Government Printing Office.
3. Chief of Ordnance. 1930. Technical Regulation, TR 1370-G, Miscellaneous Ammunition Bombs for Aircraft TR 1370-G. War Department.
4. Office of the Commandant. 1932. Office of the Commandant, Maxwell Field Alabama, Memorandum to The Chief of the Air Corps, Washington DC. Subject: Bomb Chemical, 30-lb, M1 and Indorsements. Air Corps Tactical School.
5. Bouder, N.M., & Powell, H.C. 1931. Approximate Average Weights of Fillings in Chemical Munitions. Information Division.
6. Sub-Committee on Bombs. 1926. Ordnance Committee Meeting, OCM Item # 5812, Bomb, Chemical, 25-lb. MI – Standardization, and Designation Changed to “Bomb, Chemical, 30-lb, MI”. Ordnance Committee.
7. Sub-Committee on Bombs. 1928. Ordnance Committee Meeting, OCM Item # 7209, Standardization of 30-lb, Chemical Bomb MI with WP Filling. Ordnance Committee.
8. Finklestein, Leo. 1964. History of Research and Development of the Chemical Warfare Service in World War II (1 July 1940 - 31 December 1945) Screening Smokes Part III. Chemical Research and Development Laboratories (CRDL).

6.7 Bomb, 30-pound, M46, M46A2

Figures

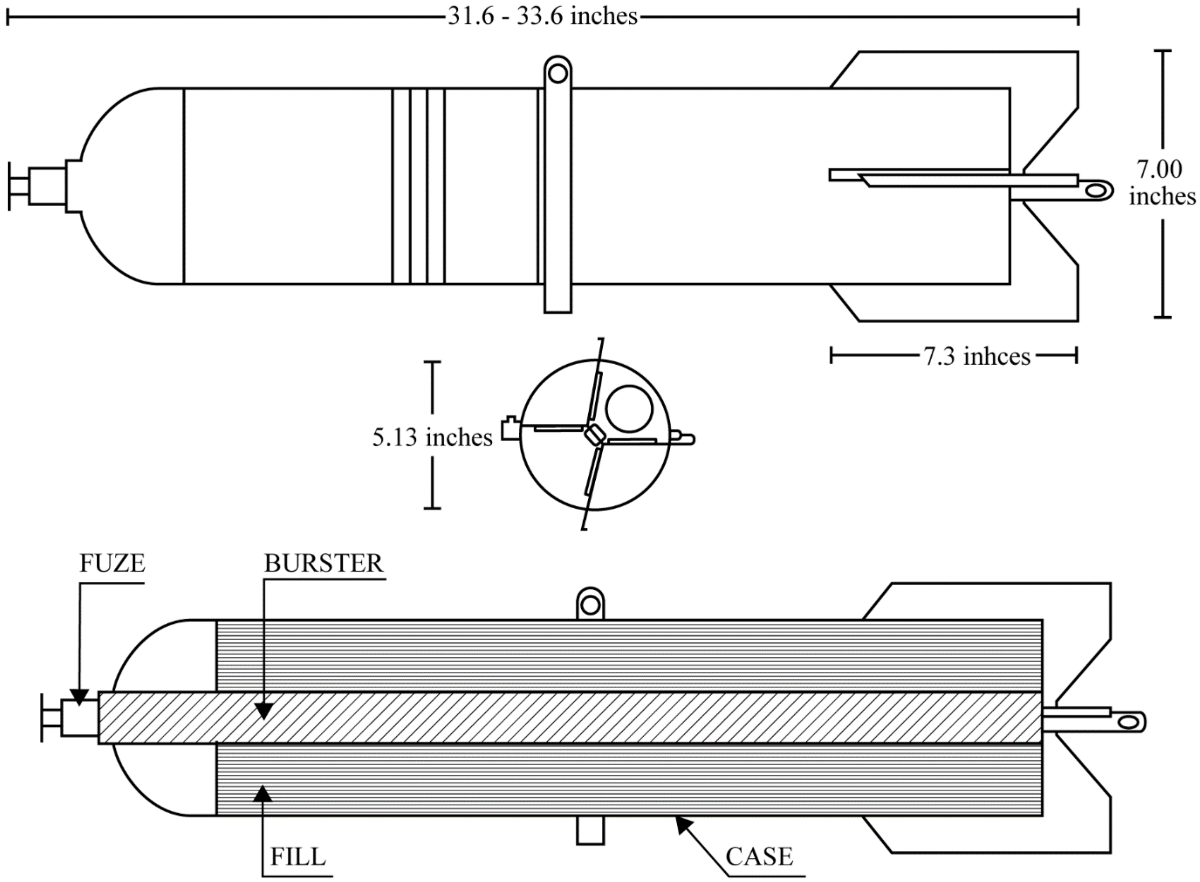

Figure 13: Bomb, 30-pound, M46, M46A2 - Line Drawing

Figure 14: Bomb, 30-pound, M46, M46A2 - Photograph

Bomb, 30-pound, M46, M46A2

Specifications

Bomb, 30-pound, M46, M46A2 - Specifications and Other Data		Citation
Historical Name	Bomb, Gas, Persistent, HS, 30-Pound, M46A2 (M46)	1 (p. 89)
Type	Bomb	2 (p. 669)
Size	30-pound	1 (p. 89)
Conflict	WWII	2 (p. 669)
Service	Air Force	2 (p. 669)
Diameter	5.10 inches (12.9 cm)	3 (p. 33)
Length	Body: 30.7 inches (77.9 cm) With fuze: 31.6-33.6 inches (80.2-85.3 cm) Tail: 7.30 inches (18.5 cm)	2 (p. 669-670), 3 (p. 33)
Width	Tail: 7.00 inches (17.8 cm)	3 (p. 33)
Other Engineering Data	Wall thickness: 1/16-inch	3 (p. 33)
Body Construction Material	Body: sheet steel Tail: sheet steel, four vanes	3 (p. 33)
B/M Dwg	82-0-38	1 (p. 89)

General Use and Description

The M46 and M46A2 were intended to produce such an irritating physiological effect upon enemy personnel as to make the troops ineffective. It was also used for screening troop movements (1 p. 89), (2 p. 669), (3 p. 33).

The M46 was standardized in 1940; it replaced the M1 chemical bomb. It was a thin case bomb, cylindrical in shape and made of sheet metal. The bomb had a lug on a band at the center of gravity and a lug welded to the tail assembly.

The M46A2 was a modification of the M46. The modifications consisted of changes in fin assembly to make it more stable in flight, and body construction. The M46A2 bomb was a sheet metal cylindrical type. It was adapted for a nose fuze only. A suitable closing plug was fitted to the adapter to keep the fuze and burster cavities free of foreign matter.

The M46A2 consisted of a sheet steel tube with a hemispherical sheet steel nose welded to the tube and a male type base plate welded to the body (1 p. 89), (2 p. 669), (3 p. 33), (4), (5 p. 87).

Explosive Train

Available references did not provide specific information on the explosive train.

Fuzing

Bomb, 30-pound, M46, M46A2 - Fuzing		
Fuze	**Note**	**Citation**
AN-M126A1	Nose - Replaced M108	5 (p. 87)
M108	Nose	1 (p. 89), 2 (p. 669), 3 (p. 33)

Booster, Adapter-Booster, or Burster

Bomb, 30-pound, M46, M46A2 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M3 Burster assembly	N/A	Tetryl	The assembly was 30 inches long. Available references did not provide weight information.	2 (p. 669)

Bomb, 30-pound, M46, M46A2

Fills

Bomb, 30-pound, M46, M46A2 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
HS	19.8-21.1	8.98-9.57	31.4-39.7	14.2-18.0	-	1 (p. 89-90), 2 (p. 669), 3 (p. 33)
WP	28.1	12.8	39.7	18.0	-	1 (p. 90), 2 (p. 669), 3 (p. 33)

Shipping/Packing

The M46A2 was packaged two per crate with two each of the M108 nose fuze, and the 82-3-234RA arming wire assembly. Each bomb displaced 1.86 cubic feet. The M46A2 (including components) weighed 102 pounds (1 p. 106-107).

Key Dates

Bomb, 30-pound, M46, M46A2 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1940	-	2 (p. 669)
Obsoleted	1942	CCTC 586 (M46, M46A1, and M46A2)	2 (p. 669)

Sources

1. Secretary of War. 1942. Technical Manual, TM 9-1980, Bombs for Aircraft. War Department.
2. War Department. 1944. Technical Manual, TM 9-1904, Ammunition Inspection Guide. U.S. Government Printing Office.
3. Chief of Ordnance. 1942. Technical Manual, TM 9-1984, Disposal of American and Allied Bombs and Fuzes. War Department.
4. Aberdeen Proving Ground. 1942. Bomb Disposal Technical Data, 1064, Bomb Disposal Headquarters. Department of the Army.
5. U.S. Navy Bomb Disposal School. 1944. United States Bombs and Fuzes, Pyrotechnics, Land Mines, Firing Devices. Department of the Army.

6.8 Bomb, 100-pound, MK 42

Figures

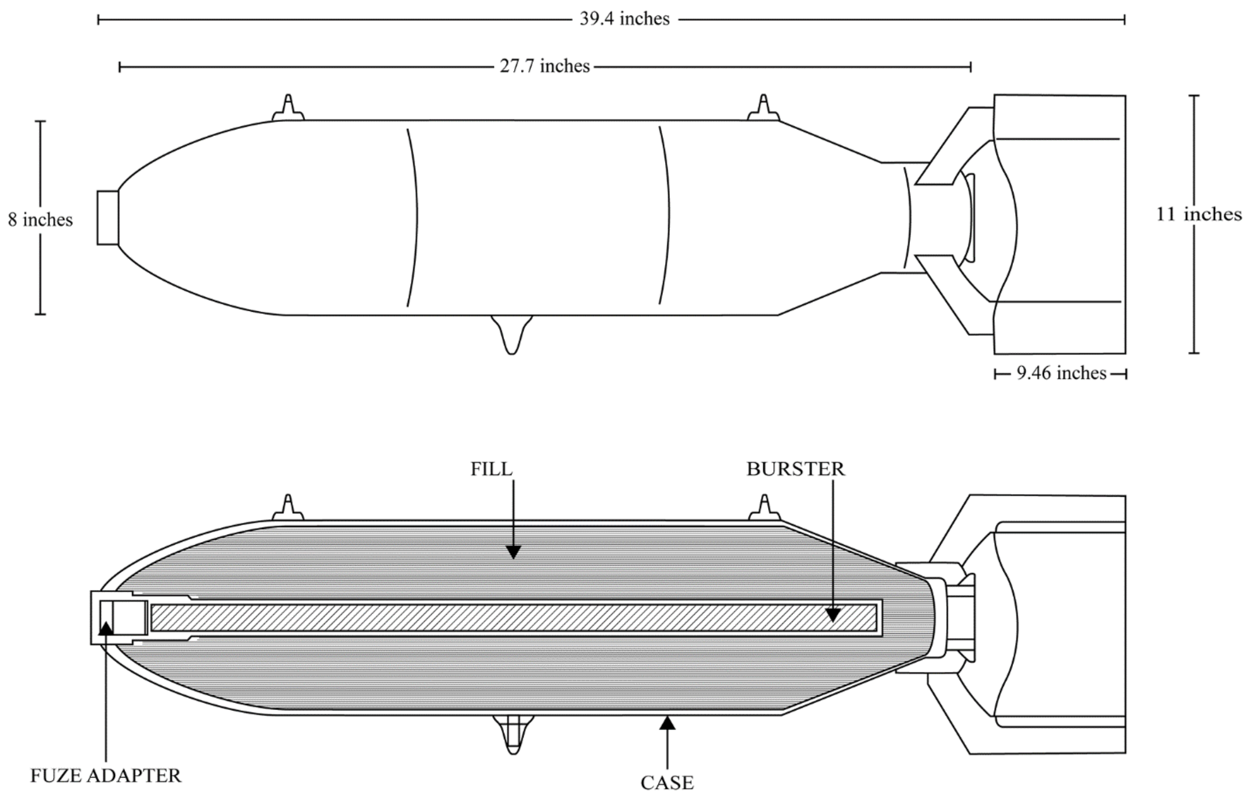

Figure 15: Bomb, 100-pound, MK 42 - Line Drawing

Specifications

Bomb, 100-pound, MK 42 - Specifications and Other Data		**Citation**
Historical Name	100-Pound Chemical, Bomb MK 42	1 (p. 424)
Type	Bomb	1 (p. 425)
Size	100-pound	1 (p. 425)
Conflict	WWII	2
Service	Navy	2 (p. 78)
Diameter	Body: 8 inches (20 cm)	1 (p. 425), 2 (p. 79)
Length	Overall: 39.4 inches (100 cm) Body: 27.7 inches (70 cm) Tail: 9.46 inches (24 cm)	1 (p. 425), 2 (p. 79)
Width	Tail: 11 inches (28 cm)	1 (p. 425)
Other	Wall thickness: 0.17 inches (0.43 cm)	1 (p. 425), 2 (p. 79)
Other Engineering Data	Tail: box type, four-fin Lugs: 14 inches apart	2 (p. 79)
Body Construction Material	Body: steel tube Tail: sheet steel	2 (p. 79)

General Use and Description

The MK 42 was used against personnel and material (3 p. 91).

Bomb, 100-pound, MK 42

The steel tube was swaged aft. An adapter screwed into the nose and was threaded to receive the fuze. A burster tube containing TNT ran the length of the bomb and screwed into the after end of the adapter. The after end of the body was closed by a male base plate, which was threaded for the tail assembly to be fitted. The bomb was filled through the nose. Suspension was by two lugs seven inches on either side of the center of gravity or a single lug 180 degrees removed and at the center of gravity. The bomb had a box-type, four-fin tail, secured by a locking nut (1 p. 425).

Explosive Train

The fuze used the rotor system of arming and would function on impact with water or denser medium if it was dropped from a high enough altitude. Upon impact, the fuze function would initiate the burster charge, split the bomb case, and disperse the filling over the area to be contaminated (1 p. 425).

Fuzing

Bomb, 100-pound, MK 42 - Fuzing		
Fuze	**Note**	**Citation**
AN-MK 219	-	2 (p. 79)
MK 119	-	2 (p. 78)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Bomb, 100-pound, MK 42 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
H	40.5-43.0	183-19.5	86.5-92.0	39.2-41.7	-	1 (p. 425), 2 (p. 79)
HE	75.0	34.0	N/A	N/A	TNT	2 (p. 79)

Shipping/Packing

Available references did not provide this information.

Key Dates

Bomb, 100-pound, MK 42 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Obsoleted	1952	CCTC 2503 (H-fill)	-

Sources

1. Bureau of Ordnance. 1947. Ordnance Pamphlet, OP 1664 (Vol. 1), U.S. Explosive Ordnance. Department of the Navy.
2. Chief of Ordnance. 1942. Technical Manual, TM 9-1984, Disposal of American and Allied Bombs and Fuzes. War Department.
3. U.S. Navy Bomb Disposal School. 1944. United States Bombs and Fuzes, Pyrotechnics, Land Mines, Firing Devices. War Department.

6.9 Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series

Figures

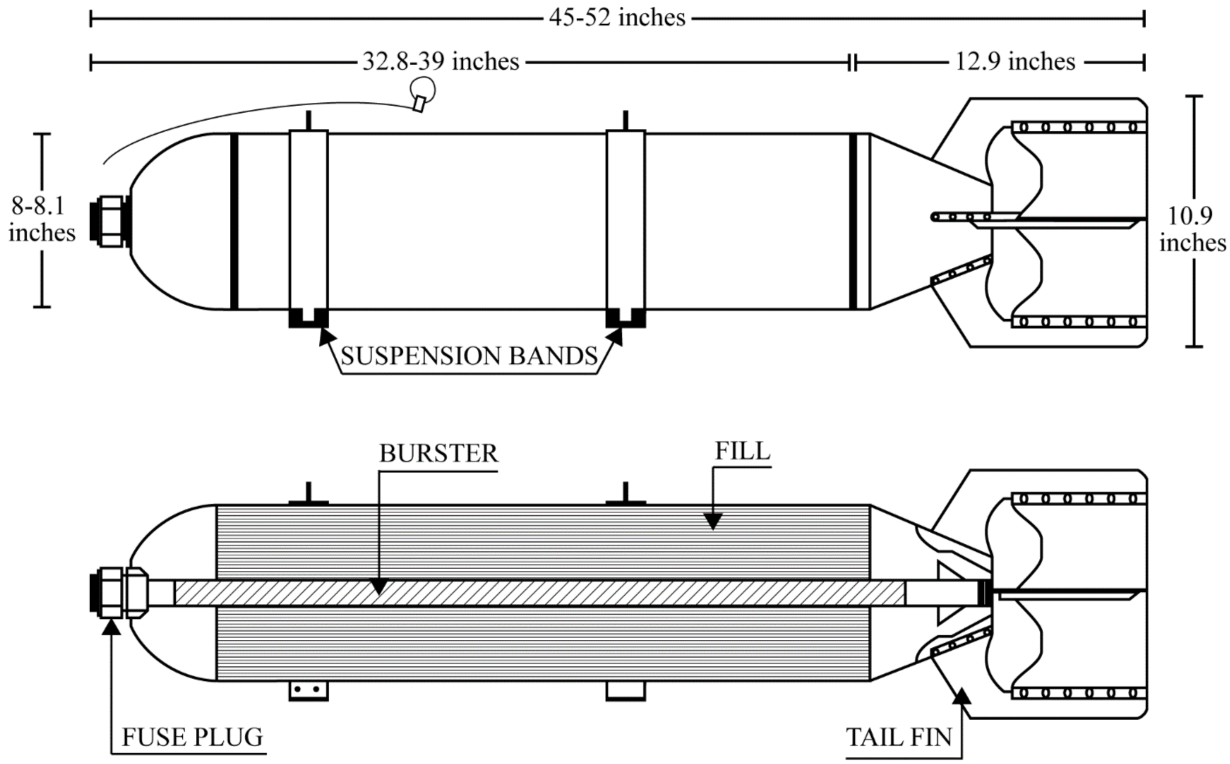

Figure 16: Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series - Line Drawing

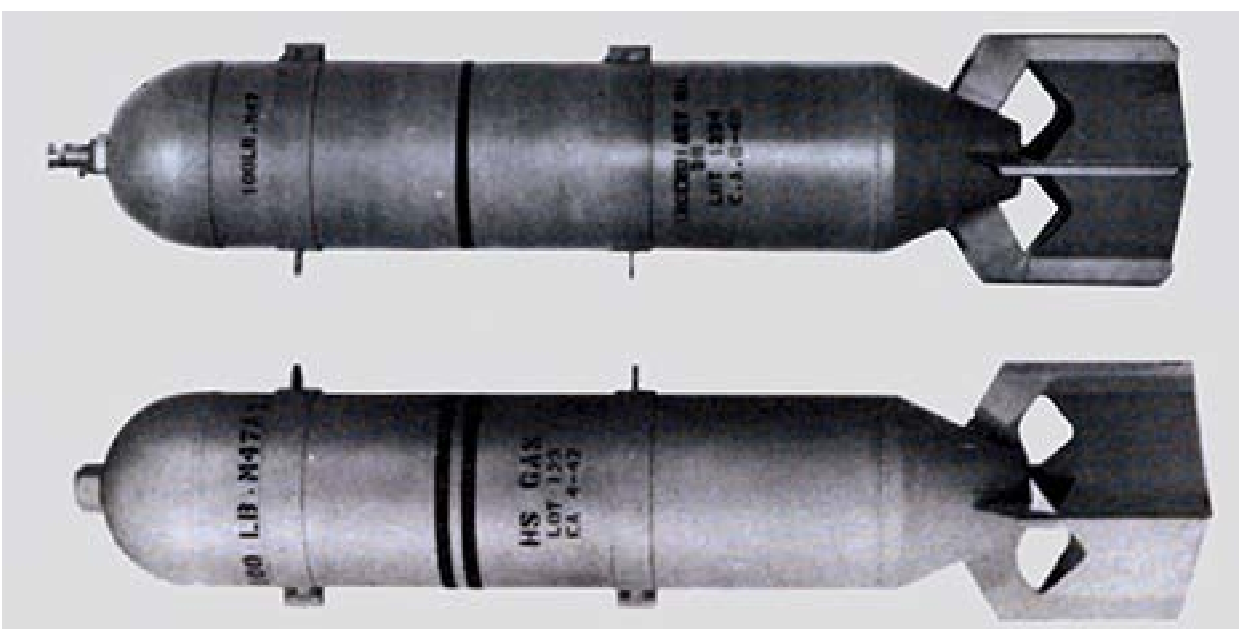

Figure 17: Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series - Photograph - Top: M47, Bottom: M47A2

Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series

Specifications

Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series - Specifications and Other Data		**Citation**
Historical Name	Bomb, Chemical, 100-Pound, M47, M47A1, M47A2, M47A3, M47A4	1 (p. 673-677)
Type	Bomb	2 (p. 432)
Size	100-pound	2 (p. 432)
Conflict	WWII	1 (p. 673-677)
Service	Air Force, Army, Navy	1 (p. 673-676), 2 (p. 433), 3 (p. 4)
Diameter	8.0-8.1 inches (20.3-20.6 cm)	1 (p. 673-676), 2 (p. 432)
Length	Body: 32.8-39 inches (83.3-99.1 cm) Tail: 12.9 (32.8 cm) Overall: 45-52 inches (114-132 cm)	1 (p. 673-676), 2 (p. 432), 4 (p. 4-23)
Width	Tail: 10.9 inches (27.7 cm)	2 (p. 432)
Other	Wall thickness: 0.06-inch (M47)	2 (p. 432-433)
Other Engineering Data	AN-M47A3 and AN-M47A4 tail assembly was three inches longer on these models. The M47 was designated T6E1 during development.	2 (p. 432)
Body Construction Material	Tube made of sheet steel with a longitudinal seam weld with nose and rear welded on.	2 (p. 432-433)
B/M Dwg	82-0-80 (AN-M47A4)	4 (p. 4-22)
National Stock Number (NSN)	1325-00-219-8507 (AN-M47A3 PWP) 1325-00-219-8508 (AN-M47A$ PWP) 1325-00-219-8509 (AN-M47A4 WP)	5 (p. 30)

General Use and Description

The M47 series of bombs was developed to meet the requirements of the Air Force for a chemical bomb for "bombardment" purposes. It was a thin case bomb whose design and construction was such as to provide maximum efficiency after release from the bomb bay of the plane (1 p. 673-676).

The 100-pound AN-M47 series included the AN-M47A2, which could be filled with H, WP, or gasoline gel; the M47A2 Gas, Chemical, Smoke, or Incendiary; the M47A1 Gas, Smoke, or Incendiary; the M47 Chemical; the AN-M743A Incendiary; and the AN-M47A4 Incendiary.

The bodies of these bombs were made of 1/32-inch sheet metal rolled and lap welded into a cylindrical shape eight inches in diameter. The nose was hemispherical and welded to the body as was the box type tail fin assembly that formed the tail taper of the bomb body. The burster well was screwed into the bomb body by means of pipe threads to make a gastight seal at the nose. It was held in place at the tail of the bomb body by an attached cone in the inner side of the fin assembly. It was internally threaded to receive a sleeve that had a groove in its lower portion to seat the fuze, which was pressed in place. The pipe threads were coated with either white lead-in-oil, red lead-in-oil, or varnish shellac before the burster was inserted to make a leak tight joint. Around the bomb body were two suspension bands 14 inches apart, which provided suspension lugs for horizontal suspension. One blade of the fixed box type tail assembly was in line with the suspension lug.

The M47A1 bomb was designed to replace the 100-pound M47. The 100-pound M47 was found to have too thin a wall section, and in handling and storage, it developed leaks due to corrosion and rough treatment. Consequently, the wall thickness was increased from 1/32 inch to 1/16 inch, and the case was protected by coating inside with acid proof black paint. However, H was still found to leak from the bomb case and the only standard fills were WP and PT.

The M47A2 bomb was designed to be able to receive the chemical filler H without leaking. It was coated on the inside with a special oil that proved, in theoretical tests, to be resistant to filler pressure having a resistance of 400-pound pressure. It did not differ from the 100-pound M47A1 in any appreciable way. It was found; however, that this bomb was also subject to leaking, but not to such an extent as its predecessors. H was still to be loaded into this bomb as a temporary emergency filler. It could also be filled with HD, WP, gelled gasoline, or NP (1 p. 673-676), (2 p. 432), (6 p. 1), (7 p. 33).

Explosive Train

On impact, the striker would be forced inward, which would shear the shear wire and bring the firing pin into the detonator. The detonator consisted of priming mixture, lead azide, and tetryl. When detonated it sent a wave to the burster charge of tetryl or black powder in the burster casing. The burster split the shell and the chemical filler was spread (1 p. 670-671).

Fuzing

Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series - Fuzing		
Fuze	**Note**	**Citation**
AN-M126	Preferred over the M108	8 (p. 179)
AN-M126A1	Preferred over the M108	2 (p. 432)
AN-M147	-	2 (p. 432)
AN-M159	Nose- preferred for incendiary (e.g., PWP) fill	3 (p. 133)
M108	Nose	1 (p. 673-676), 2 (p. 432)
M126	Nose	1 (p. 676), 2 (p. 432)
M159	-	2 (p. 432)

Booster, Adapter-Booster, or Burster

Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
AN-M12 Burster	1.1 pounds	50% black powder 50% magnesium	-	2 (p. 432), 3 (p. 137)
AN-M13 Burster	0.15 pounds	TNT and tetryl pellets	Used in conjunction with the igniter AN-M9 (WP or NP) in the AN-M47A2, AN-M47A1, or AN-M47A3 incendiary bombs.	2 (p. 432), 3 (p. 137)
M115 Adapter Booster	N/A	N/A	-	2 (p. 433)
M18 Burster	0.6 pounds	Black powder	Authorized for low-altitude bombing. Used in the M47A2 smoke bomb.	2 (p. 432), 3 (p. 133, 137)
M20 Burster	0.87 pounds	0.75-inch tetryl pellets	Required for PWP fill in the AN-M47A4 incendiary bomb.	2 (p. 433), 3 (p. 137)
M4 Burster	2.4 pounds	Tetryl	Used for WP or H filler in the M47A1 and the M47A2. Authorized for high-altitude bombing in the M47A2 smoke bomb.	1 (p. 670), 2 (p. 432), 9 (p. 582)
M7 Burster	2 pounds	Black powder	Could be substituted for either M4 or M18 in the M47A2 smoke bomb.	1 (p. 674), 9 (p. 582)

Fills

Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
H	68.5-73.0	31.0-33.1	93.0-102	42.1-46.2	Used in the M47A1 and M47A2 bombs.	1 (p. 673-676), 2 (p. 432), 10 (p. 33)
HD	N/A	N/A	N/A	N/A	-	11
IM	41.0-47.0	18.6-21.3	61.0	27.6	Used in M47, M47A1, and M47A2 bombs.	12 (p. 14), 13 (p. 38)
NP	40.0-42.0	18.1-19.0	60.0-68.6	27.1-31.1	Fill for M47, M47A1, and AN-M47A2 bombs.	2 (p. 432), 14 (p. 14), 15 (p. 2)
PT	59.7	27.1	86.0	39.0	-	13 (p. 38)
PWP	74.0-75.0	33.5-34.0	105	47.6	Required the M20 burster.	2 (p. 433), 4 (p. 4-23)
WP	100-103	45.3-46.7	127-131	57.6-59.4	Used in the M47A1 and M47A2 smoke bombs.	1 (p. 673-676), 2 (p. 432)

Shipping/Packing

When shipped filled, this bomb was packed in a wooden box, one per box without fuze, arming wire or burster charge. When shipped unfilled, they were packed two per crate at a weight of 82 pounds per crate (1 p. 673-676), (16 p. 257).

Miscellaneous Information

The bomb could be loaded with an incendiary filler of rubber and gasoline in the field. The base filling was gasoline supplemented by one of four different incendiary ingredients as follows:

1. LA-60. Consisted of crude latex or sap in combination with caustic soda, coconut oil, and water.
2. Crepe rubber. This is crude latex but was reduced to a solid by precipitation and kneading.
3. LA-100. This is crude latex dried until it was approximately 100 percent solid.
4. Smoked rubber sheets. This is crude latex which had been dried over a smoky fire until it was approximately 100 percent solid.

The Chemical Warfare Service experimented with a solution of WP in HD with carbon disulphide fill (carrying the code: HP). The HP fill was between 66 and 70 pounds per bomb.

In 1946, the authorization for Bombs, Chemical, l00-lb., HL [mustard-lewisite mixture] & L, M47A2 was cancelled with no stocks in storage. Filling with L was never authorized, and HL was an experimental fill (1 p. 673-676), (6 p. 1), (17), (18), (19 p. II-2).

Key Dates

Bomb, 100-pound, M47, M47A1, M47A2, M47A3, M47A4, AN-M47 Series - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1940	OCM Items 16142 and 16059 (M47)	4 (p. 1), 20 (p. 1)
Obsoleted	1942	CCTC 19111 (M47A1)	20 (p. 1-5)
Standardized	1942	OCM 19111 (M47A2)	20 (p. 1-5)
Standardized	1943	CCTC 803 (incendiary bombs M47, M47A2, M47A1)	21
Standardized	1945	CCTC 1461 (HD-fill Standard and HS-fill Limited Standard for M47A2C and M47A3C)	11
Obsoleted	1946	CCTC 1672 (HL & L-fill for the M47A2)	18
Standardized	1946	CCTC 1673 (IM and NP-fill Standard for M47A4)	22
Standardized	1946	CCTC 1565 (PWP-fill Standard for M47A2)	23
Obsoleted	1950	CCTC 2085 (M47 series bombs)	24
Obsoleted	1952	CCTC 2527 (WP-fill for AN-M47A1 and AN-M47A2)	25
Obsoleted	1956	CCTC 3193 (IM and NP-fill AN-M47A3 and AN-M47A4)	21
Standardized	1958	CCTC 3408 (PT1-fill for M47A3- Standard-Air Force, PWP-fill for M47A4- Standard-Air Force, NP-fill for M47A3-Ltd Standard-Air Force, and WP-fill for M47A4-Ltd Standard-Air Force)	26
Standard Modernization	1959	CCTC 3525 (NP and PWP-fill for M47A3- Standard-C-Air Force, WP-fill for M47A4 - Standard-C-Air Force)	27

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6.10 Bomb, 100-pound, Cube, E132

Figures

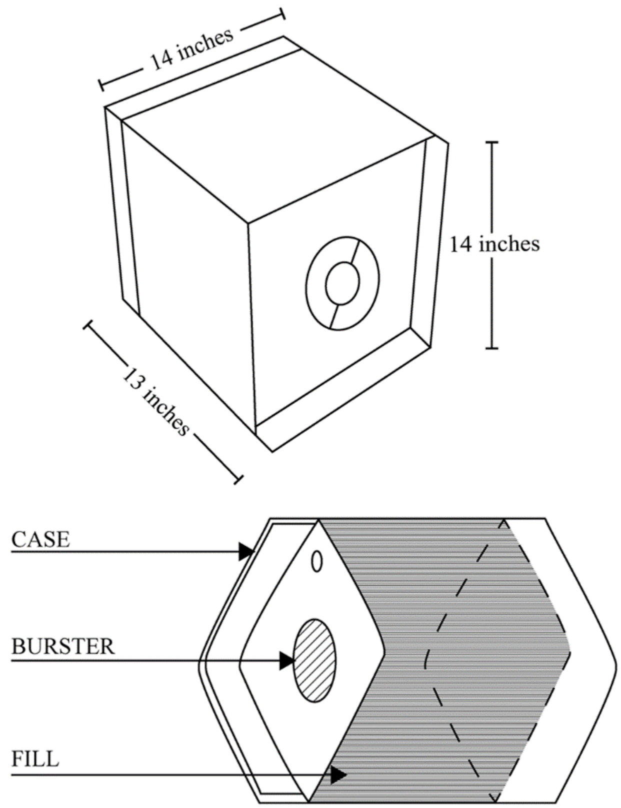

Figure 18: Bomb, 100-pound, Cube, E132 - Line Drawing

Specifications

Bomb, 100-pound, Cube, E132 - Specifications and Other Data		Citation
Historical Name	Bomb, Gas, Nonpersistent, GB, 100-Pounds, E132	1 (p. 4-20)
Type	Bomb	1 (p. 4-20)
Size	100-pound	2 (p. 4-21)
Conflict	Cold War	1 (p. 4-20)
Service	Air Force, Navy	1 (p. 4-20), 2 (p. 4-21)
Length	14 inches (35.5 cm)	1 (p. 4-21), 2 (p. 4-22)
Width	14 inches (35.5 cm) Fins: 1.5 inches (3.8 cm); diagonally opposed	1 (p. 4-21), 2 (p. 4-22)
Height	13 inches (33.0 cm)	1 (p. 4-21), 2 (p. 4-22)
Other Engineering Data	The E132 was designed for use in the XMC-1 dispenser. Development history: CMLC project 4-04-15-032-08	1 (p. 4-21), 2 (p. 4-22)

General Use and Description

The E132 100-pound bomb was designed to disseminate chemical agents from aircraft (1 p. 4-20), (2 p. 4-21).

Bomb, 100-pound, Cube, E132

The E132 was a compact munition designed with maximum performance and payload weight per total systems weight. It provided the greatest area coverage consistent with the potential of the agent (e.g., GB, VX) employed. This inferred widely dispersed multiple source points, and an efficient agent dissemination through improved fuzing and burster system. Self-dispersion was accomplished by driving vanes on the cube body to provide spin during flight. The fuze system could be set for air or ground burst.

The E132 could be dropped from aircraft using Boeing-Hays (XMC-1) dispensers carrying 72 bombs (1 p. 4-20-4-21), (2 p. 4-21, 4-22).

Explosive Train

The electric fuze functioned at either airburst or upon impact. When the fuze functioned, the burster was initiated breaking the shell and disseminating the agent (2 p. 4-22).

Fuzing

Bomb, 100-pound, Cube, E132 - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Proximity - When using a GB fill, a new fuze or a compromise fuze could be used. No further details were provided in available references.	1 (p. 4-21)

Booster, Adapter-Booster, or Burster

Bomb, 100-pound, Cube, E132 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	N/A	N/A	Electric fuze burster with a 1.75-inch diameter. Available references did not provide weight information.	2 (p. 4-22)

Fills

Bomb, 100-pound, Cube, E132 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	70.0	31.7	125	56.7	-	1 (p. 4-21), 2 (p. 4-22)
VX	70.0	31.7	125	56.7	-	1 (p. 4-21), 2 (p. 4-22)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

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6.11 Bomb, 115-pound, E46, E46R1

Figures

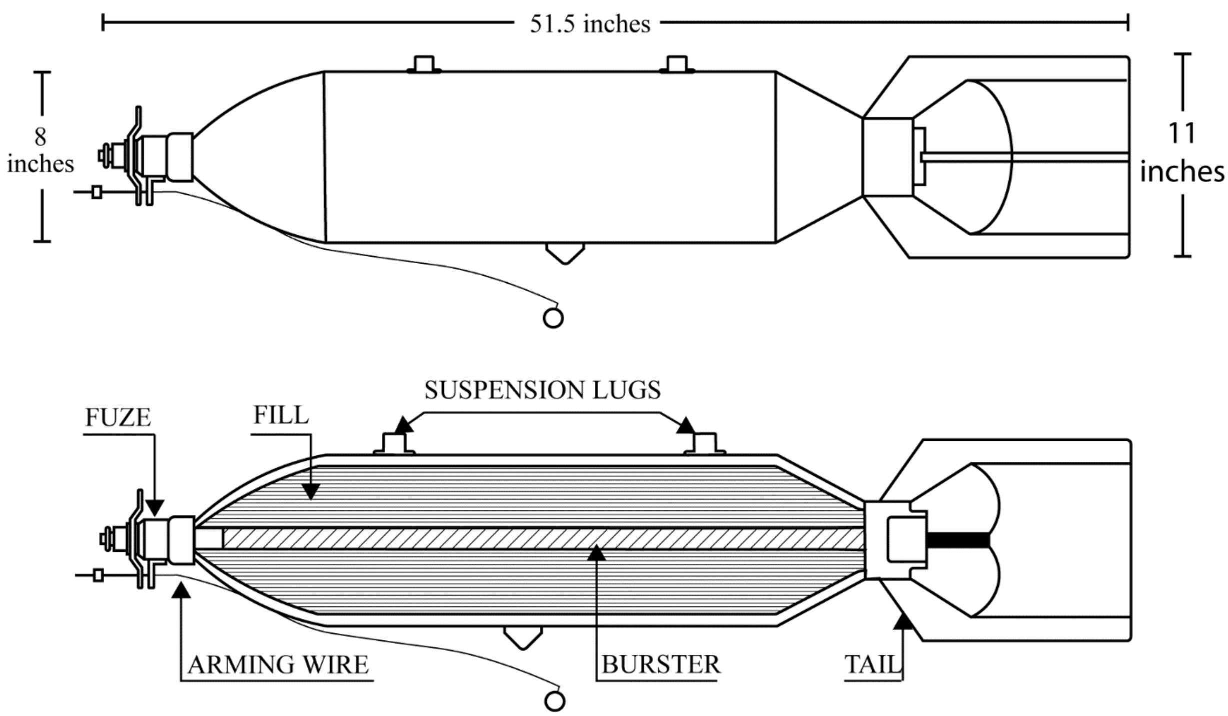

Figure 19: Bomb, 115-pound, E46, E46R1 - Line Drawing

Specifications

Bomb, 115-pound, E46, E46R1 - Specifications and Other Data		**Citation**
Historical Name	E46R1, 115 Pound Bomb, Chemical	1 (p. 55, Appendix A)
Type	Bomb	2 (p. 1), 3 (p. 2), 4 (p. 10-11), 5 (p. 1)
Size	115-pound	1 (p. 55, Appendix A), 2 (p. 1, 10), 3 (p. 2), 5 (p. 1)
Conflict	Post WWII	1 (p. 55, Appendix A)
Service	Army	2
Diameter	8 inches (20.3 cm)	2 (p. Figure 1)
Length	Body: 31.25 inches (79.4 cm); Overall: 51.5 inches (131 cm)	2 (p. Figure 1)
Width	Tail: 11 inches (27.9 cm)	2 (p. Figure 1)
Other Engineering Data	The agent to burster ratio of the E46R1 from the E46 was increased to 5:1.	5 (p. 1)

General Use and Description

The development of the E46 was undertaken to determine the effectiveness of the 115-pound chemical bomb (M70) as a munition for the dispersal of G-agents and to gain fundamental knowledge of the agents in the field (3 p. 1).

The E46R1 bomb was a 115-pound GB or tabun (GA) bomb. It used the same casing as the M70 bomb fitted with an experimental burster. The bomb was nose-fuzed with a modified M103A1 for static firing.

Bomb, 115-pound, E46, E46R1

Field test 111 was conducted in 1948 to determine whether the E46R1 chemical bomb was suitable for dispersing GB. For field test 111, the E46 was fitted with an experimental burster, which gave an agent to burster ratio of 5:1, and was designated E46R1 (1 p. 55, Appendix A), (2 p. 1-2).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Bomb, 115-pound, E46, E46R1 - Fuzing		
Fuze	**Note**	**Citation**
M108	Nose- used with E46	3 (p. 3)
Modified M103A1	Nose- fuzed for static firing	1 (p. 55, Appendix A), 2 (p. 2)

Booster, Adapter-Booster, or Burster

Bomb, 115-pound, E46, E46R1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Experimental burster	8.59 pounds	Tetrytol	Used with E46R1	1 (p. 55, Appendix A), 2 (p. 2)
M10 burster	1.5 pounds	Tetryl	Used with E46	3 (p. 2)

Fills

Bomb, 115-pound, E46, E46R1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GA	49.0	22.2	N/A	N/A	Agent to burster ratio 35:1	3 (p. i), 4 (p. 10), 5 (p. 1)
GB	42.0	19.0	115	52.1	-	2 (p. 1), 4 (p. 15)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

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6.12 Bomb, 115-pound, M70, M70A1

Figures

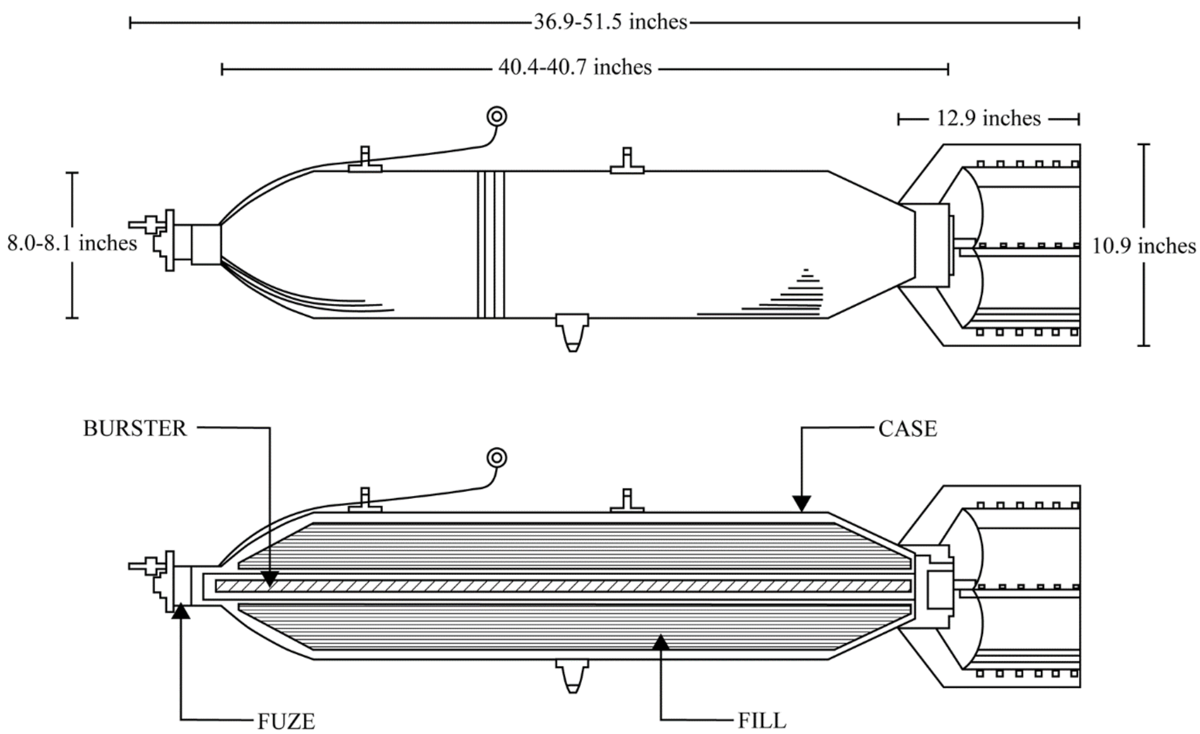

Figure 20: Bomb, 115-pound, M70, M70A1 - Line Drawing

Figure 21: Bomb, 115-pound, M70, M70A1 - Photograph - Simulated, Top: Intact, Bottom: Cutaway View

Bomb, 115-pound, M70, M70A1

Specifications

Bomb, 115-pound, M70, M70A1 - Specifications and Other Data		Citation
Historical Name	Bomb, Gas, Persistent, HD 115-Pound M70A1, H 115-Pound M70	1 (p. 4-24)
Type	Bomb	2 (p. 4-25)
Size	115-pound	2 (p. 4-25), 3, 4 (p. 1)
Conflict	WWII	5
Service	Air Force, Army, Navy	1 (p. 4-24), 2 (p. 4-26)
Diameter	8.0-8.1 inches (20.3-20.5 cm)	6 (p. 420), 7 (p. A-12), 8 (p. 8)
Length	Body: 40.4-40.7 inches (102-103 cm) Tail: 12.9 inches (32.7 cm) Overall: 36.9-51.5 inches (93.7-131 cm)	6 (p. 420), 7 (p. A-12), 8 (p. 8), 9 (p. 4-26), 10 (p. 35)
Width	Tail: 10.9 inches (27.6 cm)	6 (p. 420)
Other	Wall thickness: 0.12-0.2 4 inches	8 (p. 8), 10 (p. 35)
Other Engineering Data	The tail fin assembly was an AN-M103A1, M102A2, or M102. A cluster of four M70s could be formed by using the Cluster Adapter M22.	2 (p. 4-25), 6 (p. 423), 7 (p. A-12)
Body Construction Material	Seamless steel tube	2 (p. 4-25), 10 (p. 35)
B/M Dwg	82-0-63, D 14-5-1187 82-0-83, D14-5-1187	1 (p. 4-25), 2 (p. 4-26), 7 (p. A-12)
FSN	1325-219-8571 (M70 H-fill) 1325-219-8572 (M70A1 HD-fill)	11

General Use and Description

The M70 bomb was developed to replace the M47A1 which was unsatisfactory due to the development of leaks and the inability to withstand the pressures developed from an HS-fill

The M70A1 115-pound Bomb was designed for use with propeller-driven aircraft. It was used primarily for antipersonnel effects (2 p. 4-25 - 4-26), (7 p. A-12), (12).

It was a central burst, fin stabilized bomb. The bomb was round, with an ogival nose and truncated conical rear section. The body was cast of forged steel. Both double and single suspension lugs were welded to the body. Two lugs, 14 inches apart were provided for double suspension and a single lug was located at the center of gravity for single suspension. The rear section tapered down to about four inches where a threaded extension closed the rear and provided support for the tail fin. A force fitted burster well extended the axial length of the bomb. It fit into a cup brazed inside the bomb rear section, and its nose end had a threaded fuze adapter. The interior coating was phenolic varnish. The tail fin assembly was secured to the bomb by a fin lock nut installed on the external threads of the rear closure extension. The M70A1 was identical with the M70A1 except that the body of the M70 had no interior phenolic varnish coating (2 p. 4-25, 4-26), (3), (5), (7 p. A-12 - A-15), (9 p. 60, 67), (12).

Explosive Train

Upon release from the aircraft, vane rotation armed the fuze. The fuze functioned upon impact and detonated the burster. The burster shattered the bomb and released the fill (7 p. A-12), (9 p. 60, 67), (12).

Fuzing

Bomb, 115-pound, M70, M70A1 - Fuzing		
Fuze	**Note**	**Citation**
AN-M110A1	Nose- authorized alternate (1.0 pound)	2 (p. 4-26), 3, 6 (p. 420), 13 (p. 2-73), 14 (p. 670), 15 (p. 73, 251)
AN-M126	Nose (0.68 pounds)	3
AN-M126A1	Nose (1.1 pounds)	3
AN-M158	Preferred, impact arming vane nose type fuze with M20 detonators	2 (p. 4-26), 7 (p. A-12), 9 (p. 67)
M110	Nose- may be reworked and substituted if required	15 (p. 251)
M126	Nose- arming vane	14 (p. 670-671)
M127	Nose	15 (p. 251)
M159	Nose- impact arming vane with M20 detonators	2 (p. 4-26), 6 (p. 420), 7 (p. A-12), 9 (p. 60, 67), 12

Booster, Adapter-Booster, or Burster

Bomb, 115-pound, M70, M70A1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M10 Burster	0.51 pounds	Tetryl	Used with E46	1 (p. 4-25), 2 (p. 4-26), 3, 7 (p. A-12)
M4 Burster	0.5 pounds	N/A	Used with E46R1	3, 15 (p. 180, 251)

Fills

Bomb, 115-pound, M70, M70A1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
H	57.1-60.7	25.9-27.5	122-128	55.3-59.1	In 1944, H was the only filler for the M70.	6 (p. 420), 8 (p. 1), 14 (p. 676), 15 (p. 180)
HD	60.0-60.6	27.2-27.4	128	58.1	-	1 (p. 4-24, 4-25, B-1), 7 (p. A-12)
L	N/A	N/A	N/A	N/A	-	5, 15 (p. 180), 16 (p. II-2)
NP	N/A	N/A	N/A	N/A	IM could also be used as an incendiary fill.	6 (p. 423)
WP	N/A	N/A	N/A	N/A	-	6 (p. 423)

Shipping/Packing

The M70 bomb was shipped loaded with closing plugs to seal the bomb and to protect the fuze threads. The M70A1 was protected for shipping by shipping bands. Some bombs had lug protectors, which protected the suspension lugs. With shipping bands, the M70A1 weighed approximately 135 pounds and displaced 3.9 cubic feet. With lug protectors the M70A1 weighed approximately 133 pounds and displaced 2.1 cubic feet. The tail fin, burster, fuze, and arming wire were packed separately (3), (7 p. A-14).

Miscellaneous Information

Between 1943 and 1945, 722,968 M70 series bombs were procured to meet Navy and Air Force requirements. In 1943, 128,752 of these bombs were filled with L. Responsibility for the M70 series bombs was transferred to the Chemical Corps' jurisdiction in 1949 and 1950 with 425,438 M70 bombs on hand. During the Korean period, certain stocks were rehabilitated and renovated, 150,000 being transferred to the Navy. Subsequently, the Air Force cancelled all requirements for this munition which resulted in the M70 and M70Al Bombs being designated Standard-C and Standard-A Bu-Ord items respectively by the 1959 CCTC Item 3425. In 1963, the Navy determined that it had no further requirements for certain chemical munitions including the 58,639 M70 Bombs stored at Rocky Mountain Arsenal for which immediate disposal was authorized (11).

Key Dates

Bomb, 115-pound, M70, M70A1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1943	CCTC 881 (H-fill Standard; L-fill substitute Standard)	17 (p. 82)
Obsoleted	1945	CCTC 1461 (M70 L-fill)	18
Standard Modernization	1958	CCTC 3408 (M70A1 HD-Fill to Standard Type and L-fill to Limited Standard for Bureau of Ordnance)	19
Standard Modernization	1959	CCTC 3525 (H-fill to Standard C for Bureau of Ordnance) (M70 Standard-C) (M70A1 Standard-A)	20
Obsoleted	1963	CCTC 4139 (M70 H-fill and M70A1 HD-fill)	11

Sources

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17. Chemical Corps Technical Committee. 1943. CCTC Item # 881, Classification of Fillings for Chemical Munitions. Department of the Army.
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19. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.
20. Chemical Corps Technical Committee. 1958. CCTC Item # 3525, Reclassification of Development and Limited Standard items in Accordance with Revised AR 705-6. Department of the Army.

6.13 Bomb, 125-pound, M113 (T3E2)

Figures

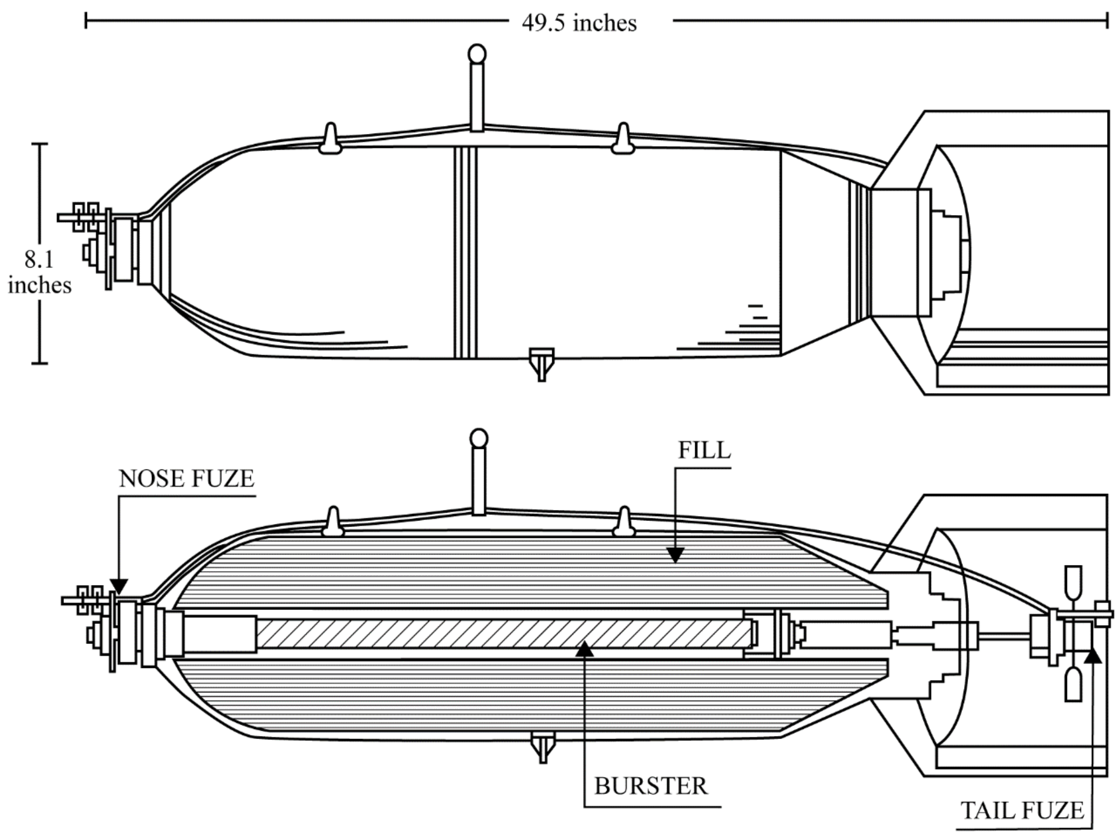

Figure 22: Bomb, 125-pound, M113 (T3E2) - Line Drawing

Specifications

Bomb, 125-pound, M113 (T3E2) - Specifications and Other Data		**Citation**
Historical Name	Bomb, Gas, Persistent HD, 125-Pound, M113 (T3E2)	1 (p. 48)
Type	Bomb	2 (p. B4)
Size	125-pound	3
Conflict	Cold War, WWII	2 (p. B1), 4
Service	Air Force, Navy	2 (p. B2)
Diameter	8 inches (20.32 cm)	2 (p. B2), 5, 6 (p. i)
Length	49.5 inches (125.73 cm)	2 (p. B1), 5, 6 (p. i)
Other Engineering Data	Fin assembly M125 or M125A1. During development, this bomb was designated T3E2, which was a modification of the T3. The adapter-booster M119 was mounted in the internal threads of the rear closure extension. Used fin assembly M125A1 or M125, and arming wire M1A1.	5
Body Construction Material	0.25-inch forged-steel casing	2 (p. F5c)
B/M Dwg	P-74971	7

Bomb, 125-pound, M113 (T3E2)

General Use and Description

The T3E2 125-pound bomb was designed for persistent fills in low-altitude bombing and bombing over wooded areas. It was designed to replace the 115-pound Chemical Bomb M70. Development of this item resulted from the wartime shortage of the M70 and other types of mustard bombs and provided a munition suitable for both mustard and explosive fillings, as required (2 p. B2), (6 p. i).

This bomb was round with an ogival nose and truncated conical rear section. The bomb body was cast or forged steel. Both double and single suspension lugs were welded to the body. The rear section tapered down to about four inches where a threaded extension was welded on to close the rear and provide mountings for both the tail fin and adapter-booster. A nose fuze seating cavity was welded in the nose. An adapter-booster seating cavity was press fitted to the rear closure extension. A burster well extended approximately two-thirds of body axial length between the nose fuze and adapter-booster cavities. Interior coating was phenolic varnish (4), (5)

Explosive Train

Upon bomb release from the aircraft bomb station, arming wires (M1A1) were withdrawn from both fuzes, freeing arming vanes to rotate. Vane rotation in the air stream armed the fuzes. Both fuzes normally functioned on impact, the nose fuze acting faster. The nose fuze normally detonated the burster, but if the nose fuze failed, the tail fuze, through the adapter-booster charge, would set off the burster. The burster shattered the bomb and released the chemical agent (2 p. B3), (5).

Fuzing

Bomb, 125-pound, M113 (T3E2) - Fuzing		
Fuze	**Note**	**Citation**
AN-M100A2	Tail- impact non-delay arming vane type fuze	5, 6 (p. i), 7
AN-M103A1	Nose- impact instantaneous arming vane type	2 (p. B1), 5, 6 (p. i)
AN-M112A1	Tail- delay	2 (p. B2), 6 (p. i)
M160	Tail	2 (p. B2), 6 (p. i)
M163	Nose	6 (p. i), 7

Booster, Adapter-Booster, or Burster

Bomb, 125-pound, M113 (T3E2) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M119 Adapter-booster	N/A	N/A	Used on T3E2 bomb. Available references did not provide weight information.	2 (p. B2), 8 (p. WH 1104)
M125 Burster	N/A	N/A	Used with T3E2 bomb. Available references did not provide weight information.	2 (p. B3)
M25 Burster	1 pound	Tetryl	-	2 (p. B2), 6 (p. 3), 8 (p. WH 1104)
T17 Burster	N/A	N/A	Used with T3E1 adapter-booster. Available references did not provide weight information.	6 (p. i)
T3E1 Adapter-booster	N/A	N/A	Used with T17 burster on T3E2 bomb. Available references did not provide weight information.	6 (p. i)

Bomb, 125-pound, M113 (T3E2)

Fills

Bomb, 125-pound, M113 (T3E2) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	59.0	26.7	141	64.0	-	5
H	55.5-60.1	25.2-27.3	135-151	61.2-68.6	T3E2	6 (p. 4), 9, 10 (p. 47)
HD	59.0-60.2	26.7-273	135-151	61.2-68.5	-	3 (p. 2), 9 (p. 12), 10 (p. 47)
HN-1	N/A	N/A	N/A	N/A	-	10 (p. 47)

Shipping/Packing

The M113 was packaged in shipping rings. The approximate weight was 148 pounds (2 p. B2).

Miscellaneous Information

An estimated 17,600 M113 bombs were procured, 17,332 were on hand when the bomb was standardized in 1949 and, as of 1955, none remained in stock. The HE counterpart to this was designated the 150-lb T2 Bomb and classified similarly (2 p. B1-B2), (6 p. i), (7).

Key Dates

Bomb, 125-pound, M113 (T3E2) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1949	CCTC 1953 (HD-fill)	2 (p. B1), 7
Obsoleted	1955	CCTC 3115	2 (p. B1)

Sources

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6.14 Bomb, 175-pound, Cluster, Generator, M44 (E154)

Figures

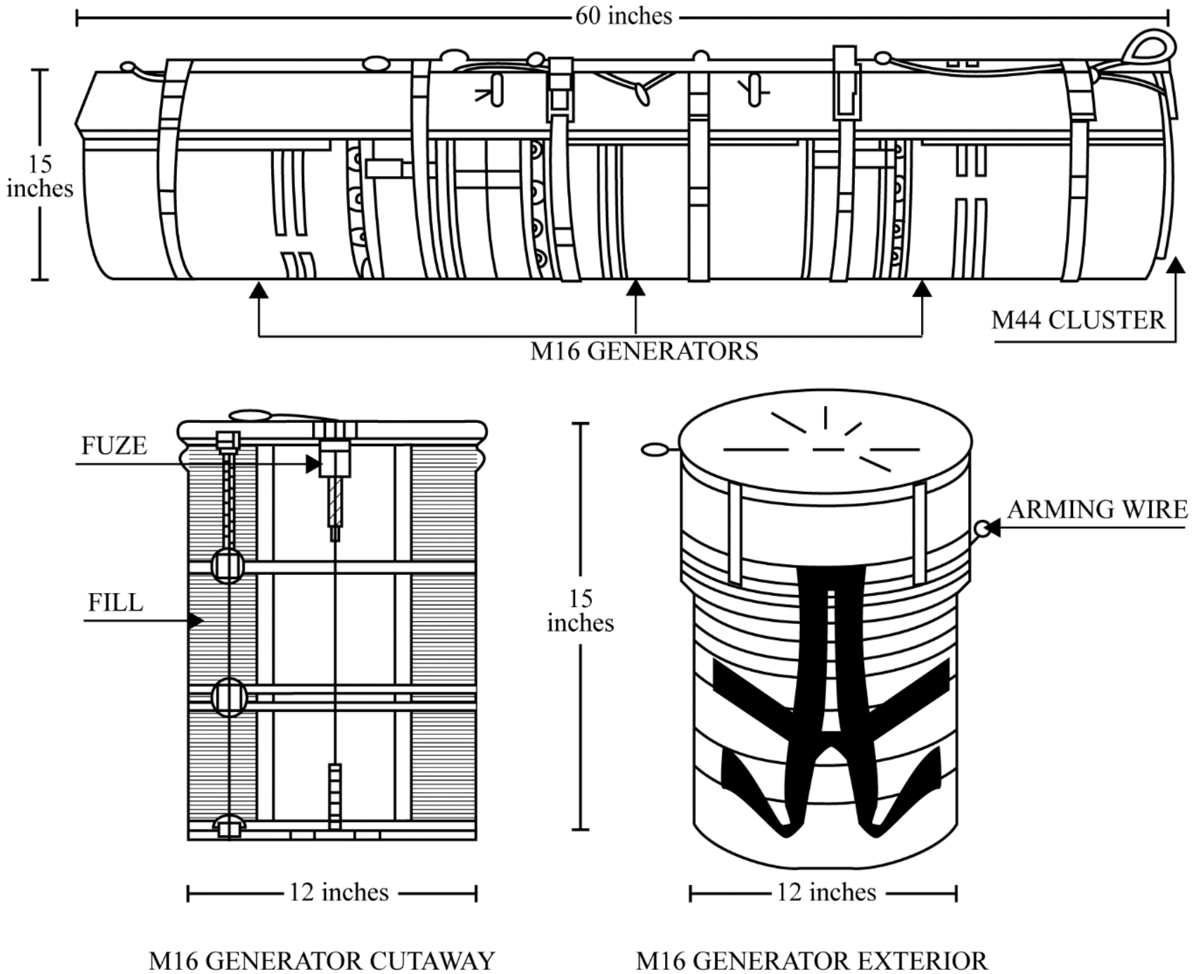

Figure 23: Bomb, 175-pound, Cluster, Generator, M44 (E154) - Line Drawing

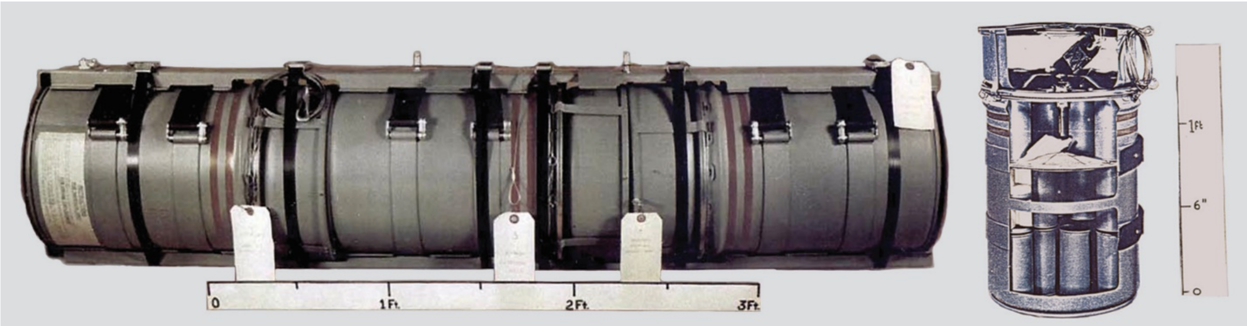

Figure 24: Bomb, 175-pound, Cluster, Generator, M44 (E154) - Photograph, Top: Cluster, Bottom: M16 Generator

Bomb, 175-pound, Cluster, Generator, M44 (E154)

Specifications

Bomb, 175-pound, Cluster, Generator, M44 (E154) - Specifications and Other Data		**Citation**
Historical Name	Cluster, Generator, Incapacitating BZ, 175-Pound, M44 (E154)	1 (p. 52)
Type	Bomb	2 (p. 3)
Size	175-pound	3 (p. 4-47a)
Conflict	Cold War	4 (p. 52)
Service	Air Force, Army	3 (p. 4-47b), 5 (p. cover), 6 (p. 8)
Diameter	15.0-16.16 inches (38.1-41.04 cm) M16 Generator: 12 inches (30.48 cm)	3 (p. 4-47b), 5 (p. 1-7), 7 (p. 3-17)
Length	60 inches (152.4 cm)	3 (p. 4-47b), 5 (p. 1-7), 7 (p. 3-17)
Width	15 inches (38.1 cm)	5 (p. 1-8), 7 (p. 3-17)
Height	15 inches (38.1 cm)	5 (p. 1-7), 7 (p. 3-17)
Other Engineering Data	Parachute: M9 Parachute container: 1 M16 Canister: M6 (42 per M16 generator) Cluster Adapter: M39	3 (p. 4-47b), 5 (p. 1-8), 6 (p. 8), 7 (p. 3-17)
Body Construction Material	Canister M6: cylindrical sheet metal Cluster and generator casings: Low carbon steel	8 (p. 6-1)
B/M Dwg	LM 31-21-11, D336-1-207	5 (p. 1-8), 6 (p. 8)
NSN	1325-00-857-0610	5 (p. 1-8), 6 (p. 8)

General Use and Description

The M44 175-pound generator cluster was designed for aerial delivery of M16 50-pound incapacitating 3-quinuclidinyl benzilate (BZ) generators on selected targets to temporarily incapacitate exposed personnel by slowing mental and physical activity, causing disorientation and hallucinations (3 p. 4-47b), (5 p. 1-7), (6 p. 8), (7 p. 3-17).

The M44 175-pound incapacitating BZ generator cluster consisted of three M16 50-pound incapacitating BZ generators clustered in an M39 generator cluster adapter. The cluster was mounted externally on wing racks and dropped as a cluster, or it could be disassembled and the M16 generators dropped singly. Also, the M16 generator could be used as a ground emplacement.

Each cluster was tagged to simplify the instructions contained on instruction decals for cluster airdrop, individual airdrop, or ground emplacement.

The M16 50-pound incapacitating BZ generator consisted of 42 each M6 incapacitating BZ canisters, arranged in 14-canister tiers, packaged in a pail and fuzed with an M220 fuze. The M16 pail is 12 inches in diameter, 15 inches high and has 14 holes in the top and bottom. An M9 parachute-and-container cluster was released by the fixture on the wing rack causing the branches of the arming wire to pull out of the buckles of the cluster adapter. The steel strapping separates, and the M16 BZ generators fell from the cluster. Canister M6 was a cylindrical sheet-metal container approximately 2.5 inches in diameter and 4.5 inches high. Each canister was filled with a solid mixture of BZ. Each M6 canister is filled with 0.625 pounds of 50/50 agent-pyrotechnic mixture (pyromix) (3 p. 4-47b), (5 p. 1-17), (6 p. 8), (7 p. 3-17), (8 p. 6-7), (9 p. 2-3), (10 p. 2).

Bomb, 175-pound, Cluster, Generator, M44 (E154)

Explosive Train

As the M16 BZ generators fell, the arming wire on the generator pulled free and the parachute separated from the generator. As the parachute opened, the cover of the M220 fuze was pulled from the fuze body, permitting the striker pin to strike the primer, which ignited the first-fire and delay pellets in the delay housing. The delay elements burned for 10-14 seconds; then ignition of the generator was caused by the ignition mixture igniting the igniter pads (3 p. 4-47a), (5 p. 1-7), (6 p. 8), (7 p. 3-17).

Fuzing

Bomb, 175-pound, Cluster, Generator, M44 (E154) - Fuzing		
Fuze	**Note**	**Citation**
M220	Generator - delay fuze	3 (p. 4-47b), 5 (p. 1-8), 7 (p. 3-17)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Bomb, 175-pound, Cluster, Generator, M44 (E154) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BZ	39.4	17.8	175	79.4	42 canisters per generator cluster. Weight shown is per cluster.	5 (p. 1-7), 7 (p. 3-17), 9 (p. 4-4), 10 (p. 6)

Shipping/Packing

They were packed complete on a wooden skid enclosed in plywood. The skid weighed 250 pounds and was 11 cubic feet (5 p. 1-8), (6 p. 8).

Miscellaneous Information

The M44 was designated E154 during development. As of 1982, there were 973 each M44 Generator clusters in the inventory (8 p. 3-1).

Key Dates

Bomb, 175-pound, Cluster, Generator, M44 (E154) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1962	CCTC 3960 (Standard B)	11

Sources

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6.15 Bomb, 500-pound, BLU-52, BLU-52/B, BLU-52A/B

Figures

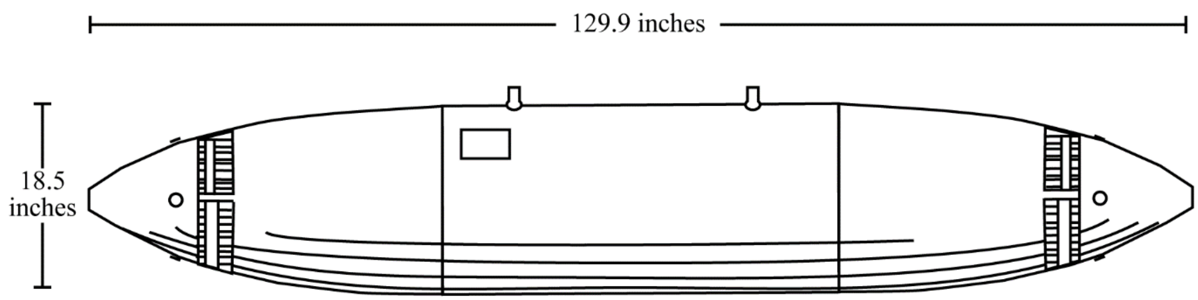

Figure 25: Bomb, 500-pound, BLU-52, BLU-52/B, BLU-52A/B - Line Drawing

Specifications

Bomb, 500-pound, BLU-52, BLU-52/B, BLU-52A/B - Specifications and Other Data		Citation
Historical Name	Bomb, Chemical Warfare, 500-Pound, BLU-52A/B	1 (p. 192)
Type	Bomb	1 (p. 192), 2 (p. 101)
Size	500-pound	1 (p. 192)
Conflict	Cold War, Other	2 (p. 101)
Service	Air Force	3 (p. 2-6)
Diameter	18.5 inches (47 cm)	1 (p. 192), 2 (p. 101), 4 (p. 2)
Length	Body: 130 inches (330 cm) With fins: 145 inches (368 cm)	1 (p. 192), 2 (p. 101), 4 (p. 2)
Other Engineering Data	Bomb casing: BLU-1C/B Igniter: AN-M23A1 Tail fin assembly: MXV-469/B or MXV-393/B	2 (p. 101)
Body Construction Material	Aluminum	2 (p. 101)
FSN	BLU-52/B: 1325-935-6039 BLU-52A/B: 1325-781-9986	2 (p. 102)

General Use and Description

The BLU-52A/B was filled with riot control agent (i.e., 2-chlorobenzalmalononitrile [CS]). The BLU-52/B ad BLU-52A/B, standard Air Force bombs, were designed for delivery by high and certain low performance aircraft (1 p. 192), (2 p. 101), (4 p. 2).

The BLU-52 A/B chemical warfare bomb was a modified BLU 1 C/B fire bomb containing CS-2 riot control agent. The bomb contained no fuze or explosive parts, and the bomb could be fitted with fins. The BLU-52/B was filled with CS1 and the BLU 52A/B was filled with carbon disulphide (CS^2) (1 p. 192), (2 p. 101), (3 p. 4-9).

Explosive Train

The BLU-52 did not have an explosive train, it relied entirely upon the breakup of the case at impact for agent dispersion (2 p. 101))

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Bomb, 500-pound, BLU-52, BLU-52/B, BLU-52A/B - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CS	250-259	113-117	345-347	156-157	BLU-52/B was filled with CS1 and BLU-52A/B was filled with CS2.	1 (p. 192)

Shipping/Packing

The BLU-52 was wrapped in heat-sealed plastic bags, incased in rigid plastic foam that was contained in a wire bound, steel strapped plywood box, which weighed approximately 850 pounds (2 p. 102).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

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2. Commodity Management Office. 1969. Edgewood Arsenal Special Publication, EASP 600-4, Riot-Control-Agent CS, Munitions, and Dispensers (U). Department of the Army.
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6.16 Bomb, 500-pound, EX38

Figures

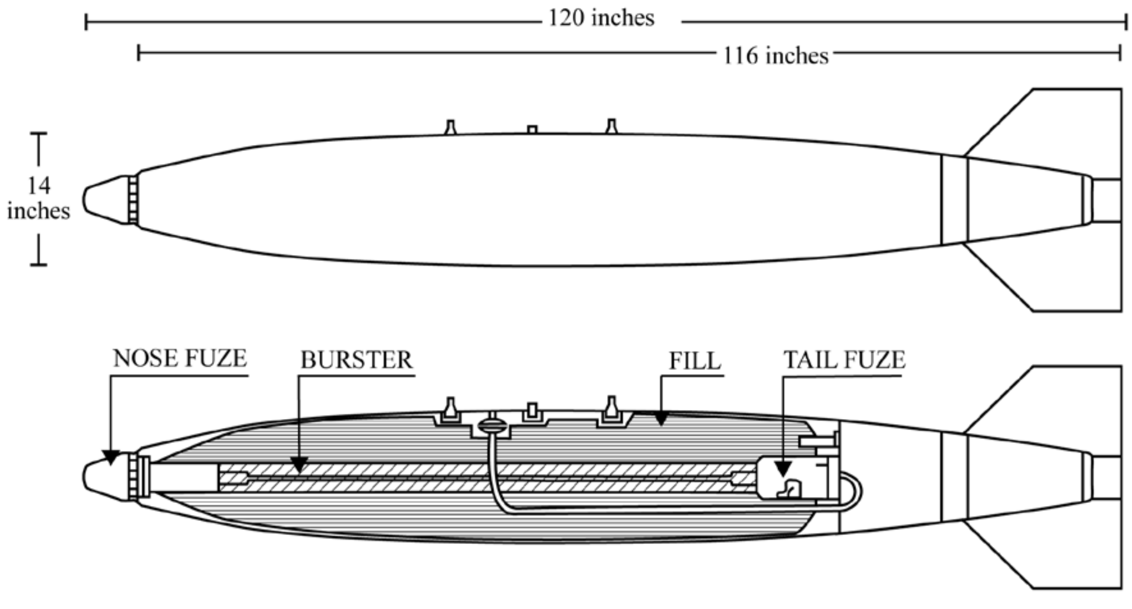

Figure 26: Bomb, 500-pound, EX38 - Line Drawing

Specifications

Bomb, 500-pound, EX38 - Specifications and Other Data		**Citation**
Historical Name	Bomb, Toxic, 500-Pound (VX-GB) EX38	1 (p. 4-27)
Type	Bomb	1 (p. 4-27)
Size	500-pound	1 (p. 4-27)
Conflict	Cold War	2
Service	Navy	1 (p. 4-27), 2 (p. 3)
Diameter	14 inches (35.56 cm)	1 (p. 4-27), 2 (p. 16)
Length	Body: 116 inches (295) With fuze: 120 inches (305 cm)	1 (p. 4-27), 2 (p. 16)
B/M Dwg	CWLR-314-5-3370	1 (p. 4-28)

General Use and Description

The EX38 was designed for carriage and release from carrier based Naval aircraft to provide toxic chemical offensive capability by aircraft (1 p. 4-27), (2).

The EX38 was suitable for carriage and release from high speed, carrier based Navy aircraft. This bomb was a low-drag design of ballistic stability and aimability with accommodations for standard fuzing of impact, variable time (VT), and electrical fuzes. It met design requirements for airborne stores, and was compatible with existing handling and transport equipment, as well as military safety and storage. The system could be set to airburst at 20 to 60 feet altitude or 100 to 160 feet altitude. It could be used with Aero 7A and Aero 20A bomb racks and Aero 3A fuze charging system. Two suspension lugs were located 14 inches apart (1 . 4-27).

Explosive Train

Fuze would initiate explosive burster at selected altitude and disseminate chemical agent (1 p. 4-28).

Fuzing

Bomb, 500-pound, EX38 - Fuzing		
Fuze	**Note**	**Citation**
M20	Nose- variable time	1 (p. 4-28)
M904	Nose- mechanical time	1 (p. 4-28)
M905	Tail- mechanical time	1 (p. 4-28)
M913 (T768)	Electric fuze system	1 (p. 4-28)
M990	Tail- electric	1 (p. 4-28)

Booster, Adapter-Booster, or Burster

Bomb, 500-pound, EX38 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	N/A	N/A	Explosive burster; ground or air.	1 (p. 4-28)

Fills

Bomb, 500-pound, EX38 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	310-314	140-142	514-515	233-234	-	1 (p. 4-28)
VX	310-314	140-142	514-515	233-234	-	1 (p. 4-28)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The EX 38 was designed to replace the MK94 bomb (1 p. 4-28).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

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6.17 Bomb, 500-pound, MK 116 Mod 0, Weteye

Figures

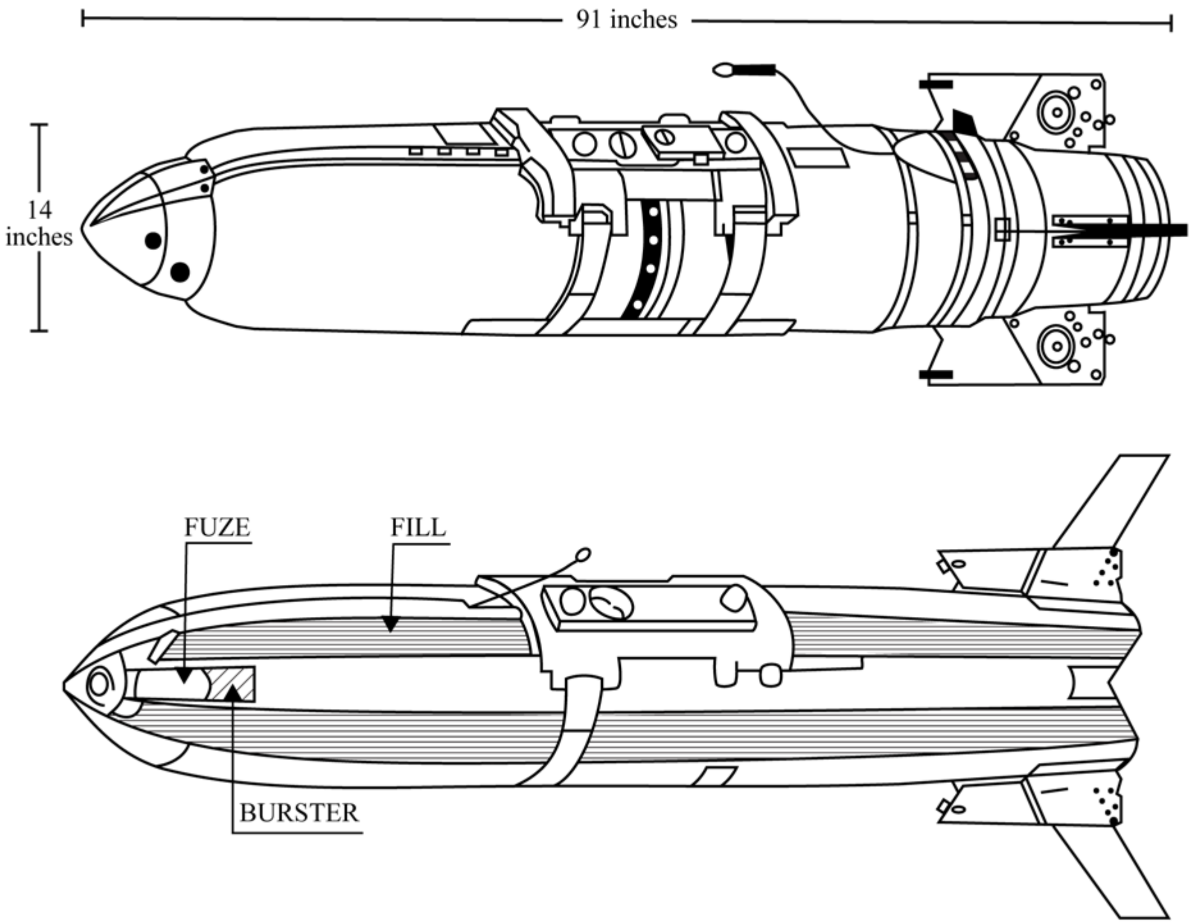

Figure 27: Bomb, 500-pound, MK 116 Mod 0, Weteye - Line Drawing

Figure 28: Bomb, 500-pound, MK 116 Mod 0, Weteye - Photograph - Weteye

Bomb, 500-pound, MK 116 Mod 0, Weteye

Specifications

Bomb, 500-pound, MK 116 Mod 0, Weteye - Specifications and Other Data		Citation
Historical Name	Bomb, Chemical Agent, MK 116 MOD 0 (Weteye)	1 (p. 10-6)
Type	Bomb	2 (p. 4-26), 3 (p. 1-7)
Size	500-pound	2 (p. B-1)
Service	Marine Corps, Navy	4 (p. 1)
Diameter	14 inches (35.56 cm)	1 (p. 10-6), 2 (p. 4-27)
Length	With fins: 91 inches (231.14 cm) Body: 86 inches	1 (p. 10-6), 2 (p. 4-27)
Width	Fins: 35 inches (88.9 cm)	1 (p. 10-6), 5 (p. 2-1)
Body Construction Material	Extruded aluminum, 0.125-inch thick	4 (p. 2), 5 (p. 2-1)
B/M Dwg	LD 270366	1 (p. 10-6)
NSN	1325-00-890-7937	1 (p. 10-6)

General Use and Description

The MK 116 Mod 0, "Weteye" Chemical Bomb was a massive antipersonnel bomb that provided a toxic chemical offensive capability (2 p. 4-26).

Weteye was an antipersonnel bomb capable of dispensing VX or GB chemical agents. The system was designed for maximum safety in shipboard handling and storage. The major components of the Weteye bomb were a nose fairing, forward bulkhead, aft bulkhead, and tail fin assembly. The extendible fin assembly, which was spring loaded, was activated immediately after the bomb was released from the aircraft. Two suspension lugs supported by a heavy strong back made the weapon compatible with the MBR, Aero 7A, and Aero 20A bomb racks.

The bomb shell weighs approximately 75 pounds and is filled with GB. The torpedo-shaped bomb has a single-piece, extruded aluminum shell. A burster tube, 3-1/4 inches in diameter, extends the full length of the bomb and is open at each end. A tail fin/assembly, a suspension assembly, and a counterweight assembly are attached to the exterior of the bomb. This removable hardware weighs 103 pounds. With the hardware attached, the filled Weteye bomb weighs 524 pounds. The interior of the bomb is divided into three separate compartments. A perforated baffle separates the forward and middle compartments. The aft compartment of the Weteye bomb was only partially filled. The incomplete filling of the aft compartment provided a void space to accommodate agent expansion. After filling the bomb, the filling port was permanently sealed.

To provide a VX capability, the bomb was supplied with an M20 fuze, to give a low-burst capability of 20 to 60 feet. An M990C fuze provided high-burst capability of 120 to 160 feet. The bomb contained a central burster consisting of four burster charges (1 p. 10-6), (2 p. 4-26), (6 p. III-1).

Explosive Train

When the bomb was released from the aircraft, the arming wire was withdrawn, allowing the fuze to arm. At the same time, the fin-release wire was withdrawn, activating the spring-tension extendible fins. Upon impact the fuze ignited the burster. The burster exploded the bomb and disseminated the chemical agent (1 p. 10-6).

Bomb, 500-pound, MK 116 Mod 0, Weteye

Fuzing

Bomb, 500-pound, MK 116 Mod 0, Weteye - Fuzing		
Fuze	**Note**	**Citation**
M20	Nose- low-burst	2 (p. 4-27)
M904E2	Nose- mechanical	5 (p. 2-1)
M990C	Nose- high-burst	2 (p. 4-23)
M990D	Nose- electrical	5 (p. 2-1)

Booster, Adapter-Booster, or Burster

Bomb, 500-pound, MK 116 Mod 0, Weteye - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Adapter-booster	0.43 pounds	Tetryl	Adapter-booster	1 (p. 10-6)
Mk 5 Mod 0 - Burster	N/A	Composition B	-	5 (p. 2-2)
Not designated	22 pounds	Composition B	Burster	1, 4 (p. 1, 2)
T45E1 - Adapter-booster	N/A	N/A	-	5 (p. 2-2)

Fills

Bomb, 500-pound, MK 116 Mod 0, Weteye - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	347	157	562	254	-	1 (p. 10-5)
VX	285	129	500	227	Fill weight was estimated based on gross weight.	1 (p. 10-7), 2 (p. 4-27)

Shipping/Packing

The shipping container weighed 327 pounds and was approximately 20 inches wide, 20 inches high and 103 inches long. The shipping container was a steel cylindrical shell that was surrounded by a rectangular frame. The top half of the container was secured by 20 bolts. The shipping container weighed approximately 851 pounds when holding the filled bomb (4 p. 1), (6 p. III-1).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

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6.18 Bomb, 500-pound, M78, AN-M78

Figures

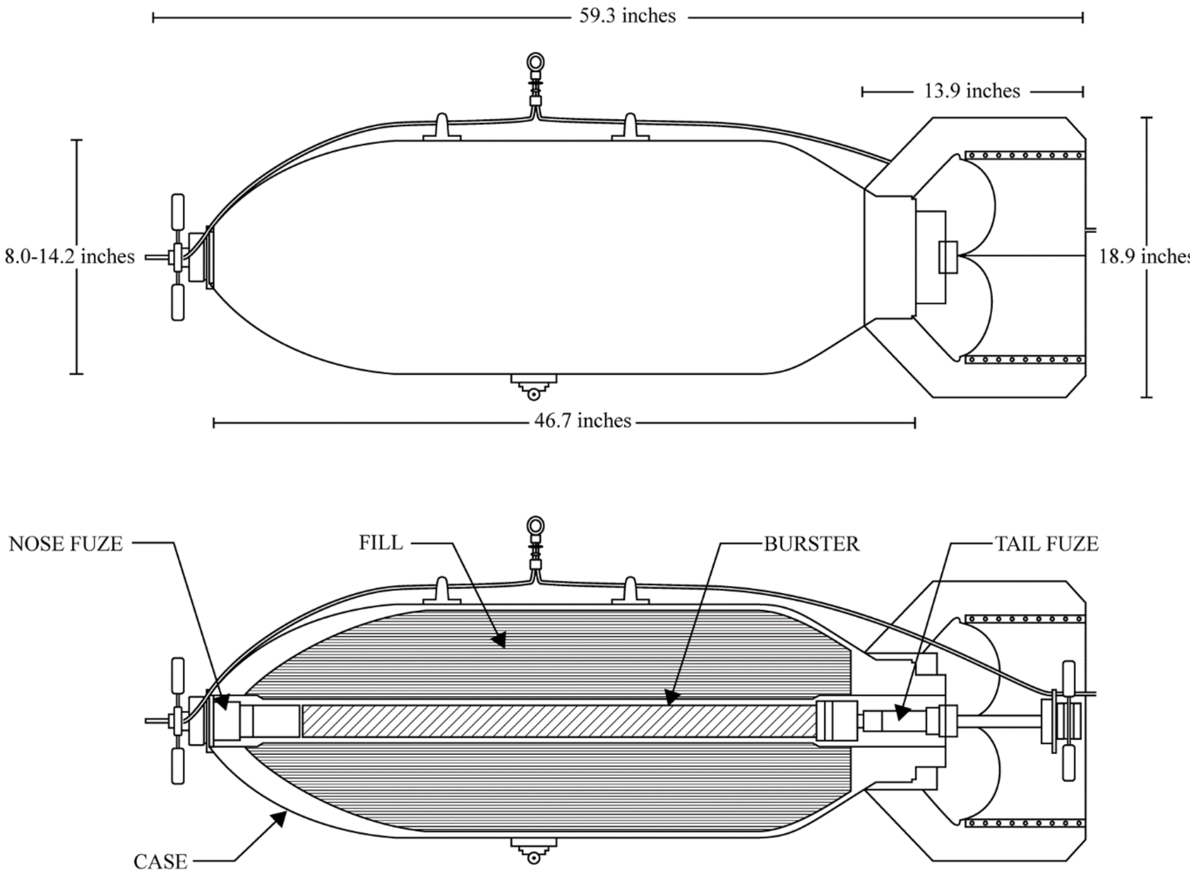

Figure 29: Bomb, 500-pound, M78, AN-M78 - Line Drawing

Figure 30: Bomb, 500-pound, M78, AN-M78 - Photograph

Bomb, 500-pound, M78, AN-M78

Specifications

Bomb, 500-pound, M78, AN-M78 - Specifications and Other Data		Citation
Historical Name	Nonpersistent Gas Bomb, CG or CK, 500-Pound, AN-M78	1 (p. A-15)
Type	Bomb	1 (p. A-15), 2 (p. 28)
Size	500-pound	3 (p. 434)
Conflict	WWII	4
Service	Air Force, Army, Navy	1 (p. A-15)
Diameter	8.0-14.2 inches (20.3-36.1 cm)	1 (p. A-15), 2 (p. 47), 3 (p. 434), 5 (p. 28)
Length	Overall: 59.3 inches (150 cm) Body: 46.7 inches (119 cm) Tail: 13.9 inches (35.3 cm)	1 (p. A-15), 2 (p. 47), 3 (p. 434), 5 (p. 28)
Width	Tail/Fin: 18.9 inches (48 cm)	3 (p. 434)
Other	Wall thickness: 0.3 inch	3 (p. 434)
Other Engineering Data	Fin Assembly model: AN-M109A1, or M109 Arming Wire: M5, M7, or AN-M7A1 type E. The M78 was designated T3E1 during development.	1 (p. A-15, A-17), 2 (p. 47)
Body Construction Material	One-piece cast steel	1 (p. A-15), 6
B/M Dwg	82-0-115	1 (p. A-15)

General Use and Description

The AN-M78 500-pound nonpersistent bomb was designed to provide a toxic chemical offensive capability using chemical agents (e.g., G or CK) (7).

The complete device consisted of a bomb body, filling, a tail fin, a burster, an adapter-booster, a nose fuze, a tail fuze, and an arming wire. The body was one-piece cast steel construction with a tubular burster that extended the entire interior length of the bomb from the threaded fuze adapter in the nose to a threaded hole in the base plate welded to the tail end of the body. The burster was threaded internally at the nose to receive the nose fuze and at the rear to receive the Adapter-Booster M115. The base plug consisted of a special forging welded to the case, containing the Needle Valve M1. The rear section of the bomb tapered down to approximately an eight-inch diameter where a base plate was welded, closing the body. The tail was a standard box-type fin assembly secured to the bomb by a locking nut that threaded onto the base plug. Suspension was by two lugs seven inches on either side of the center of gravity, or by a single suspension lug 180 degrees removed at the center (1 p. A-15), (2 p. 47).

Explosive Train

Detonation of the fuze would set off the burster, which would explode the bomb and disperse the agent. The nose fuze normally detonated the burster but, in the event of malfunction, the tail fuze set off the burster through the adapter- booster charge (1 p. 10-5).

Fuzing

Bomb, 500-pound, M78, AN-M78 - Fuzing		
Fuze	**Note**	**Citation**
AN-M101A1	Tail- substitute	3 (p. 434), 8 (p. 180)
AN-M101A2	Tail- authorized alternative, with primer-detonator, M14, non-delay	1 (p. A-15), 8 (p. 180)
AN-M103	Nose- superquick (authorized alternative)	1 (p. A-17), 3 (p. 424)
AN-M103A1	Nose- authorized alternative	1 (p. A-15, A-17), 2 (p. 47), 3 (p. 434)
AN-M139A1	Nose- authorized alternative	1 (p. A-15), 3 (p. 434)
AN-M140A1	Nose- authorized alternative	1 (p. A-15)
AN-M145A1	Nose - mechanical time (1.6 pound) Used with M117 adapter-booster	1 (p. A-17), 9 (p. 2-139)
AN-M146A1	Used with M117 adapter-booster	1 (p. A-17)
AN-M166	Nose- variable time	1 (p. A-15), 3 (p. 434)
M101A1	Tail- authorized alternative	1 (p. A-17)
M103	Nose	3 (p. 434)
M124	Tail	3 (p. 434), 8 (p. 180)
M127	Nose- Army only with M117 adapter-booster	3 (p. 434)
M128	Nose- Navy only	3 (p. 434)
M135	Nose	3 (p. 434)
M135A1	Nose	3 (p. 434)
M136	Nose	3 (p. 434)
M136A1	Nose	3 (p. 434)
M139	Nose	3 (p. 434)
M139A1	Nose	1 (p. A-15)
M140	Nose	3 (p. 434)
M161	Tail- preferred	3 (p. 434)
M163	Nose- preferred non-delay	1 (p. A-15, A-17)
M164	Nose- authorized alternative	1 (p. A-15)
M165	Nose- authorized alternative	1 (p. A-15)
T504E	Nose- variable time	3 (p. 434)
T82	Nose- variable time	3 (p. 434)

Booster, Adapter-Booster, or Burster

Bomb, 500-pound, M78, AN-M78 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
AN-M15	N/A	N/A	-	1 (p. A-15), 2 (p. 47), 3 (p. 434)
M115 Adapter-booster	N/A	N/A	-	1 (p. A-17)
M115A1 Adapter-booster	N/A	N/A	-	1 (p. A-17)
M117 Adapter-booster	N/A	N/A	-	1 (p. A-17)
M15	2.54 pounds	Tetrytol	-	2 (p. 47), 3 (p. 434), 10 (p. 2)

Bomb, 500-pound, M78, AN-M78

Fills

Bomb, 500-pound, M78, AN-M78 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
AC	100	45.3	383	173	-	3 (p. 434)
CG	205	92.9	488-496	221-224	-	1 (p. A-15), 2 (p. 47), 3 (p. 434), 7
CK	165-176	74.8-79.8	448-467	203-211	-	1 (p. A-15), 2 (p. 47), 3 (p. 434), 7

Shipping/Packing

The AN-M78 bomb was protected for shipping by shipping bands. Shipping bands protected the bomb during shipping and storage. Shipping weight was approximately 472 pounds when CG-filled. The explosive components, arming wire, and fin assembly were packed separately (1 p. A-18).

Key Dates

Bomb, 500-pound, M78, AN-M78 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1943	CCTC 881 (CG and CK-fill, Standard)	11 (p. 82)
Standardized	1944	OCM 23112 and 2884 (M78 (T3E1)	4 (p. 1), 12
Standardized	1958	CCTC 3408 (CG-fill -Standard-Air Force and CK and AC-fill - Ltd Standard-Air Force)	13
Standard Modernization	1959	CCTC 3525 (CK-fill Standard-C-Air Force)	14 (p. 213)
Obsoleted	1960	CCTC 3686 (AC obsoleted)	15
Obsoleted	1963	CCTC 4141 (AN-M78 CG- and CK-fill)	16 (p. D-6)

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6.19 Bomb, 500-pound, MK 94 Mod 0 (EX23, E110)

Figures

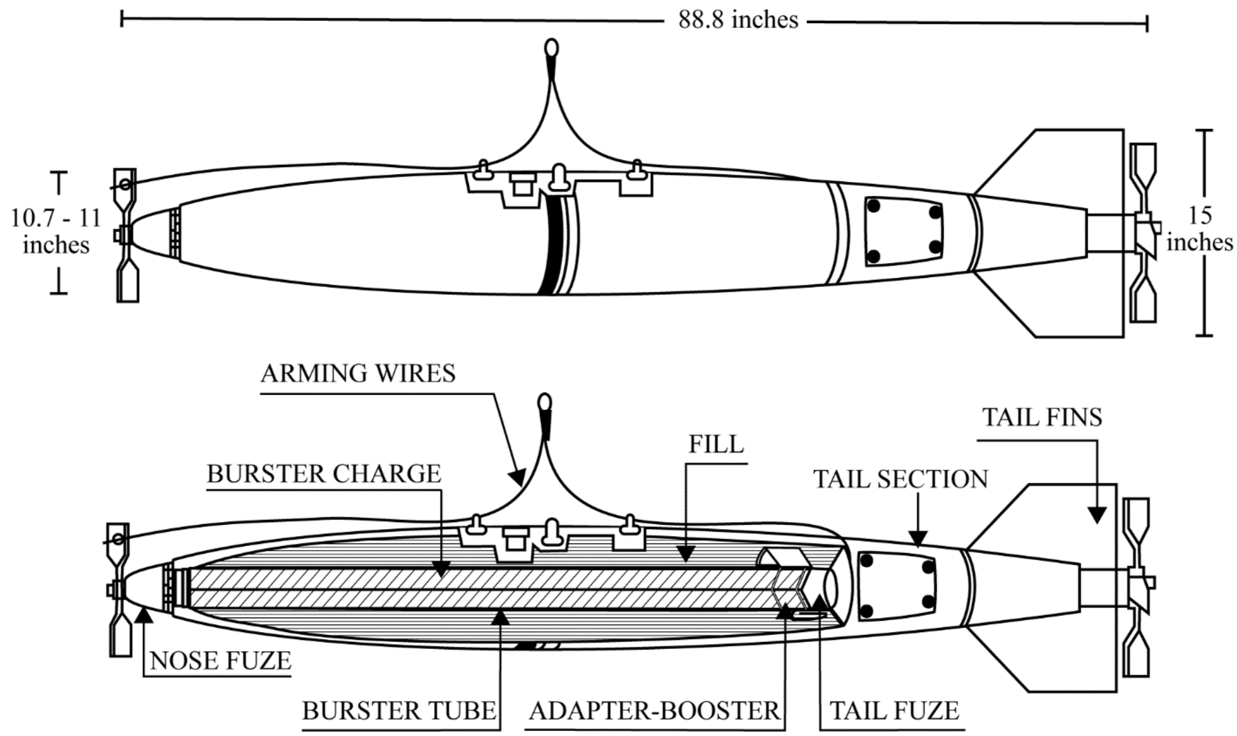

Figure 31: Bomb, 500-pound, MK 94 Mod 0 (EX23, E110) - Line Drawing

Figure 32: Bomb, 500-pound, MK 94 Mod 0 (EX23, E110) - Photograph - Simulated, made from inert MK 82 bomb

Bomb, 500-pound, MK 94 Mod 0 (EX23, E110)

Specifications

Bomb, 500-pound, MK 94 Mod 0 (EX23, E110) - Specifications and Other Data		Citation
Historical Name	Bomb, Gas, Nonpersistent, 500-Pound, MK94 Mod 0 (EX23) (E110)	1 (p. 4-30)
Type	Bomb	1 (p. 4-30), 2 (p. 4-31), 3 (p. 1-7), 4 (p. 16), 5 (p. 4-3), 6 (p. 2-61)
Size	500-pound	2 (p. 4-31), 5 (p. 4-3), 6 (p. 2-61)
Service	Marine Corps, Navy	1 (p. 4-31), 2 (p. 4-32), 4 (p. 16), 7 (p. 8)
Diameter	10.7-11.0 inches (27.3-27.9 cm)	1 (p. 4-31), 3 (p. A-21), 5 (p. 4-3), 6 (p. 2-61)
Length	Fuzed: 88.8 inches (223 cm)	1 (p. 4-31), 2 (p. 4-32), 5 (p. 4-3), 6 (p. 2-61)
Width	Fin Span: 15 inches (38.1 cm)	2 (p. 2-61), 5 (p. 4-3), 6 (p. 2-61)
Other Engineering Data	Arming wire: M6A2, two required Empty bomb weight: 278 pounds Designated EX23 by Navy and E110 by the Army Chemical Corps (ACC) during development.	1 (p. 4-31), 2 (p. 4-32), 5 (p. 4-3), 6 (p. 2-61)
Body Construction Material	Steel	1 (p. 4-30), 2 (p. 4-32)
B/M Dwg	1380220, 1380549, 1380977	2 (p. 4-31), 5 (p. 4-3)
NSN	1325-00-566-0324	7 (p. 30)

General Use and Description

The MK 94 Mod 0 bomb provided a toxic chemical offensive capability (1 p. 4-30), (2 p. 4-31).

The 500-pound nonpersistent GB bomb MK94 Mod 0 was essentially a MK 82 general purpose fin stabilized, low-drag bomb that had been modified for GB filling. The modification consisted largely in the elimination of electric-cable conduits from the low-drag bomb, and adding a burster and a filling hole. The major components of the bomb were the body section, fin assembly, arming wire, nose fuze, long stem tail fuze, burster tube with charge, suspension, and hoisting lugs. The body was of steel construction with minimum wall thickness of 0.4 inches. Two suspension lugs were spaced 14 inches apart, with a hoisting lug located at the center of gravity. The lugs were screwed into the length of the body cavity. The walls at the nose and the tail end of the welded bomb body were internally threaded to receive the burster retainer and the adapter-booster M115A1 respectively. The burster retainer was screwed into the nose after installation of the explosive burster. A nose fuze adapter was then screwed into the nose to accommodate the nose fuze. At the tail end of the body, there was a step of smaller diameter to retain the burster. An M115A1 adapter-booster was then screwed into the aft wall of the body to accommodate the tail fuze.

The filling hole was closed by installation of a steel ball as a primary seal, and a steel plate, resistance welded to the body, as the secondary seal (1 p. 4-30), (2 p. 4-31), (5 p. 4-3), (6 p. 2-61).

Explosive Train

When the bomb was released from the aircraft, the arming wires were withdrawn. This would permit both fuzes to arm. Both the nose fuze and the tail fuze would detonate upon impact. The nose fuze would set off the adapter-booster and the burster, which would explode the bomb and disperse the chemical agent. The tail fuze would act upon impact as back up to detonate the adapter-booster (5 p. 4-6), (6 p. 2-61).

Bomb, 500-pound, MK 94 Mod 0 (EX23, E110)

Fuzing

Bomb, 500-pound, MK 94 Mod 0 (EX23, E110) - Fuzing		
Fuze	**Note**	**Citation**
AN-M103A1	Nose	2 (p. 4-32), 4 (p. 16), 5 (p. 4-3), 6 (p. 2-61)
AN-M139A1	Nose	5 (p. 4-3), 6 (p. 2-61)
AN-M140A1	Nose	5 (p. 4-3), 6 (p. 2-61)
AN-M166E1	Nose- variable time	2 (p. 4-32), 5 (p. 4-3), 6 (p. 2-61)
AN-M168	Nose- variable time	5 (p. 4-3), 6 (p. 2-61)
AN-M195	Tail- impact	2 (p. 4-32), 4 (p. 16), 5 (p. 4-3), 6 (p. 2-61)
M163	Nose	6 (p. 2-61)
M164	Nose	6 (p. 2-61)
M165	Nose	6 (p. 2-61)
M188	Nose- variable time	6 (p. 2-61)
MK243	Nose	1 (p. 4-31), 2 (p. 4-32), 5 (p. 4-3), 6 (p. 2-61)

Booster, Adapter-Booster, or Burster

Bomb, 500-pound, MK 94 Mod 0 (EX23, E110) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Burster not designated	16.1 pounds	HBX-1	-	2 (p. 4-32), 6 (p. 2-61)
M115A1 Adapter-booster	N/A	N/A	-	1 (p. 4-31), 2 (p. 4-32), 5 (p. 4-3), 6 (p. 2-61)

Fills

Bomb, 500-pound, MK 94 Mod 0 (EX23, E110) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	108-110	48.9-50.0	441	200	-	1 (p. 4-30), 2 (p. 4-31), 3 (p. 1-7, A-21), 4 (p. 16), 5 (p. 4-3), 6 (p. 2-61), 8 (p. 90)

Shipping/Packing

One bomb was shipped on a pallet with a weight of 414 pounds. Six pallets could be shipped in a container (3 p. 4-12), (5 p. 4-6), (7 p. 30).

Miscellaneous Information

The MK 96 Mod 0 was designated EX23 by Navy and E110 by ACC during development. The bomb was released for production in 1958 (1 p. 4-31), (2 p. 4-32).

Key Dates

Bomb, 500-pound, MK 94 Mod 0 (EX23, E110) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Developed	1953	Designated EX23 by Navy and E110 by ACC	2 (p. 4-32)
Production	1958	-	2 (p. 4-32)

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6.20 Bomb, 750-pound, Cluster, CBU-5/B (M43)

Figures

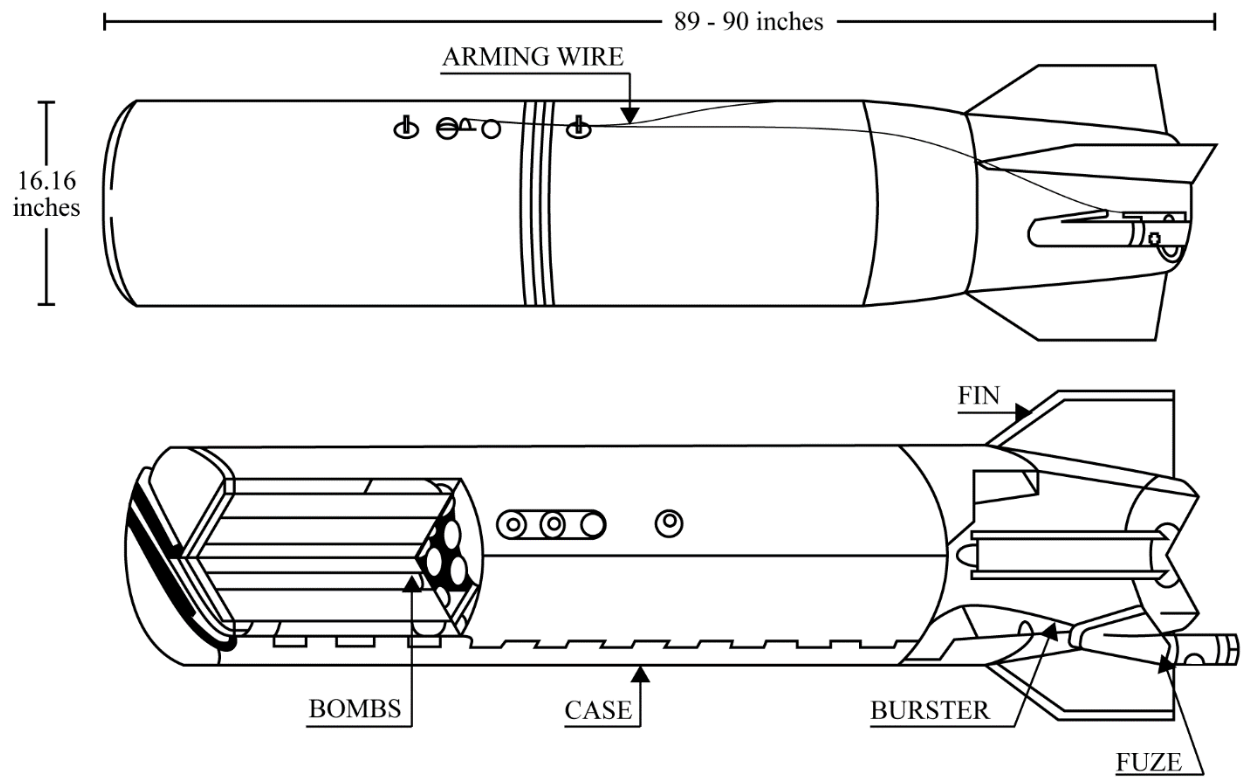

Figure 33: Bomb, 750-pound, Cluster, CBU-5/B (M43) - Line Drawing

Figure 34: Bomb, 750-pound, Cluster, CBU-5/B (M43) - Photograph, Top: Intact, Bottom: Cluster

Bomb, 750-pound, Cluster, CBU-5/B (M43)

Specifications

Bomb, 750-pound, Cluster, CBU-5/B (M43) - Specifications and Other Data		Citation
Historical Name	Cluster, Chemical, Bomb, 750 pounds, CBU-5/B (M-43)	1 (p. 2)
Type	Bomb	2 (p. 4-46)
Size	750-pound	3 (p. 7), 4 (p. 4), 5 (p. 7)
Conflict	Cold War	
Service	Air Force, Army, Navy	2 (p. iv, 4-47), 3 (p. 7), 5 (p. 7), 6 (p. 17)
Diameter	16-16.16 inches (40.64-41.04 cm)	2 (p. 4-47), 7 (p. 1-6), 8 (p. 3-14)
Length	89-90 inches (226.06-228.6 cm) with tail fin assembly	2 (p. 4-47), 7 (p. 1-6), 8 (p. 3-14)
Other Engineering Data	Generator: M16 (3 each) Cluster adapter: M30, M39 Tail Assembly: M14 or E12R2 In development, cluster was E153, bomb was E135. Alternate Tail: E12R2	2 (p. 4-47), 4 (p. 5)
Body Construction Material	Cluster and submunition casings: low carbon steel	9 (p. 6-1)
Spec/PD No	196-131-780A	3 (p. 7)
B/M Dwg	D14-23-1468, D14-5-2309, DL 14-23-1467	2 (p. 4-47), 7 (p. 1-6)
NSN	Complete: 1325-00-857-0611, Without fuze, fin, and wire: 1325-00-857-0024	7 (p. 1-6)

General Use and Description

The CBU-5/B and M-43 cluster bomb (E153) was designed to provide the capability for air delivery of incapacitating chemical agents (2, p. 4-46). The CBU-5/B cluster is essentially an M43 cluster modified for external carriage on high performance aircraft. The modification consisted of adding an ogive nose, strengthening the tailfin assembly, and replacing the external arming wire by an internal arming wire (2 p. 4-46), (10 p. 2-3).

The CBU-5/B Cluster (M43), consisted of an M30 cluster adapter and 57 M138 BZ bombs. The cluster adapter consisted of upper and lower casing assemblies; during the clustering procedure, these were mated and sealed with an internal gasket. Nineteen bombs were clustered in each of three longitudinal compartments inside the casing; the clustered bombs were separated by spacers during assembly of the cluster. Two suspension lugs were screwed into the two outer threaded holes in the upper casing assembly.

The M138 BZ bomb was a thermal generator munition consisting of four M7 canisters, each with 0.37 pounds of BZ in a 50/50 pyrotechnic mixture, nested in a tubular steel bomb casing, which had been crimped to hold the canister in place. The canisters that contained BZ agent were aligned within the casing. Each bomb was fuzed with an E8R8 bomb fuze, which was screwed into the end of the bomb. This was an all-ways impact fuze of the direct-arming pin type. The arming pin was depressed and the safety wire withdrawn during clustering; the pin was held in the depressed position by the spacers within the cluster.

A complete round consisted of an M14 tail assembly, two M152A1 tail fuzes, an M23 arming wire, an M43 bomb cluster, and suspension lugs (2 p. 4-46), (7 p. 1-5), (10 p. 2-3).

Bomb, 750-pound, Cluster, CBU-5/B (M43)

Explosive Train

When the cluster M43 was released from the aircraft, the arming wire assembly M23 would be withdrawn, the arming vanes of the fuze would rotate in the airstream, and the fuzes would be armed. After the preset time, one or both fuzes would function and detonate the burster, which would break the straps holding the cluster together. When the cluster opened the bomblets would fall individually to the target where they would function as designed (7 p. 1-5), (9 p. 6-2).

Fuzing

Bomb, 750-pound, Cluster, CBU-5/B (M43) - Fuzing		
Fuze	**Note**	**Citation**
M152A1	Tail- two each, delay arming, combination mechanical time and impact	2 (p. 4-47), 7 (p. 1-6)
M908	2 each	8 (p. 3-14)
M909	Tail	7 (p. 1-6)

Booster, Adapter-Booster, or Burster

Bomb, 750-pound, Cluster, CBU-5/B (M43) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Detonating Cord	0.16 pounds	pentaerythritol tetranitrate (PETN)	-	8 (p. 3-14), 9 (p. 6-2)

Fills

Bomb, 750-pound, Cluster, CBU-5/B (M43) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BZ	86.0	39.0	800	363	57 M138 bomblets clustered in M43 bomb.	2 (p. 4-46), 3 (p. 7), 4 (p. 4), 6 (p. 17), 7 (p. 3-15), 8 (p. 3-14), 10 (p. 2-3)

Shipping/Packing

The bombs were packed one per crate. Each crate weighed 900 pounds (3 p. 7).

Miscellaneous Information

During development, the cluster was designated E153 and the bomblet was designated E135. As of 1982, there were 518 each M43 bomb clusters in the inventory (2 p. 4-47), (4 p. 5), (7 p. 1-5), (9 p. 3-1).

Key Dates

Bomb, 750-pound, Cluster, CBU-5/B (M43) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1962	CCTC 3960 (Standard B)	2 (p. 4-47), 11

Sources

1. Yeager, Kurt E. 1963. Test of M-43 Cluster Bomb, Aerospace Internal Data Report No. 63-28. Department of the Air Force.

2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

3. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

4. Test and Evaluation Command. 1964. Dugway Proving Ground Trial Report, DPGTR 384, Hazard Classification Test for Storage, Handling, and Disposal of M43 Bomb Cluster, BZ-Filled, 750-lb, and M44 Generator Cluster, BZ-Filled, 175-lb, USATECOM Project No. 5-3-0130-01. U.S. Army.

5. Chemical Branch. 1964. Dugway Proving Ground Trial Record, DPGTR 394, Engineering Test of USAF [U.S. Air Force] Cluster, Aimable, 750-lb, Incapacitating, BZ, CBU-5/B (Dissemination Phase), 656B (U). APGC (PGKK) Eglin AFB.

6. Departments of the Army, Navy, and Air Force. 1966. Field Manual, FM 3-10, Employment of Chemical and Biological Agents. Department of the Army.

7. Department of the Army. 1982. Technical Manual, TM 43-0001-26-2, Army Equipment Data Sheets, Chemical Weapons and Munitions. U.S. Government Printing Office.

8. Departments of the Army, Navy, and Air Force. 1966. Technical Manual, TM 9-1325-200/Ordnance Pamphlet, OP 3530/Technical Order, TO 11-1-28, Bombs and Bomb Components. U.S. Government Printing Office.

9. Battelle, Columbus Laboratories. 1982. BZ Desk Reference, Contract DAAK 11-81-C-0080, CBRNIAC-CB-018474, Revised March 22. U.S. Army.

10. Deseret Test Center. 1972. Joint [Chemical- Biological] CB Technical Data Source Book (U), Volume II, Riot Control and Incapacitating Agents (U), Part Three: Agent BZ (U). U.S. Army.

11. Chemical Corps Technical Committee. 1962. CCTC Item # 3960, Classification of Cluster, Bomb, Incapacitating BZ, 750-lb., M43 (E153); Cluster Generator, Incapacitating BZ, 175-lb, M44 ([E]154); and Incapacitating Agent, BZ as Standard-B Types. Department of the Army.

6.21 Bomb, 750-pound, MC-1

Figures

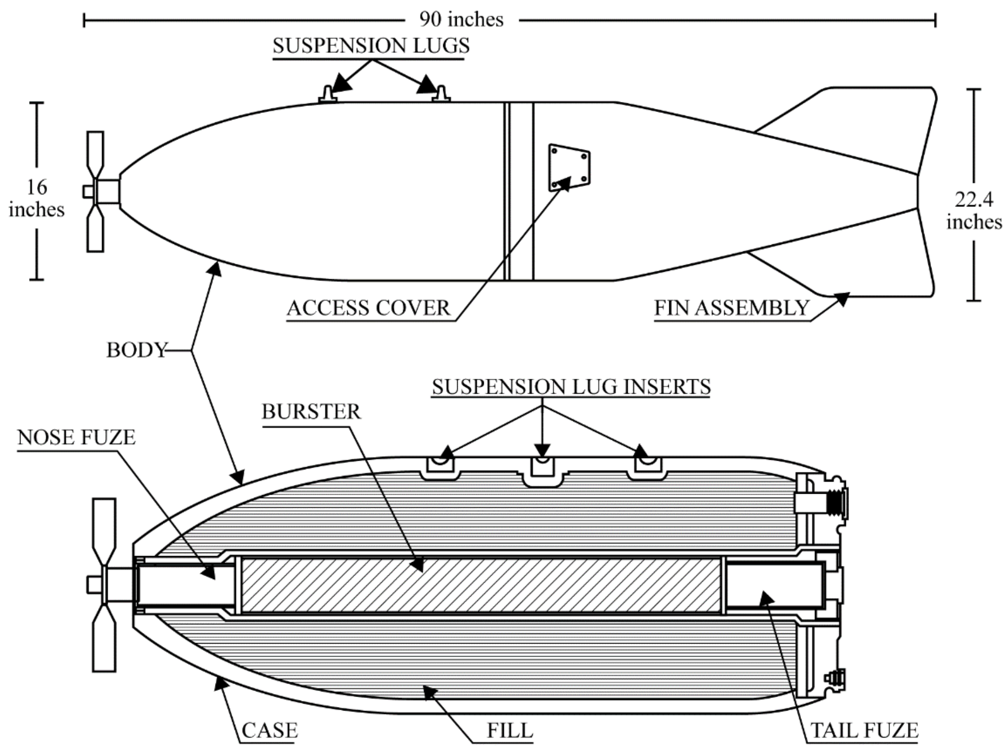

Figure 35: Bomb, 750-pound, MC-1 - Line Drawing

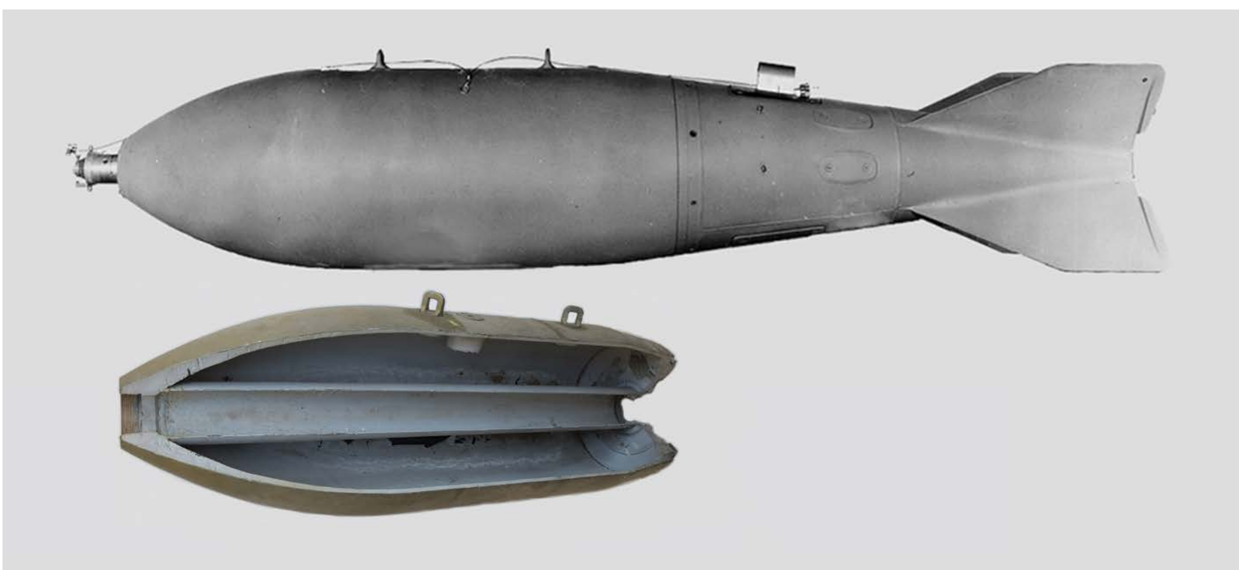

Figure 36: Bomb, 750-pound, MC-1 - Photograph - Top: Intact, Bottom: Cutaway View, Simulated, made from inert M117

Specifications

Bomb, 750-pound, MC-1 - Specifications and Other Data		Citation
Historical Name	Bomb, Gas: Nonpersistent, GB, 750-Pound, MC-1	1 (p. 2-62)
Type	Bomb	2 (p. 4-33), 3 (p. 4-32), 4 (p. 30)
Size	750-pound	2 (p. 4-34), 3 (p. 4-33), 4 (p. 30), 5 (p. 3)
Conflict	Cold War	6 (p. N1)
Service	Air Force	2 (p. 4-33), 3 (p. 4-33), 4 (p. 30), 5 (p. 3), 7 (p. 16)
Diameter	16 inches (40.64 cm)	1 (p. 2-62), 2 (p. 4-34), 3 (p. 4-32)
Length	90 inches (228.6 cm)	1 (p. 2-62), 2 (p. 4-34), 3 (p. 4-33)
Width	Fin span: 22.4 inches (56.9 cm)	1 (p. 2-62)
Other Engineering Data	Fin Assembly: M131 (T152E2)	2 (p. 4-34), 3 (p. 4-33)
B/M Dwg	CMLC: 14-5-2735	2 (p. 4-34), 3 (p. 4-33)
NSN	1325-716-1444, 1325-554-1173	4 (p. 30)

General Use and Description

The MC-1 750-pound bomb was used to provide toxic chemical offensive capability. The bomb was designed for internal or external carriage on bomber and fighter-bomber aircraft utilizing single or double lug suspension for release at altitudes up to 60,000 feet, and air speeds up to 600 knots. It was a general-purpose bomb M117 modified to accommodate a liquid chemical filler and a burster (2 p. 4-33).

The MC-1 bomb was essentially a M117-GP demolition bomb modified for a liquid chemical filler and burster. The complete bomb consisted of a body, fin assembly, one arming wire, three suspension lugs, a nose fuze, adapter-boosters, burster, filling agent, and a tail fuze, which included a tail fuze drive with a flex coupling that connected the drive to the tail fuze. The bomb body was round in a cross section with an ogival nose and truncated conical tail. A burster tube was welded to the body at the nose end and into a hole in the base plate at the rear. The burster tube was internally threaded at each end and was fitted with fuze wells. The burster was a tubular fiberboard container filled with Composition B and closed by metal end caps. It was installed in the burster tube when the bomb was assembled. For use with one or two lug suspensions on Air Force bomber and fighter-bomber type aircraft (2 p. 4-33), (3 p. 4-32).

Explosive Train

The fuzes armed when the bomb was released from the aircraft. When the bomb impacted, the fuzes functioned and detonated the adapter-boosters which in turn detonated the burster. The burster ruptured the bomb body and disseminated the filler (1 p. 2-63).

Bomb, 750-pound, MC-1

Fuzing

Bomb, 750-pound, MC-1 - Fuzing		
Fuze	**Note**	**Citation**
AN-M103A1	Nose	1 (p. 2-62)
AN-M139A1	Nose	1 (p. 2-62)
AN-M140A1	Nose	1 (p. 2-62)
M163	Nose	1 (p. 2-62)
M164	Nose	1 (p. 2-62)
M165	Nose	1 (p. 2-62)
M190	Tail	1 (p. 2-62)
M904 (T709E3)	Nose	2 (p. 4-34), 3 (p. 4-33)
M904E1	Nose	1 (p. 2-62)
M904E2	Nose	1 (p. 2-62)
M905 (T771E4)	Tail - with T25E6 tail fuze drive assembly and T40 flexible coupling	1 (p. 2-62), 3 (p. 4-33)

Booster, Adapter-Booster, or Burster

Bomb, 750-pound, MC-1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M126A1 (T45E1) Adapter-Booster	N/A	N/A	-	1 (p. 2-62)
M32	14.5 pounds	Composition B	-	1 (p. 2-62)
T45E1 Adapter-Booster	5.6 ounces	Composition C-3	Nose	5 (p. 18)
T6E4 Adapter-Booster	7.24 ounces	Composition C-3	Tail	1 (p. 2-62), 5 (p. 18)

Fills

Bomb, 750-pound, MC-1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	220	99.7	710-725	332-328	-	2 (p. 4-34), 3 (p. 4-33), 5 (p. 3), 8 (p. 1-7)

Shipping/Packing

The EX38 was shipped without fuzing components, weighed 625 pounds, and displaced 4.6 cubic feet (4 p. 30).

Miscellaneous Information

This bomb replaced the M78 and M79 bombs (2 p. 4-34), (3 p. 4-33).

Key Dates

Bomb, 750-pound, MC-1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1959	CCTC 3524	4 (p. 30), 6 (p. N1)

Sources

1. Departments of the Army, Navy, and Air Force. 1966. Technical Manual, TM 9-1325-200/Ordnance Pamphlet, OP 3530/Technical Order, TO 11-1-28, Bombs and Bomb Components. U.S. Government Printing Office.

2. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

3. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

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5. CW Branch. 1958. Dugway Proving Ground Report, DPGR 219, Final Development Testing of the MC-1 USAF 750-Pound Toxic Bomb (U). U.S. Army Chemical Corps Research and Development Command.

6. Chemical Corps Technical Committee. 1958. CCTC Item # 3524, Subject: Classification of Bomb, Gas, Nonpersistent GB, 750 lbs., MC-1 as Standard-A, USAF Type. Department of the Army.

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6.22 Bomb, 1,000-pound, T2

Figures

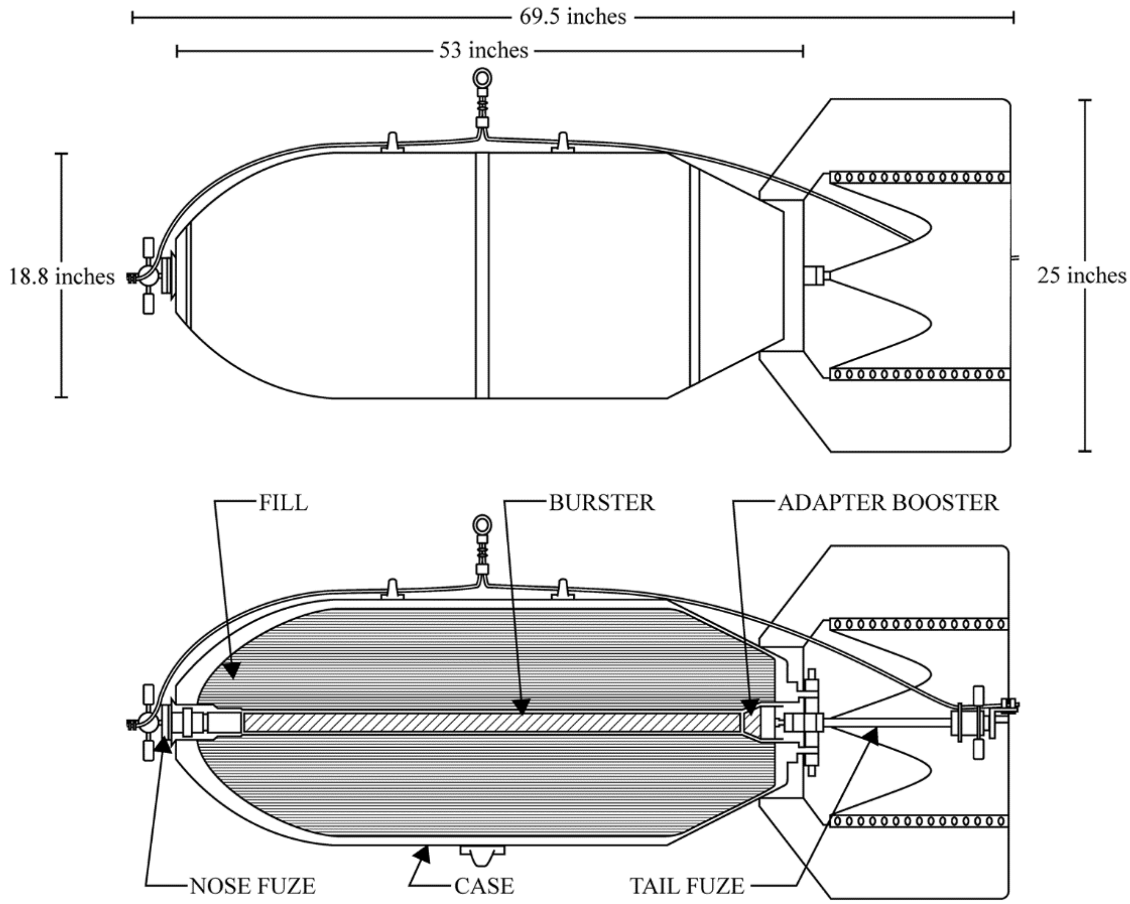

Figure 37: Bomb, 1,000-pound, T2 - Line Drawing

Figure 38: Bomb, 1,000-pound, T2 - Photograph

Bomb, 1,000-pound, T2

Specifications

Bomb, 1,000-pound, T2 - Specifications and Other Data		**Citation**
Historical Name	T2 1000-Pound Chemical Bomb	1 (p. 1)
Type	Bomb	1 (p. 1)
Size	1,000-pound	1 (p. 1)
Conflict	WWII	1 (p. 1)
Service	Navy	1
Diameter	18.9 inches (48.01 cm)	1 (p. 1)
Length	Overall: 69.5 inches (175.26 cm) Body: 53.0 (135 cm)	1 (p. 1)
Width	Fin: 25 inches (63.5 cm)	1 (p. 7)
Other	Empty weight: 490 pounds (222 kg)	1 (p. 1)
B/M Dwg	395185	1

General Use and Description

The 1,000-pound T2 chemical bomb was intended to be filled with various chemicals, principally nonpersistent toxic agents, which required large quantities to obtain concentrations that would be lethal to personnel (1 p. 1).

The T2 1000-pound chemical bomb was essentially an AN-M65 1,000-pound general purpose bomb modified for chemical filling. It had a bursting charge sufficient to break the body into a few large pieces and to disperse the filler, and it was adapted for both a nose and 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 1.5-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 insure a tight seal. The filling holes were located diametrically opposite the two double suspension lugs. The test hole was midway between the filling hole and the single suspension lug.

The burster well was a steel tube welded into the tail plug of the bomb and to the nose of the bomb. The tail plug was screwed into the bomb and welded. The box-type fin assembly was the same as was used with the AN-M65 1,000-pound general purpose bomb.

The AC loaded bombs were equipped with a special plug that contained a sampling valve, in place of the forward 1.5-inch plug in the side of the bomb. The valve was flush with the bomb surface. The T2 bomb differs from the M79 bomb mainly in the location and type of filling holes, in the method of assembling the full length burster well, and in the adapter-booster (1 p. 1, 11).

Explosive Train

Available references did not provide specific information on explosive train (1 p. 1).

Fuzing

Bomb, 1,000-pound, T2 - Fuzing		
Fuze	**Note**	**Citation**
AN-M102A1	Alternative	1
AN-M102A2	Tail	1 (p. 2)
AN-M103	Nose	1 (p. 2)
AN-MK 219 bomb fuze	Used with MK 219 fuze adapter and MK 4 auxiliary booster	1 (p. 1), 2 (p. 2-247)

Bomb, 1,000-pound, T2

Booster, Adapter-Booster, or Burster

Bomb, 1,000-pound, T2 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M102 Adapter-booster	N/A	N/A	-	1 (p. 2)
M16 Burster	4.29 pounds	Tetrytol	-	3
T2	4.45 pounds	Cast tetrytol	The T2 had a 1.75-inch diameter and were 41.97 inches long.	1 (p. 2)

Fills

Bomb, 1,000-pound, T2 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
AC	208	94.3	707	320	-	1 (p. 6, 52)
CG	428	194	923	418	-	1 (p. 6, 52)
CK	370	167	860	390	Filled as CC	1 (p. 1)
DP (diphosgene)	N/A	N/A	N/A	N/A	-	1 (p. 1)
H	N/A	N/A	N/A	N/A	-	1 (p. 1), 4 (p. II-2)
L	N/A	N/A	N/A	N/A	-	1 (p. 1)

Shipping/Packing

The T2 bomb body, suspension lugs, and filling holes were protected during shipment by metal shipping bands. The tail fin assernb1y, fuzes, and arming wire assembly were shipped together in a crate, separately from the bomb body. The filled bomb was shipped from naval ammunition depots with the high explosive burster, the adapter-booster, and the fuze seat liner installed, and with the shipping plugs screwed into the fuze cavities at both ends of the bomb (1 p. 14).

Miscellaneous Information

As of 1948, the Bomb, chemical, 1,000 lb., T2 filled with AC, CG and H were listed as “unauthorized CML C Items” (4 p. II-2).

Key Dates

Bomb, 1,000-pound, T2 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1944	OCM Item 22844	5 (p. 4)

Sources

1. Bureau of Ordnance. 1943. Ordnance Pamphlet, OP 1030, Nonpersistent Gas Munitions. Department of the Navy.
2. Department of Defense. 1982. Military Handbook, MIL-HDBK-146, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146. Department of Defense.
3. Dugway Proving Ground. 1944. Dugway Proving Ground Memorandum Report, DPGMR No. 18, 500-LB, 1000-LB, 2000-LB, and 4000-LB Bombs filled with Nonpersistent Agents. U.S. Army.
4. Office of the Chief Chemical Corps. 1948. Disposition of Chemical Corps Items, Department of the Army. U.S. Army.
5. Ordnance Committee. 1944. Ordnance Committee Meeting, OCM Item # 22844, Bomb, Chemical, 1000-LB., M79 (T3E1), Burster M16, and Valve, Needle M1: - Standardization. Ordnance Department.

6.23 Bomb, 1,000-pound, Cluster, M34 (E101R3), M34A1 (E101R5)

Figures

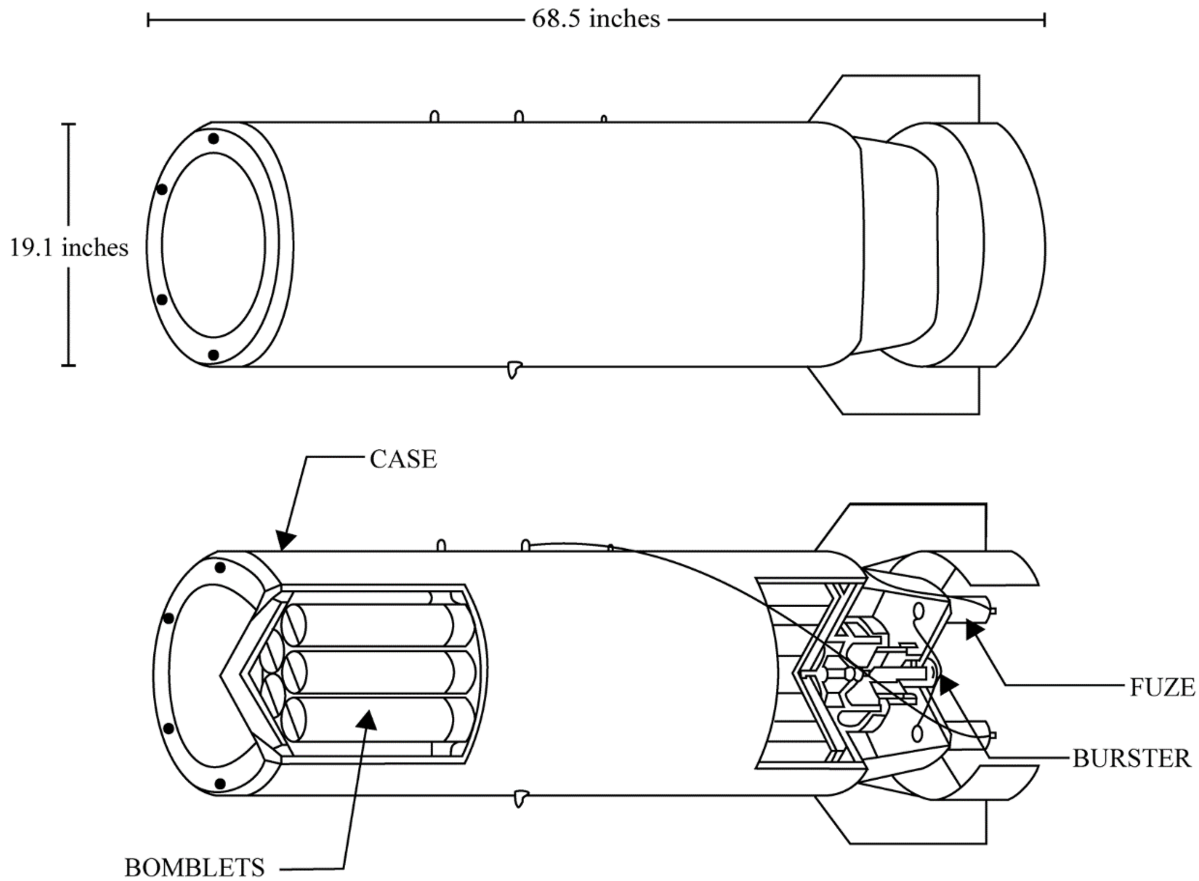

Figure 39: Bomb, 1,000-pound, Cluster, M34 (E101R3), M34A1 (E101R5) - Line Drawing

Bomb, 1,000-pound, Cluster, M34 (E101R3), M34A1 (E101R5)

Specifications

Bomb, 1,000-pound, Cluster, M34 (E101R3), M34A1 (E101R5) - Specifications and Other Data		**Citation**
Historical Name	Cluster, Gas Bomb, Nonpersistent GB, 1000-Pound, M34 (E101R3) and M34A1 (E101R5)	1
Type	Bomb	2 (p. 4-50), 3 (p. 3-12)
Size	1,000-pound	4 (p. 4-49), 5 (p. 50), 6 (p. 5)
Service	Air Force	2 (p. 4-50), 4 (p. 4-49)
Diameter	19.1 inches (48.6 cm)	2 (p. 4-51), 3 (p. 3-12)
Length	68.5 inches (174 cm)	2 (p. 4-51), 3 (p. 3-13)
Other Engineering Data	The M34 used Fin Assembly M13, cluster adapter M29, and M22 Type B Arming Wire. During development, the M34A1 was designated E101R3 and the M34A1 was designated E101R5.	1, 2 (p. 4-50), 3 (p. 3-13), 4 (p. 4-50)
Body Construction Material	Steel	4 (p. 4-50)
Propellant	Ejection Cartridges: M3 (4 required)	2 (p. 4-51), 3 (p. 3-13)
Spec/PD No	C14-23-1080 (M34) D14-23-1533 (M34A1)	

General Use and Description

The M34 and M34A1 GB 1,000-pound cluster bomb provided toxic chemical offensive capability (2 p. 4-50), (4 p. 4-49).

The M34A1 bomb cluster consisted of cluster adapter M29 filled with 76 M125A1 nonpersistent chemical agent bombs and fitted with four M3 cluster-ejection cartridges, two fuzes, and an arming wire. The M125A1 were loaded into cluster adapter M29 in four bundles of 19 bombs each. The bombs were arranged in the bundles in such a way that the arming bar on each bomb was depressed by an adjacent bomb. M34 was identical to the M34A1 except that the M34 used M125 bombs (1 p. 68), (2 p. 4-50), (3 p. 3-13), (4 p. 4-49 to 4-50).

Explosive Train

When the cluster was released from an aircraft, the arming wire was withdrawn, the fuze arming vanes rotated in the airstream, and the fuzes armed. After the preset time had elapsed, one or both fuzes functioned and detonated the burster. Concussion from the explosion of the burster depressed the diaphragm in the striker assemblies, driving the points of the strikers into the primers in the cluster-ejection cartridges, exploding the cartridges. Gases released by the cartridges passed through the gas chamber, through vent holes in the chamber, and into the space between the adapter casing base and the pressure plate. Pressure developed by the gases forced the pressure plate toward the nose of the cluster and caused the stud attached to the pressure plate to pull out of the split nut. Continued expansion of the gases freed the nose assembly and forced the framework out of the casing. As each cluster buckle cleared the casing, the buckle opened. After all buckles opened, the adapter framework fell apart, allowing the bombs to fall individually to the target (2 p. 4-50), (3 p. 3-13), (4 p. 4-40).

Fuzing

Bomb, 1,000-pound, Cluster, M34 (E101R3), M34A1 (E101R5) - Fuzing		
Fuze	**Note**	**Citation**
M152	Tail- mechanical time and impact with arming vane and pin, 2 required	2 (p. 4-50), 5 (p. 50)
M152A1	Tail- mechanical time, 2 required	2 (p. 4-50), 3 (p. 3-13), 4 (p. 4-50), 5 (p. 92)
M15A1	Tail- mechanical time and Impact with arming vane and pin	4 (p. 4-50)
M908	2 required	3 (p. 3-12)

Booster, Adapter-Booster, or Burster

Bomb, 1,000-pound, Cluster, M34 (E101R3), M34A1 (E101R5) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	N/A	N/A	Component of M29 cluster adapter in tail fin. Available references did not provide weight information.	4 (p. 4-50)
Not designated	N/A	Detonating cord	Available references did not provide weight information.	3 (p. 3-12)

Fills

Bomb, 1,000-pound, Cluster, M34 (E101R3), M34A1 (E101R5) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	198	89.8	1,130	512	76 M125A1 bomblets (each containing 2.6 lb. / 1.17 kg of agent) in M34 cluster.	2 (p. 4-50), 3 (p. 3-13), 4 (p. 4-50)

Shipping/Packing

The M34 bomb cluster was packed in a shipping guard without the tail-fin, arming wire, and fuzing components. The packed cluster weighed approximately 1,300 pounds and displaced 20.1 cubic feet. The tail-fin stud, nut washer, lock washer, cartridge holders, striker assemblies and tail fin are packed in a separate crate (5 p. 51-53).

Miscellaneous Information

Between 1953 and 1954, the Air Force procured at total of 23,700 each M34 and M34A1 clusters including 2,700 in unserviceable condition (i.e., condition “0”). There were 9,676 each M34 clusters and 11,445 each M34A1 clusters in storage at Rocky Mountain Arsenal in 1969. These obsolete munitions were initially proposed for “burial at sea” but were not disposed of in this manner after review by the National Academy of Sciences (1 p. 63), (4 p. 4-50).

Key Dates

Bomb, 1,000-pound, Cluster, M34 (E101R3), M34A1 (E101R5) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Type Classified	1954	CCTC 2947 (M34A1 Standard – Air Force, M34 Limited Standard – Air Force)	7
Standardized	1958	CCTC 3408 (M34A1 Standard - Air Force, M34 Ltd Standard - Air Force)	8
Standard Modernization	1959	CCTC 3525 (Standard-C Air Force)	9
Obsoleted	1969	Army Materiel Command Technical Committee (AMCTC) 7028 and 7125 (M34 and M34A1)	10 (p. 2)

Sources

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5. Departments of the Army and Air Force. 1957. Technical Manual, TM 3-400/Technical Order, TO 11C2-1-1, Chemical Bombs and Clusters. Department of the Army.
6. Chemical Corps. 1953. Dugway Proving Ground Report, DPGR 137, Assessment of a CW Cluster: assessment of the cluster, nonpersistent gas bomb, 1000-lb, E101R3, CW 7-53. U.S. Army.
7. Chemical Corps Technical Committee. 1954. CCTC Item # 2947, Classification of Clusters, Gas Bomb, GB, 1000-lb., M34 (E101R3) & M34A1 (E101R5) as Limited Standard and Standard Types, Respectively. Department of the Army.
8. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.
9. Chemical Corps Technical Committee. 1958. CCTC Item # 3525, Reclassification of Development and Limited Standard items in Accordance with Revised AR 705-6. Department of the Army.
10. Chemical Corps Technical Committee. 1969. Chemical Corps Book of Standards, 2nd Abridged Edition, Revision No. 29. Department of the Army.

6.24 Bomb, 1,000-pound, M79, AN-M79 (T3E1)

Figures

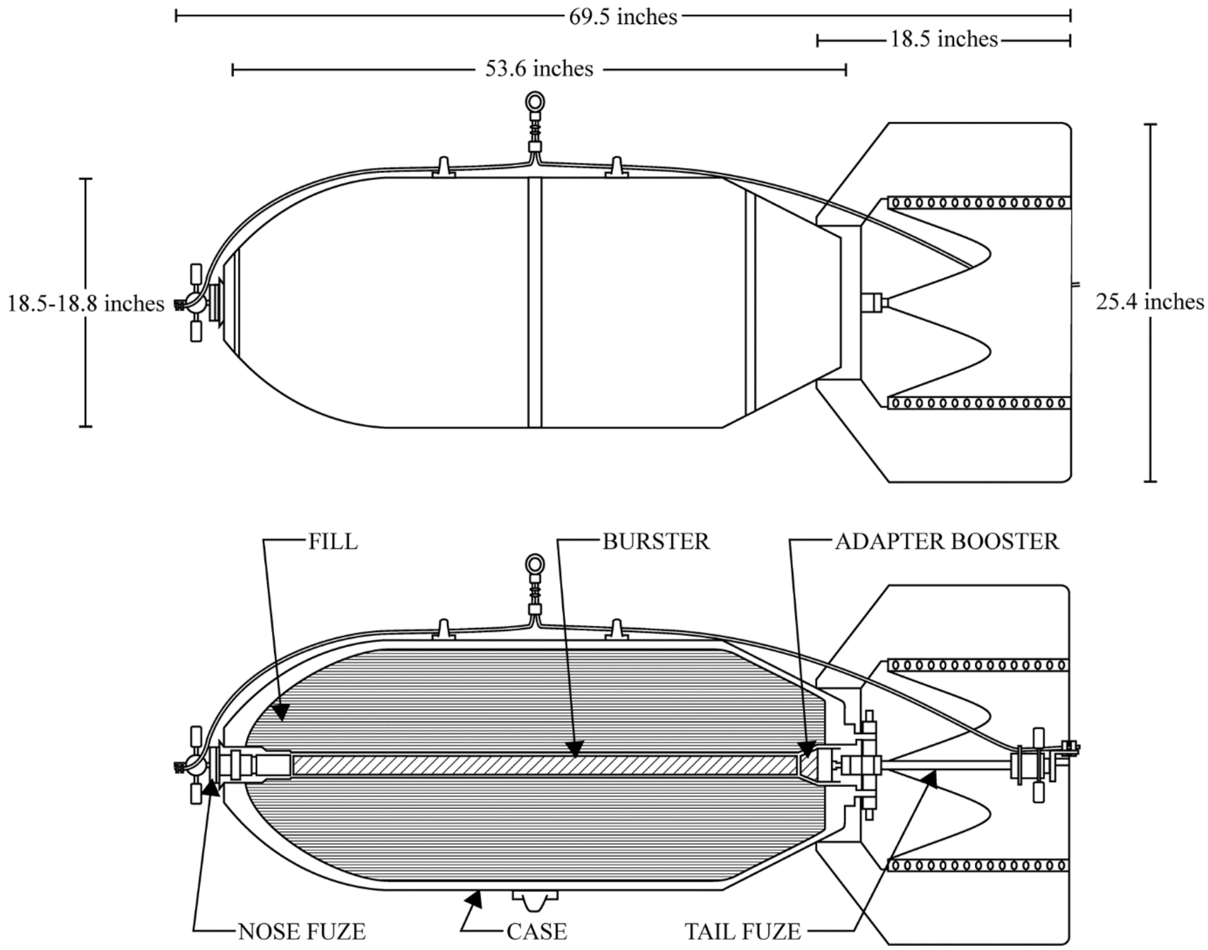

Figure 40: Bomb, 1,000-pound, M79, AN-M79 (T3E1) - Line Drawing

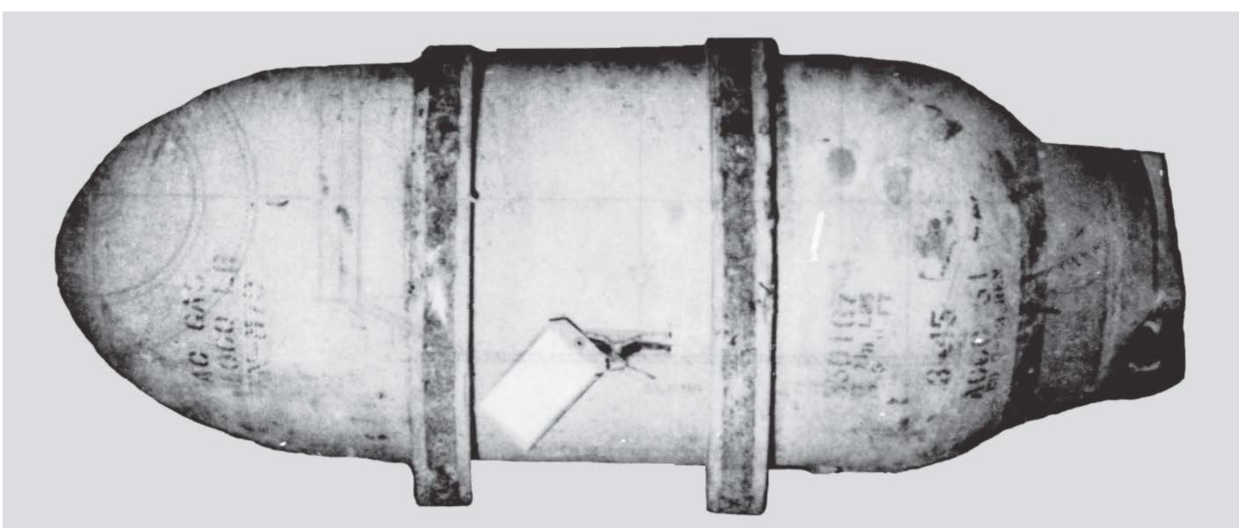

Figure 41: Bomb, 1,000-pound, M79, AN-M79 (T3E1) - Photograph - AN-M79

Bomb, 1,000-pound, M79, AN-M79 (T3E1)

Specifications

Bomb, 1,000-pound, M79, AN-M79 (T3E1) - Specifications and Other Data		Citation
Historical Name	Bomb, Gas, Nonpersistent, CG, AC, or CK, 1,000-Pound, AN-M79 (T3E1)	1 (p. 30)
Type	Bomb	2 (p. 1), 3 (p. 10-8)
Size	1,000-pound	2 (p. 1), 3 (p. 10-8), 4 (p. 434)
Conflict	WWII	4
Service	Air Force, Army, Navy	4 (p. 434), 5 (p. I3)
Diameter	18.5-18.8 inches (46.9-47.75 cm)	3, 4 (p. 434), 6 (p. 30), 7 (p. A-19)
Length	Body: 53.6 inches (136.4 cm) Tail: 18.5 inches (46.99 cm) Overall: 69.5 inches (176.53 cm)	3, 4 (p. 434), 6 (p. 30), 7 (p. A-19)
Width	Fin: 25.4 inches (65.52 cm)	4 (p. 434), 8 (p. A-19)
Other Engineering Data	Fin Assembly: AN-M64, AN-M65, AN-M113A1 or M113, or M129 An M115Al or M115 adapter-booster was mounted in the base plate threaded holder. During development, the AN-M79 was designated T3E1.	3, 4 (p. 434), 6 (p. 30), 7 (p. A-19)
Body Construction Material	Forged steel	2 (p. 1), 4 (p. 424)
B/M Dwg	82-0-98	3 (p. 10-8)
FSN	1325-219-8569 (CG) 1325-219-8582 (CK)	9 (p. D3)

General Use and Description

Available references did not provide information on specific use.

The AN-M79 nonpersistent chemical agent bomb was an adaptation of the 1,000-pound AN-M65 general purpose bomb. It could be filled with AC, CG, or CK. It was round, with an ogival nose and truncated conical rear section. The bomb body was forged steel. Both double and single suspension lugs were welded to the body. The rear section tapered down to about 13 inches in diameter where a base plate was welded to close the body. The base plate had a filling hole, a hole for venting and sampling with a M1 needle valve, and a threaded center hole for an adapter-booster. A burster well was welded inside the base plate and extended to the bomb nose, where it was threaded to receive a fuze seat liner. The fuze seat liner in the bomb nose provided a seat for the fuze (1 p. 30), (3), (4 p. 434), (6 p. 30), (7 p. A-19).

Explosive Train

Upon bomb release from aircraft bomb station, arming wires were withdrawn from both fuzes, freeing arming vanes to rotate. Vane rotation in the air stream armed the fuzes. The nose fuze normally detonated the burster, but if the nose fuze failed, the tail fuze, through the adapter-booster charge, would set off the burster. The burster shattered the bomb and released the agent (3), (4 p. 434), (6 p. 30-31), (7 p. A-22).

Bomb, 1,000-pound, M79, AN-M79 (T3E1)

Fuzing

Bomb, 1,000-pound, M79, AN-M79 (T3E1) - Fuzing		
Fuze	**Note**	**Citation**
AN-M102A1	Tail- alternate	6 (p. 60)
AN-M102A2	Tail, standard in 1945	4 (p. 434)
AN-M103	Nose- alternate	6 (p. 60)
AN-M103A1	Nose- arming-vane type (standard in 1945)	2, 6 (p. 60)
AN-M139A1	Nose- alternate	6 (p. 62)
AN-M140A1	Nose- alternate	6 (p. 62)
AN-M168	Nose- alternate	7 (p. A-19)
AN-M184	Tail- alternate, required with M129 fins	3 (p. 10-8)
M127	Nose- alternate (Army only with adapter-booster M117)	4 (p. 434)
M128	Nose- alternate (Navy only)	4 (p. 434)
M135	Nose- alternate	4 (p. 434)
M135A1	Nose- alternate	4 (p. 434)
M136	Nose- alternate	4 (p. 434)
M136A1	Nose- alternate	4 (p. 434)
M162	Tail- preferred	4 (p. 434)
M162	Tail- alternate	6 (p. 71)
M163	Nose- preferred	3, 4 (p. 434), 6 (p. 71), 7 (p. A-19)
M164	Nose- alternate	6 (p. 71)
M165	Nose- alternate	6 (p. 71)
M166	Nose- variable time	4 (p. 434)
M175	Tail	10
M176	Tail	9 (p. D2), 10
T50E4	Nose- variable time	4 (p. 434)
T82	Nose- variable time	4 (p. 434)

Booster, Adapter-Booster, or Burster

Bomb, 1,000-pound, M79, AN-M79 (T3E1) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
AN-M16	N/A	Tetrytol	Used with M1151A1 adapter-booster holder assembly.	2 (p. 2), 7 (p. A-19)
M115 Adapter booster	N/A	N/A	-	9 (p. D2)
M16	4.45 pounds	Tetrytol	Waterproof fiber tube.	7 (p. A-19)

Fills

Bomb, 1,000-pound, M79, AN-M79 (T3E1) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
AC	185-200	83.9-90.7	707-728	320-330	-	1, 3, 4 (p. 434), 6 (p. 50), 7 (p. A-19), 11 (p. 183)
CG	404-417	183-189	926-948	420-430	-	1, 2 (p. 1), 3, 4 (p. 434), 6 (p. 50), 7 (p. A-19)
CK	340-351	154-159	860-884	390-401	-	1, 3, 6 (p. 50), 7 (p. A-19)

Shipping/Packing

Shipping bands protected the bomb during shipping and storage. The bombs were shipped without fins, fuzes, or burster components. Shipping weight was approximately 710 pounds when AC-filled, 930 pounds when CG-filled, and 866 when CK-filled (2 p. 3), (3 p. 10-9).

Bomb, 1,000-pound, M79, AN-M79 (T3E1)

Miscellaneous Information

A total of 63,578 CG-filled and 55,851 CK-filled AN-M79 bombs were procured between 1944 and 1945. In 1963 when the AN-M79 was obsoleted, there were 25,411 CG-filled and 35,165 CK-filled AN-M79 bombs on hand. An additional 5,268 empty casings were also on hand.

Key Dates

Bomb, 1,000-pound, M79, AN-M79 (T3E1) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1943	CCTC 881 (CK and CG-fill Standard and AC as substitute Standard)	12 (p. 82)
Standardized	1944	OCM 22844	13 (p. 8)
Standardized	1958	CCTC 3408 (CG-Fill – Standard-Air Force CK and AC-fill – Limited Standard – Air Force)	14
Standard Modernization	1959	CCTC 3525 (CK and AC-fill Standard C – Air Force)	15
Obsoleted	1960	CCTC 3686 (AC fill)	5 (p. I1)
Obsoleted	1963	CCTC 4141 (AN-M79 CK and CG-fill)	9

Sources

1. Departments of the Army and Air Force. 1957. Technical Manual, TM 3-400/Technical Order, TO 11C2-1-1, Chemical Bombs and Clusters. Department of the Army.

2. War Department. 1945. Technical Bulletin, TB CW 22, Nonpersistent Gas Bombs: Handling, Shipping, and Storage. Department of the Army.

3. Bureau of Naval Weapons. 1960. NAVWEPS Ordnance Pamphlet, OP 2216, Aircraft Bombs, Fuzes and Associated Components. U.S. Government Printing Office.

4. Bureau of Ordnance. 1947. Ordnance Pamphlet, OP 1664 (Vol. 1), U.S. Explosive Ordnance. Department of the Navy.

5. Chemical Corps Technical Committee. 1960. CCTC Item # 3686, Obsoletion of Bomb, Gas, Nonpersistent AC, 1000-lb., AN-M79 & Quick-acting Hydrogen Cyanide, AC Quick-Acting Hydrogen Cyanide, AC. Department of the Army.

6. Departments of the Army and Air Force. 1953. Technical Manual, TM 3-400/Technical Order, TO 39B-15C-1, Chemical Bombs and Clusters. Department of the Army.

7. U.S. Naval Ordnance Laboratory. 1968. NAVORD Ordnance Pamphlet, OP 2217, Miscellaneous Chemical Munitions, Description and Operation, First Revision, Change 1. Naval Ordnance Systems Command.

8. Bureau of Ordnance. 1958. Ordnance Pamphlet, OP 2217, Miscellaneous Chemical Munitions. Department of the Navy.

9. Chemical Corps Technical Committee. 1963. CCTC Item # 4141, Subject: Obsoletion of Bombs, Gas, Nonpersistent CG & CK, 500-lb., AN-M78; & Bombs, Gas, Nonpersistent CG & CK, 1000-lb., AN-M79 (U). U.S. Army Materiel Command.

10. Chemical Corps Technical Committee. 1957. CCTC Item # 3286, Subject: Incorporation of Fin Assemblies, Bomb, AN-M128 & AN-M129; Fuzes, Bomb Tail, M175 & M176; & Arming Wire Assembly, M13 as Standard Components of the AN-M78 & AN-M79 500-lb. & 1000-lb. Gas Bombs. Department of the Army.

11. War Department. 1944. Technical Manual, TM 9-1980, Bombs for Aircraft. U.S. Government Printing Office.

12. Chemical Corps Technical Committee. 1943. CCTC Item # 881, Classification of Fillings for Chemical Munitions. Department of the Army.

13. Ordnance Committee. 1944. Ordnance Committee Meeting, OCM Item # 22844, Bomb, Chemical, 1000-LB., M79 (T3E1), Burster M16, and Valve, Needle M1: - Standardization. Ordnance Department.

14. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

15. Chemical Corps Technical Committee. 1958. CCTC Item # 3525, Reclassification of Development and Limited Standard items in Accordance with Revised AR 705-6. Department of the Army.

6.25 Bomb, 1,000-pound, General Purpose, (y) E2C

Figures

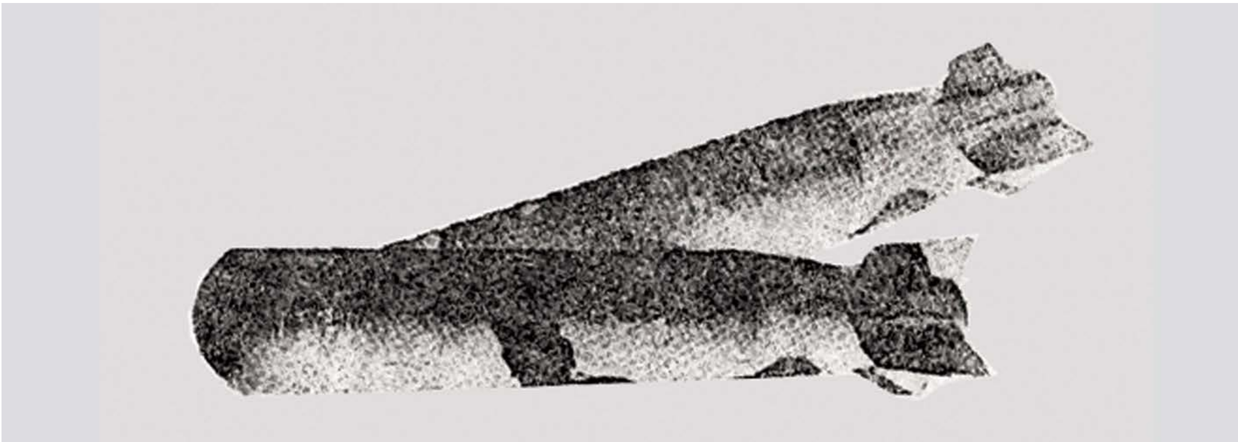

Figure 42: Bomb, 1,000-pound, General Purpose, (y) E2C - Photograph

Specifications

Bomb, 1,000-pound, General Purpose, (y) E2C - Specifications and Other Data		Citation
Historical Name	(y) E2C 1000 lb. Bomb, General Purpose	1 (p. Appendix A page 63)
Type	Bomb	2
Size	1,000-pound	1 (p. 63, Appendix A)
Conflict	Cold War	2
Diameter	16.5 inches (41.91 cm)	2
Length	99.5 inches (252.73 cm)	2

General Use and Description

The (y) E2C was a general purpose, persistent, chemical agent bomb designed for use with strategic bombing aircraft capable of flight at high speeds and high altitudes (2).

It was fuzed with a T765 VT nose fuze set at the factory to function 62 feet above terrain. This bomb was a light-cased bomb utilizing a cast axial burster weighing 10 pounds (2).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Bomb, 1,000-pound, General Purpose, (y) E2C - Fuzing		
Fuze	**Note**	**Citation**
T765	Nose- variable time	2

Booster, Adapter-Booster, or Burster

Bomb, 1,000-pound, General Purpose, (y) E2C - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Cast aerial burster	10 pounds	N/A	-	2

Bomb, 1,000-pound, General Purpose, (y) E2C

Fills

Bomb, 1,000-pound, General Purpose, (y) E2C - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
HD	522	236	858	389	-	2

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. SciTech Services, Inc. 1998. Old Chemical Weapons Reference Guide. U.S. Army.

2. Dugway Proving Ground. 1953. Dugway Proving Ground Report, DPGR 124, Operational Evaluation of the Bomb (y) E2C, CW 12-52. AD896570. Department of the Army.

7 Bomblet

Small (10-pound and less) bombs are called bomblets when loaded into clusters. The bodies of small chemical agent bombs are round in cross section while those of small incendiary bombs are hexagonal. Large (100-pound and more) bombs are not loaded into clusters but are dropped individually from aircraft (Department of the Army 1955, 66). A bomblet is a component part of a clustered munition designed to achieve wide area coverage (Carter, Jr., and Wilson 1957, 1).

7.1 Bomblet, 2.5-inches, E139

Figures

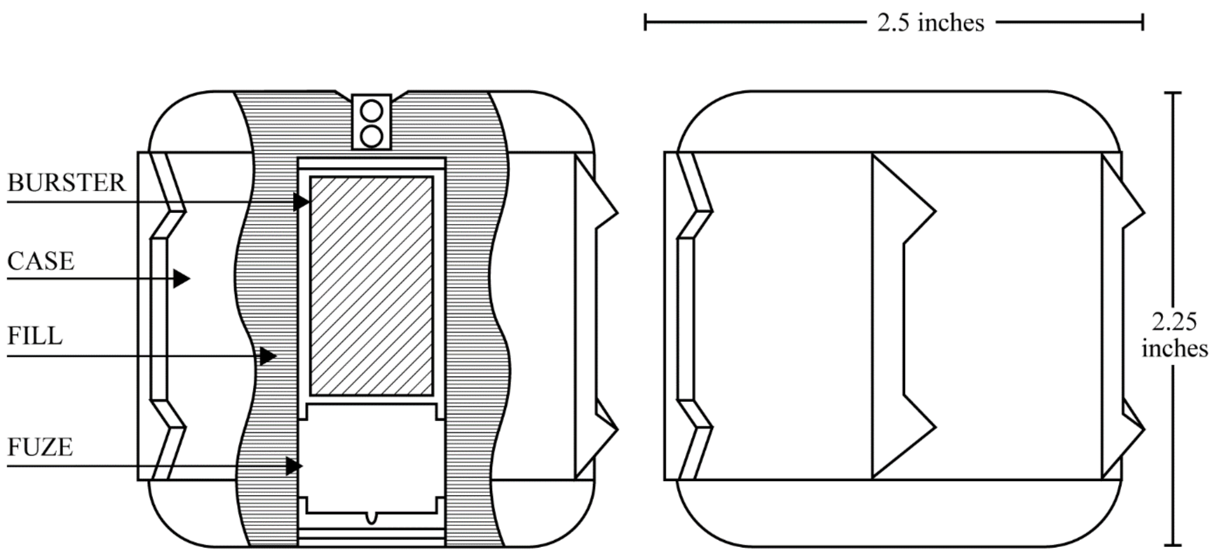

Figure 43: Bomblet, 2.5-inches, E139 - Line Drawing

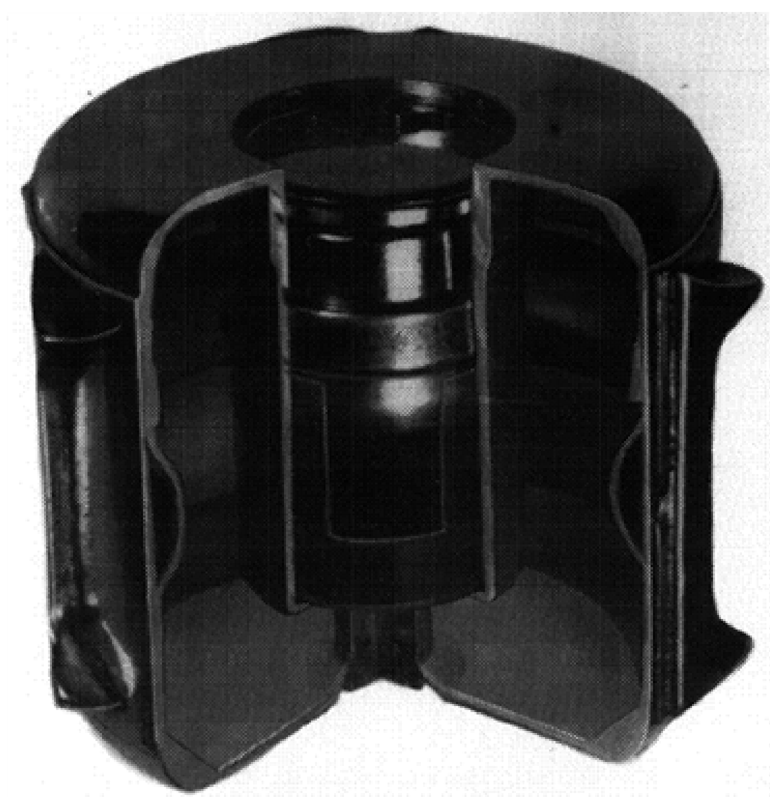

Figure 44: Bomblet, 2.5-inches, E139 - Photograph - Cutaway View

Bomblet, 2.5-inches, E139

Specifications

Bomblet, 2.5-inches, E139 - Specifications and Other Data		Citation
Historical Name	E139, Bomblet	1 (p. 10-14)
Type	Bomblet	1 (p. 10-14)
Size	2.5-inches	2 (p. 15)
Conflict	Cold War	1, 3, 4
Service	Army	2, 4
Diameter	2.5 inches (6.35 cm)	1 (p. 10), 2 (p. 15)
Length	2.25 inches (5.72 cm)	1 (p. 10), 2 (p. 15), 4 (p. 7)
Other	Wall thickness: 0.045 inch	1 (p. 10), 2 (p. 15)
Body Construction Material	Aluminum alloy	3 (p. 8), 4 (p. 7)

General Use and Description

The E139 was designed to provide long range offensive chemical capabilities (4 p. 8).

The E139 bomblet was a self-dispersing cylindrical munition. It was constructed of two cylindrical cups, each made of approximately 0.045-inch thick aluminum alloy. These cups were Tig-welded together at their periphery. A 0.137-pound hard lead band was 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 by a pressed double-ball closure. The opposite end had an accessible burster well. The burster assembly consisted of a tetryl pellet (encased in polyethylene) that was 0.98-inch in diameter and 0.671-inch long, the M219E1 grenade fuze, and a steel compression spring, washer, and snap-ring retainer. A collar of 0.020-inch thick aluminum alloy, which had been extruded with six integral driving ribs, was pressed onto the cylindrical body. In flight these ribs induced the bomblet to spin about its longitudinal axis to arm the M219E1 fuze, as well as to create an aerodynamic lifting force on the bomblet for dispersion (1 p. 10), (4 p. 7).

Explosive Train

The armed fuze functioned upon impact with the ground when a stab type firing pin initiated the detonator, thereby igniting a lead cup of Royal Demolition Explosive (RDX) which would disseminate the agent (1 p. 14), (4 p. 7).

Fuzing

Bomblet, 2.5-inches, E139 - Fuzing		
Fuze	**Note**	**Citation**
M219E1 grenade fuze	-	1 (p. 14), 4 (p. 7)

Booster, Adapter-Booster, or Burster

Bomblet, 2.5-inches, E139 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	0.265 pounds	Tetryl pellet	Burster	1 (p. 10)

Fills

Bomblet, 2.5-inches, E139 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	0.26	0.12	0.67	0.30	0.0265 pounds of HE bursting charge	1 (p. 10), 4 (p. 7)

Bomblet, 2.5-inches, E139

Shipping/Packing

Approximately 1,130 E139 bomblets were in six nylon fabric bags that were used for packaging and dispersing of the bomblets (4 p. 7).

Miscellaneous Information

Approximately 1,140 E139 bomblets were used in the E27 warhead section 1,000-pound Lance missile (2 p. 10).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bush, O.J. 1971. Edgewood Arsenal Technical Report, EATR 4476, Test and Evaluation of E27 Warhead Section (Lance) Safety Features Involving the Agent Hazard. U.S. Army Munitions Command.
2. Bush, O.J. 1972. Edgewood Arsenal Technical Report, EATR 4613, E27 Chemical Warhead Section Final Report (U). Department of the Army.
3. Michniewicz, Peter. 1971. Edgewood Arsenal Technical Report, EATR 4517, Final Flight Test Report of the E27 Warhead Section/ Lance Missile, O8L. Department of The Army.
4. Michniewicz, Peter. 1971. Edgewood Arsenal Technical Report, EATR 4529, Final Flight Test Report of the E27 Warhead Section/ Lance Missile, 12L. US Army Munitions Command.

7.2 Bomblet, 4.25-inch, Cube, E123

Figures

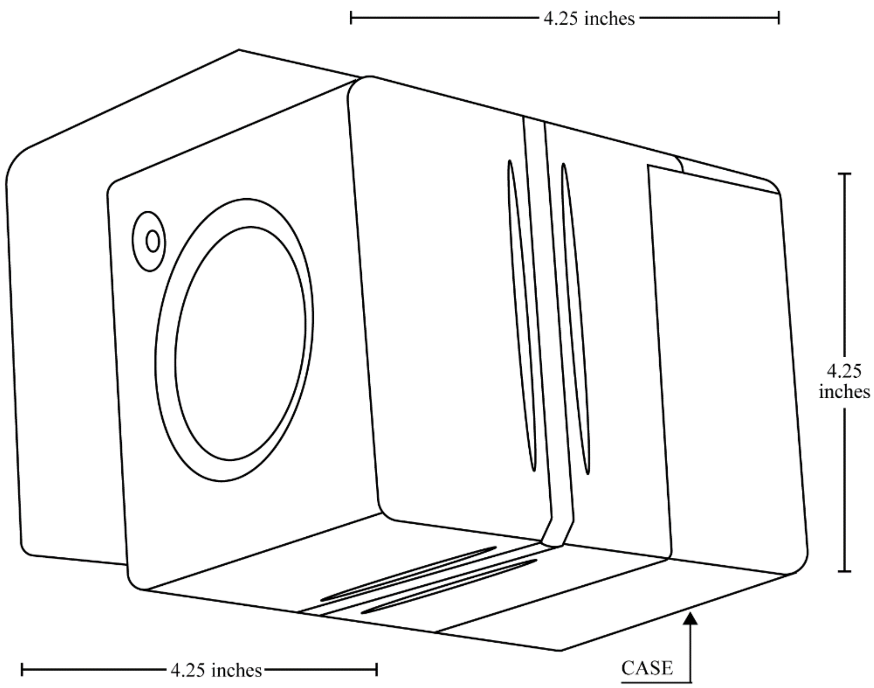

Figure 45: Bomblet, 4.25-inch, Cube, E123 - Line Drawing

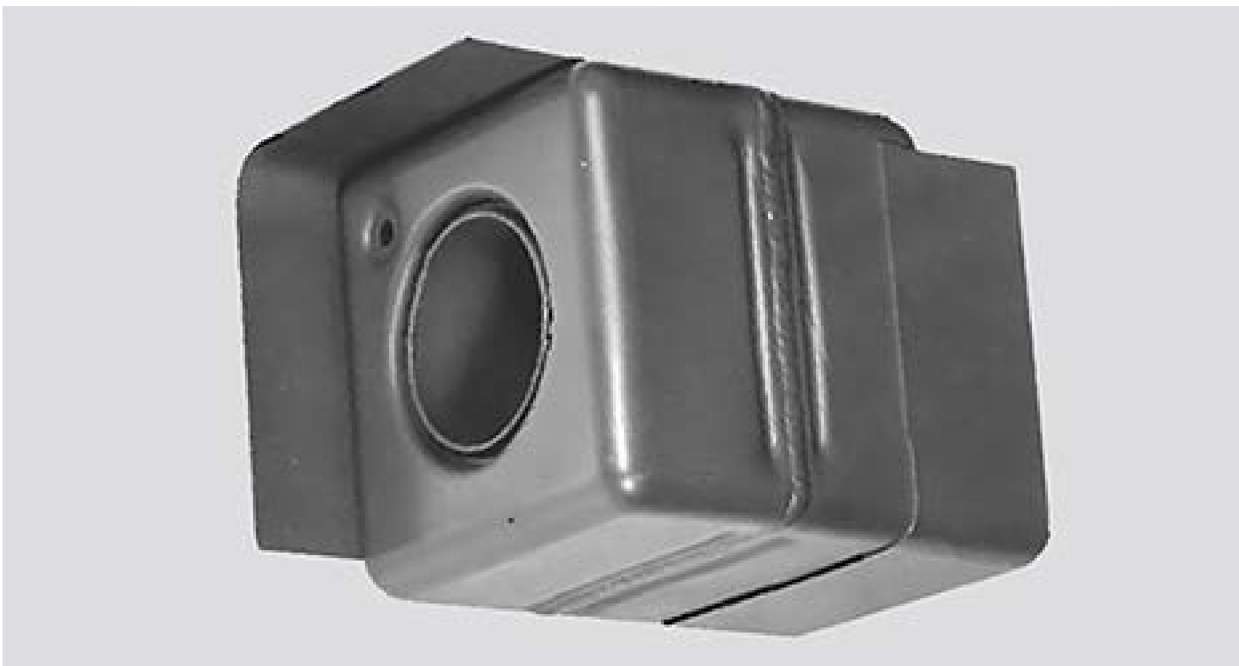

Figure 46: Bomblet, 4.25-inch, Cube, E123 - Photograph

Bomblet, 4.25-inch, Cube, E123

Specifications

Bomblet, 4.25-inch, Cube, E123 - Specifications and Other Data		Citation
Historical Name	E123 "Cube" Bomblet	1
Type	Bomblet	1 (p. 1)
Size	4.25-inch	1 (p. 3)
Conflict	Cold War	1
Service	Air Force	1 (p. 1)
Length	4.25 inches (10.79 cm)	1 (p. 3)
Width	4.25 inches (10.79 cm)	1 (p. 3)
Height	4.25 inches (10.79 cm)	1 (p. 3)

General Use and Description

The E123 cluster munition was designed to achieve wide area coverage of toxic agents (1 p. 1).

The E123 bomblet was cube shaped with walls 4.25-inches in length. It had a central burster well and a simple soldered closure. The bomblet was fitted with an internal stiffener plate located at the center of the bomblet and perpendicular to the burster well. The bomblet was equipped with one-inch fins. Subsequent bomblets were equipped with 0.5-inch fins, which were shown to result in better dispersion. Stiffener ribs were provided in the bomblet walls close to the seam formed in welding the bomblet body halves to the stiffener plate. The ribs served to minimize distortion of the bomblet walls by the heat of welding.

The fuze was a mechanical type all-ways fuze that had a centrifugal arming system (1 p. 3).

Explosive Train

Upon release from the cluster adapter, aerodynamic forces would cause the bomb to spin. Centrifugal force would then arm the fuze. Upon impact the fuze would initiate, setting off the burster, which would spread the chemical agent filler (1 p. 4).

Fuzing

Bomblet, 4.25-inch, Cube, E123 - Fuzing		
Fuze	**Note**	**Citation**
Not designated	All-ways acting, mechanical	1 (p. 4)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Bomblet, 4.25-inch, Cube, E123 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	1.90	0.86	4.30	1.95	-	1 (p. 4)

Shipping/Packing

Available references did not provide this information.

Bomblet, 4.25-inch, Cube, E123

Miscellaneous Information

Used with the M30 adapter. Each adapter held 91 cubes. Total weight of agent in an adapter was 173 pounds (1 p. 4).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Carter, J, Jr., & Wilson, Billy. 1957. Munitions Development Division Technical Memorandum, Development of E123 "Cube" Bomblet (U). Munitions Development Division.

7.3 Bomblet, 4.5-inch, Spherical, M139 (E130R2)

Figures

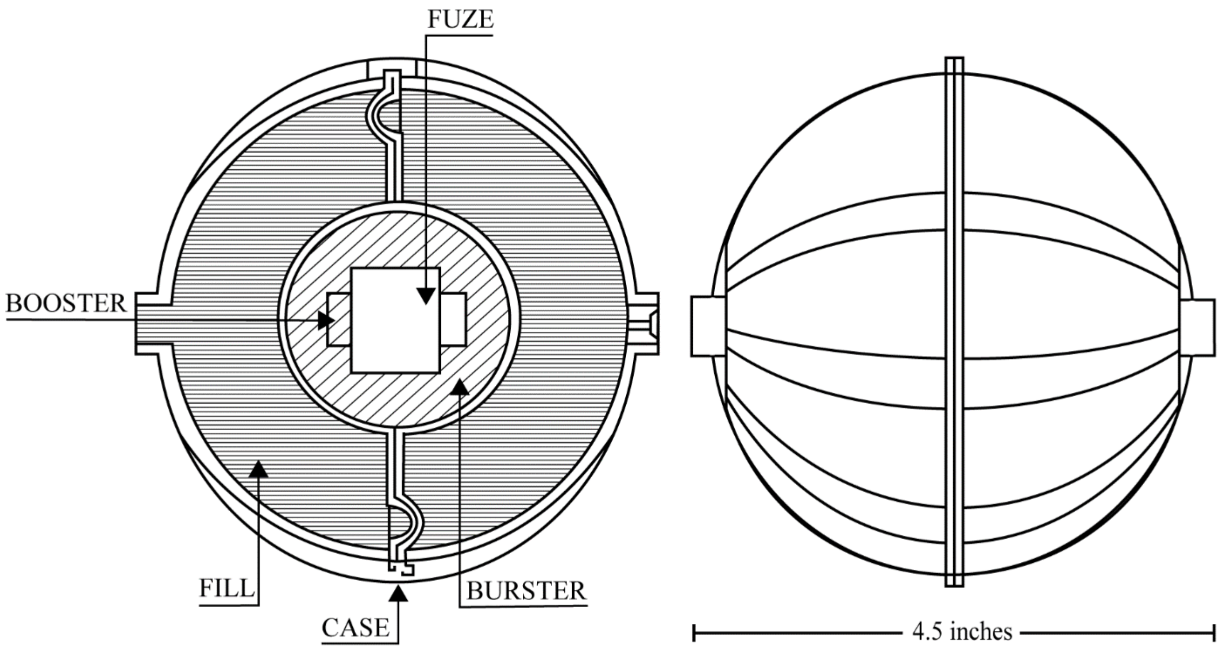

Figure 47: Bomblet, 4.5-inch, Spherical, M139 (E130R2) - Line Drawing

Figure 48: Bomblet, 4.5-inch, Spherical, M139 (E130R2) - Photograph - Left: Cutaway View, Right: Exterior

Bomblet, 4.5-inch, Spherical, M139 (E130R2)

Specifications

Bomblet, 4.5-inch, Spherical, M139 (E130R2) - Specifications and Other Data		Citation
Historical Name	Bomblet, Spherical, 2.4-Pound (GB-VX) E130R2	1 (p. 4-5)
Type	Bomblet	2 (p. 1)
Size	4.5-inch	1 (p. 4-6), 2 (p. 3), 3 (p. 4-7)
Conflict	Cold War	1
Service	Army	2 (p. cover)
Diameter	4.5 (11.5 cm)	1 (p. 4-6), 3 (p. 4-6), 4 (p. 165)
Other Engineering Data	During development, this item was designated E130R2.	5
Body Construction Material	Aluminum and steel	1 (p. 4-5)
B/M Dwg	CMLC DRWG: C14-6-2768 D3314-5-3132	1 (p. 4-6), 3 (p. 4-7)
NSN	1325-00-729-5261	6 (p. 30)

General Use and Description

The M139 self-dispersing bomblets were used in the Sergeant M212 and Honest John M190 warheads in order to provide a long range chemical offensive capability (1 p. 4-6), (3 p. 4-6).

This bomblet had an aluminum outer shell with six aerodynamic ribs on the outer surface. A spherically-shaped burster charge, located concentrically with the outer surface, was used for disseminating the fill. The bomblet was constructed in two halves to facilitate assembly of the fuze and burster charge. A steel ring clamped the two halves together. The inner shell was steel (1 p. 4-6), (3 p. 4-6).

Explosive Train

The fuze was an all-ways acting impact type, which armed upon being rotated at a speed of 1,800 revolutions per minute. Upon impact, the fuze functioned, setting off an RDX booster pellet mounted in the center of the burster. The booster caused the burster to function and spread the chemical agent (i.e., GB and VX) (1 p. 4-5), (5).

Fuzing

Bomblet, 4.5-inch, Spherical, M139 (E130R2) - Fuzing		
Fuze	**Note**	**Citation**
XM912	Centrifugal arming, all-ways/impact	1 (p. 4-6), 3 (p. 4-6), 4 (p. 165)

Booster, Adapter-Booster, or Burster

Bomblet, 4.5-inch, Spherical, M139 (E130R2) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M45 (E20)	0.15 pounds	Composition B	Spherically-shaped burster charge	5

Bomblet, 4.5-inch, Spherical, M139 (E130R2)

Fills

Bomblet, 4.5-inch, Spherical, M139 (E130R2) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	1.30	0.58	2.14	0.97	-	1 (p. 4-6), 3 (p. 4-7), 4 (p. 165), 6 (p. 30)
VX	1.30	0.58	2.40	1.09	-	1 (p. 4-6)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The M139 was used with the XM50 warhead (368 bomblets), the Little John warhead E20 (368 bomblets), the Sergeant warhead E21 (330 bomblets), and the improved Honest John warhead E19R2 (1 p. 4-6), (3 p. 4-7), (5).

Key Dates

Bomblet, 4.5-inch, Spherical, M139 (E130R2) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1964	AMCTC 2621	7

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

2. Army - MU(EA). 1995. Military Specification, MIL-B-60073A(MU), Bomb, Nonpersistent Gas, Spherical, 4.5 Inch, M139; Filling and Assembly. Department of the Army.

3. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

4. School Munitions Department Redstone Arsenal. 1976. Chemical Munitions EOD/TE Study Guide. U.S. Army Missile and Munitions Center.

5. Stewart, F., & Wagner, P. 1962. CRDL Technical Memorandum 30-66, Development of Bomb, Nonpersistent Gas, Spherical, 4.5-inch, E130R2 (U). Directorate of Development, U.S. Army Chemical Research & Development Laboratories, Army Chemical Center.

6. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.

7. Chemical Biological Subcommittee. 1964. AMCTC Item # 2621, Classification of Warhead Section, 762-mm Rocket, Gas, Non-persistent GB M190 (E19R2) as a Standard-A Type & Obsoletion of the Superseded M79 Warhead. U.S. Army Materiel Command.

7.4 Bomblet, 5.2-inch, Spherical, E118

Figures

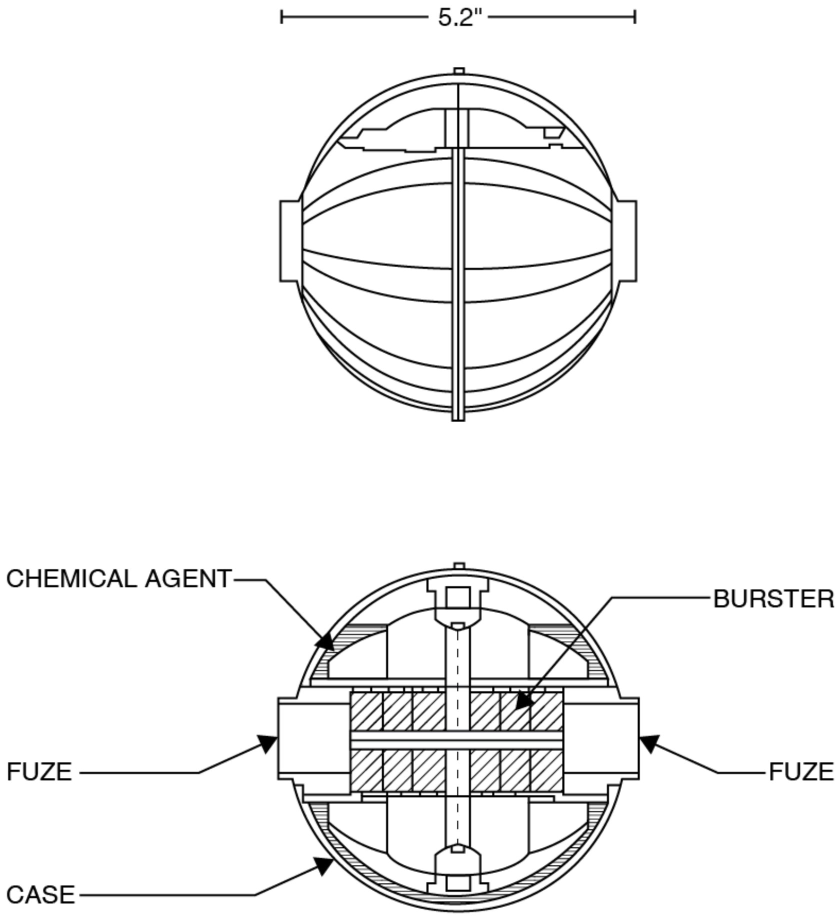

Figure 49: Bomblet, 5.2-inch, Spherical, E118 - Line Drawing

Specifications

Bomblet, 5.2-inch, Spherical, E118 - Specifications and Other Data		Citation
Historical Name	E118 5.2-Inch Bomb, Nonpersistent, Gas, Spherical	1 (p. 3, appendix A)
Type	Bomblet	1 (p. 3, appendix A)
Size	5.2-inch	1 (p. 3, Appendix A)
Conflict	Cold War	1 (p. 3, appendix A)
Diameter	5.25 inches (13.32 cm)	2 (p. 12)
Other Engineering Data	The E118 became the E130 spherical bomblet.	1 (p. 3-4, Appendix A)
Body Construction Material	Outer shell: plastic Inner shell: steel	2 (p. 12)

General Use and Description

The E118 was developed during an effort to produce self-dispersing bomblets for use with high-speed missiles. The E118 is a nine-ribbed, 5.25-inch diameter spherical GB munition with a plastic outer shell and a steel inner shell. The E118 was intended to replace the E54R6 for use in the interim cluster adapter for the Corporal missile. The optimum bomblet diameter was smaller and the establishment for the E130 requirement obsoleted the E118 (3 p. 6), (4 p. 8).

The final E118 Spherical Bomblet design employed a cylindrical burster between two T1027 centrifugally armed all-ways impact fuzes. The burster and fuzes were contained within a burster well which was located parallel and concentric with the axis of spin. Surrounding the burster well was an annular synthetic rubber tube which acted as a void control. The agent was contained between the synthetic tube and the spherical steel shell. Attached to the inner surface of the steel shell were four vanes or impellers to assist in rotating the liquid. Two hemispherically shaped plastic shells containing nine driving ribs were cemented over the spherical steel shell (4 p. 8).

Explosive Train

Available references did not provide specific information on explosive train (4).

Fuzing

Bomblet, 5.2-inch, Spherical, E118 - Fuzing		
Fuze	**Note**	**Citation**
T1027	All-ways impact fuze, 2 required	2 (p. 12), 4 (p. 8)

Booster, Adapter-Booster, or Burster

Bomblet, 5.2-inch, Spherical, E118 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	N/A	Composition C	Cylindrical burster situated between two T1027 fuzes. Weight range 0.33-0.41 pounds.	3 (p. 9)

Fills

Bomblet, 5.2-inch, Spherical, E118 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	1.60	0.72	5.50	2.49	-	1 (p. 3-4, Appendix A)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. SciTech Services, Inc. 1998. Old Chemical Weapons Reference Guide. U.S. Army.

2. SciTech Services, Inc. 1999. 1999 Main Munition Table. U.S. Army.

3. Pickett, E. 1958. CWL Technical Memorandum 33-7, A Series of Static Tests of GB-filled E118 and E130 Spherical Munitions When Equipped with Bursters of Various Configurations, AD221108. U.S. Army.

4. Wagner, P. 1958. CWL Technical Memorandum 30-35, Development of Bomb, Nonpersistent gas, Spherical, 4.5-inch, E130R1, AD356703. U.S. Army.

7.5 Bomblet, 3-pound, E91, E91R1

Figures

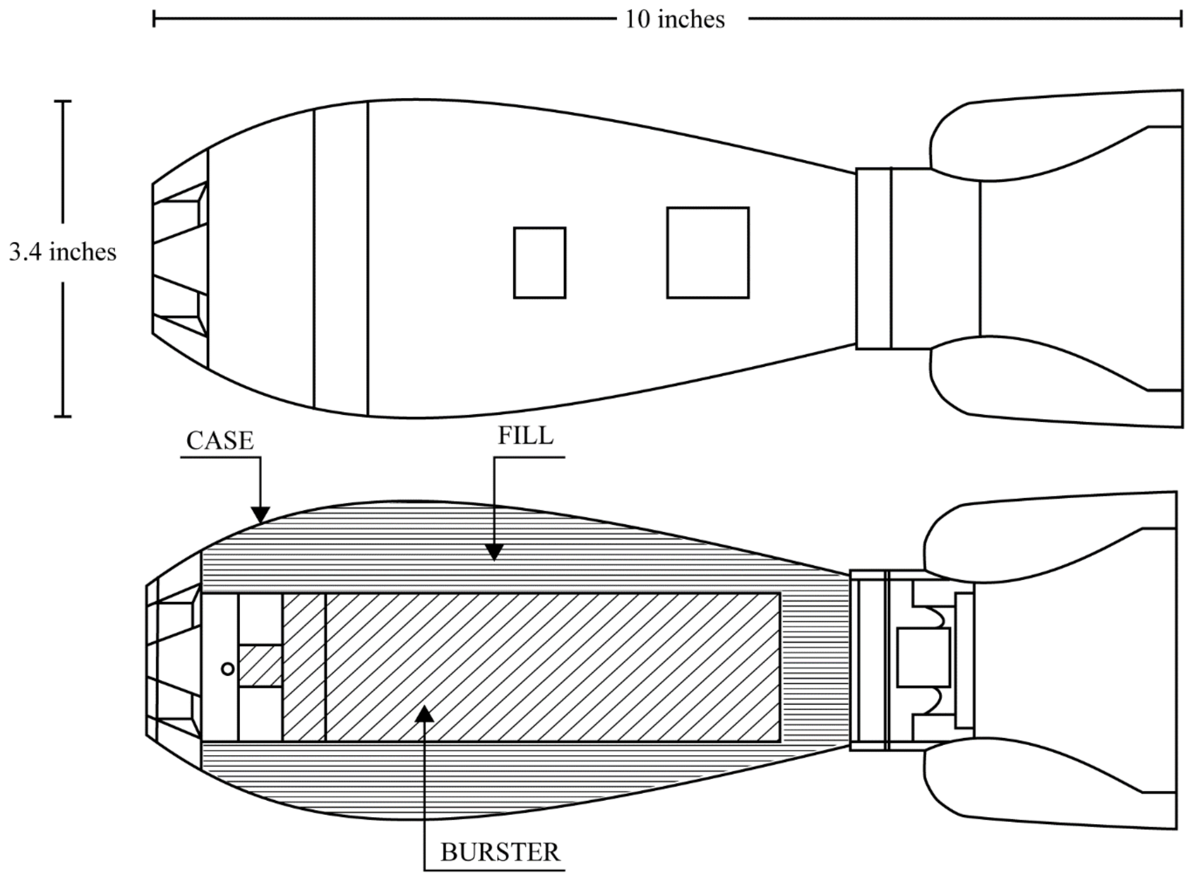

Figure 50: Bomblet, 3-pound, E91, E91R1 - Line Drawing

Figure 51: Bomblet, 3-pound, E91, E91R1 - Photograph - Recovered

Bomblet, 3-pound, E91, E91R1

Specifications

Bomblet, 3-pound, E91, E91R1 - Specifications and Other Data		Citation
Historical Name	Bomb, Nonpersistent Gas, 3-Pound, E91R1	1
Type	Bomblet	1
Size	3-pound	1 (p. 2)
Conflict	Cold War	1 (p. 2)
Diameter	3.4 inches (8.64 cm)	2 (p. 17, Appendix A)
Length	10 inches (25.4 cm)	2 (p. 17, Appendix A)
Propellant	7 increments of 4.2-inch mortar propellant	1 (p. 2)

General Use and Description

Available references did not provide information on specific use.

The E91 bomblet had a vase-shape that resulted in a high-drag, aerodynamically clean body. It was 10 inches long and 3.4 inches in diameter. The blunt nose and abrupt circular stabilizer added to the high drag and low terminal velocity. The bomb had an air-arming fuze and was designed for normal clustering in warheads.

The E91R1 3-pound bomb was a modified E91 bomb, which was designed for guided missile use. The tail consisted of four plastic fins protruding from a conical surface instead of the steel tail cup or plastic fluted assembly. The new tail assembly was designed to increase the surface area and thereby obtain static stability at subsonic speeds (2 p. 17-18).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Bomblet, 3-pound, E91, E91R1 - Fuzing		
Fuze	**Note**	**Citation**
E24R1	-	1 (p. 2)
E38	Nose - point detonating Weight: 0.70 pounds Length: 1.75 inches	3 (p. 2-19)

Booster, Adapter-Booster, or Burster

Bomblet, 3-pound, E91, E91R1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	0.24 pounds	Composition B	Agent to burster ratio was 4.5 to 1. Available references did not provide weight information.	3 (p. 2-20)

Fills

Bomblet, 3-pound, E91, E91R1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	1.08	0.48	3.00	1.36	The agent to burster ratio was 4.5 to 1.	1 (p. 2)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The E91 was used in the E118R1 Cluster, Nonpersistent Gas Bomb (750-pound) (2 p. 18).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Clay, J., & Stone, W. Jr. 1954. Dugway Proving Ground Trial Report, DPGTR 167. U.S. Army.

2. SciTech Services, Inc. 1998. Old Chemical Weapons Reference Guide. U.S. Army.

3. Department of Defense. 1982. Military Handbook, MIL-HDBK-146, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146. Department of Defense.

7.6 Bomblet, 3.4-pound, Spherical, M134 (E130R1)

Figures

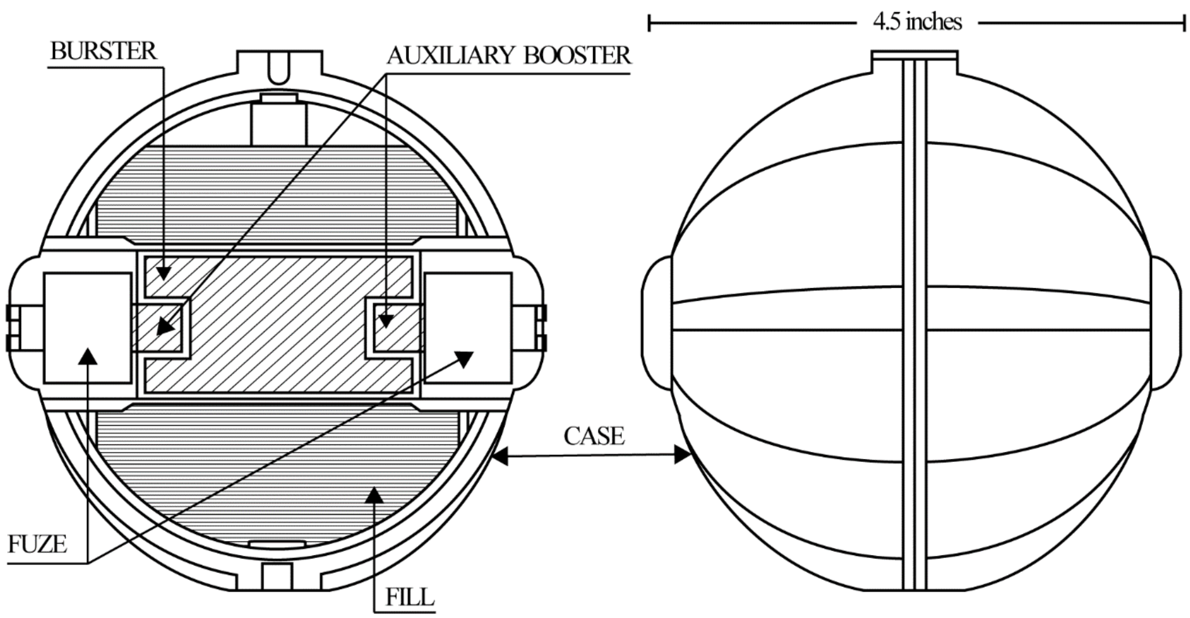

Figure 52: Bomblet, 3.4-pound, Spherical, M134 (E130R1) - Line Drawing

Figure 53: Bomblet, 3.4-pound, Spherical, M134 (E130R1) - Photograph - Left Cutaway View, Right: Exterior

Bomblet, 3.4-pound, Spherical, M134 (E130R1)

Specifications

Bomblet, 3.4-pound, Spherical, M134 (E130R1) - Specifications and Other Data		Citation
Historical Name	Bomblet, Spherical, Gas, Nonpersistent, 3.4-Pound, M134 (E130R1)	1 (p. 4-10)
Type	Bomblet	2 (p. 4-11)
Size	3.4-pound	2 (p. 4-11)
Conflict	Cold War	1 (p. 4-10)
Service	Army, Navy	2 (p. 4-11)
Diameter	4.5 inches (11.43 cm)	1 (p. 4-11), 2 (p. 4-12)
Other Engineering Data	In development, this item was designated E130R1; it was tested with VX.	1 (p. 4-11)
Body Construction Material	The outer casing of the bomblet was plastic and the inner shell was steel.	1 (p. 4-10)
B/M Dwg	CMLC C14-5-2573, C14-5-2572	1 (p. 4-11), 2 (p. 4-12)

General Use and Description

The M134 bomblet was designed to provide a long range toxic chemical offensive capability (1 p. 4-10), (2 p. 4-11).

This bomblet was a self dispersing, spherically shaped, GB-filled munition. Dispersion was accomplished by aerodynamic forces generated by nine vanes on the outside surface of the bomblet. A filling void was maintained to permit thermal expansion due to temperature changes (1 p. 4-10), (2 p. 4-11).

Explosive Train

A cylindrically shaped burster charge was located on, and concentric with, the spin axis of the bomblet. At each end of the burster charge was a tetryl booster charge and an all-ways centrifugal fuze. The fuze functioned on impact and detonated the burster. The internal pressures produced ruptured the bomblet casing and disseminated the fill (1 p. 4-11), (2 p. 4-11).

Fuzing

Bomblet, 3.4-pound, Spherical, M134 (E130R1) - Fuzing		
Fuze	**Note**	**Citation**
M911	Centrifugal arming- all-ways acting/impact, auxiliary booster M135	1 (p. 4-11), 2 (p. 4-12)

Booster, Adapter-Booster, or Burster

Bomblet, 3.4-pound, Spherical, M134 (E130R1) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M135 Burster	N/A	N/A	Auxiliary	2 (p. 4-12)
M33	0.18 pounds	N/A	M33 had a 1.75-inch diameter	1 (p. 4-11)

Fills

Bomblet, 3.4-pound, Spherical, M134 (E130R1) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	1.10	0.49	3.40	1.54	The M134 was also tested with VX.	1 (p. 4-11), 2 (p. 4-11)

Shipping/Packing

Available references did not provide this information.

Bomblet, 3.4-pound, Spherical, M134 (E130R1)

Miscellaneous Information

The M134 bomblet was used with the Honest John M79 (E19R1) 762-mm Warhead (1 p. 4-10), (2).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

2. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

7.7 Bomblet, 6-pound, E104, E104R1

Figures

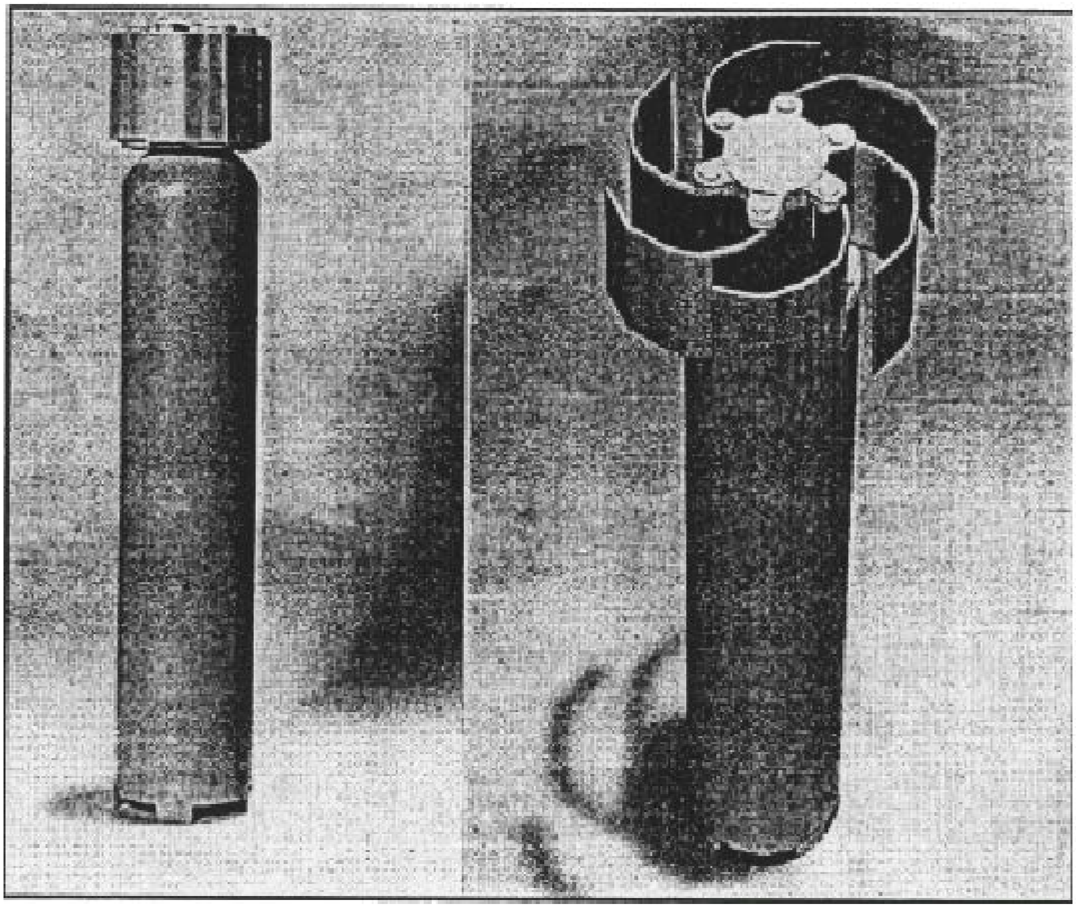

Figure 54: Bomblet, 6-pound, E104, E104R1 - Photograph

Specifications

Bomblet, 6-pound, E104, E104R1 - Specifications and Other Data		**Citation**
Historical Name	E104, E104R1, 6-Pound Bomb, Non-Persistent, Gas	1 (p. 23, Appendix A)
Type	Bomblet	1 (p. 26, appendix A), 2 (p. 1)
Size	6-pound	1 (p. 23, Appendix A), 2 (p. 2), 3 (p. 5)
Diameter	2.75 inches (7.11 cm)	2 (p. 2), 3 (p. 5)
Length	13.9-14.7 inches (35.6-37.3 cm)	1 (p. 23, Appendix A), 2 (p. 2), 3 (p. 5)

General Use and Description

Available references did not provide information on specific use.

The E104 was a nonpersistent bomb that weighed approximately 6.1 pounds. The bomblet utilized a central burster and an air-arming, out-of-line detonator, impact fuze. The cylindrical bomb was stabilized by a fin consisting of three collapsible wrap-around blades.

Bomblet, 6-pound, E104, E104R1

The E104R1 bomblet was the same as the basic E104 except it has six collapsible wrap-around blades (1 p. 23, Appendix A), (2 (p. 2).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Bomblet, 6-pound, E104, E104R1 - Fuzing		
Fuze	**Note**	**Citation**
E24R1	-	4 (p. 12)
E40	Nose- point detonating for E104R1 Weight: 0.80 pounds Length: 1.75 inches	5 (p. 2-21)
E41R1	Nose- air arming	2 (p. 2)
Not designated	Impact	1 (p. 23, Appendix A)

Booster, Adapter-Booster, or Burster

Bomblet, 6-pound, E104, E104R1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	0.35 pounds	Tetryl	Axial burster	4 (p. 12)

Fills

Bomblet, 6-pound, E104, E104R1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	1.90	0.86	6.05-6.10	2.74-2.76	-	1 (p. 23, 25, Appendix A), 2 (p. 2)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The E104R1 was used in the following clusters:

- Cluster, Chemical E130R1, the cluster contained 60 E104R1 bombs.
- Cluster, Chemical E130R3, the cluster contained 76 E104R1 bombs.
- Cluster, Chemical E136R1, the cluster contained 60 E104R1 bombs (1 p. 23-24, Appendix A)

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. SciTech Services, Inc. 1998. Old Chemical Weapons Reference Guide. U.S. Army.
2. Kelgard, Philip, E. 1956. Air Force Armament Center Test Report, AFAC-TR-56-21, Medium and High Altitude Functioning and Dispersion Tests of the E136R3 and E136R4 Type Clusters. United States Air Force.
3. Mayhew, Harry E., Jr. 1955. Plants Division Memorandum Report, Evaluation of High-Speed Filling Line Equipment for the E54R6 Bomb. Chemical Corps.

4. Shaw, D. 1956. Chemical and Biological Laboratories Report, CRLR 539, Special Report, A Series of Dynamic Tests of Single E104R1 GB-filled Bomblets with an Agent/Burster Ratio of 5/1 Fired from an Inverted Mortar, AD 094267. Chemical Corps.

5. Department of Defense. 1982. Military Handbook, MIL-HDBK-146, Fuze Catalog Limited Standard, Obsolescent, Obsolete, Terminated, and Cancelled Fuzes, MIL-HDBK-146. Department of Defense.

7.8 Bomblet, 6-pound, E105

Figures

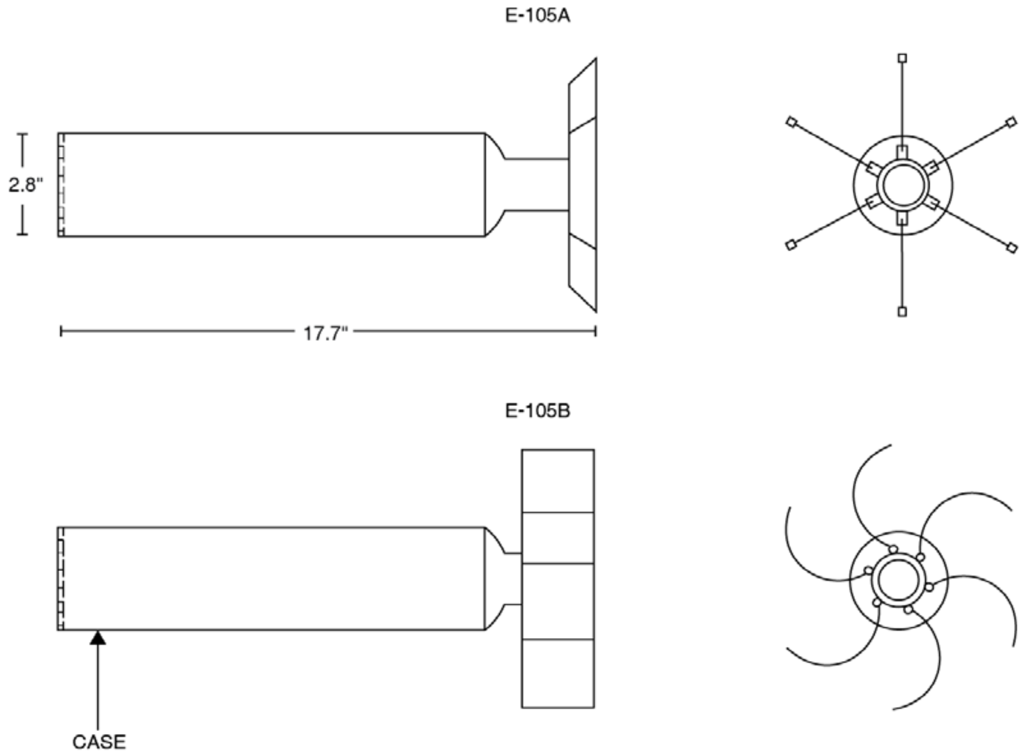

Figure 55: Bomblet, 6-pound, E105 - Line Drawing

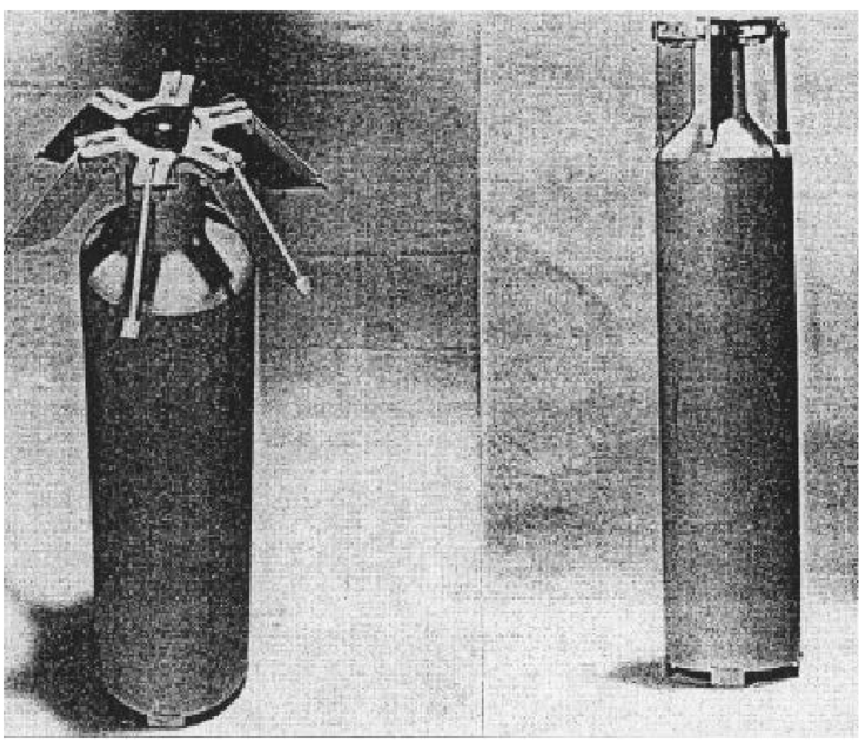

Figure 56: Bomblet, 6-pound, E105 - Photograph

Bomblet, 6-pound, E105

Specifications

Bomblet, 6-pound, E105 - Specifications and Other Data		Citation
Historical Name	E105 6-Pound Bomb, Nonpersistent, Gas	1 (p. 27, Appendix A)
Type	Bomblet	1 (p. 27, Appendix A), 2 (p. 2)
Size	6-pound	1 (p. 27, Appendix A)
Diameter	2.8 inches (7.11 cm)	1 (p. 27, Appendix A)
Length	17.7 inches (44.96 cm)	1 (p. 27, Appendix A)

General Use and Description

Available references did not provide information on specific use.

The E105 was a nonpersistent chemical agent bomb. It weighed approximately 6.1 pounds. This bomb utilized a central burster and an air-arming impact fuze with an out-of-line detonator. The bomb was stabilized by means of a six-bladed collapsible fin. When the bomb was clustered, the blades were packed with their long dimensions parallel to the axis of the bomb. When opening they rotated to a position wherein the long dimensions were normal to the longitudinal axis of the bomb. The weight of the fill was approximately 1.9 pounds (1 p. 27, Appendix A).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Bomblet, 6-pound, E105 - Fuzing		
Fuze	**Note**	**Citation**
E24R1	Modified for inverted mortar functioning	2 (p. 2)
Not designated	Impact	1 (p. 27, Appendix A)

Booster, Adapter-Booster, or Burster

Bomblet, 6-pound, E105 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Burster not designated	0.36 pounds	Tetrytol	-	2 (p. 2)

Fills

Bomblet, 6-pound, E105 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	1.80-1.90	0.81-0.86	6.10	2.76	-	2 (p. 2)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The E105 was to be used in the Cluster, Chemical 750-pound GB E135, which contained 60 E105 bombs (1 p. 27, Appendix A), (2 (p. 2).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. SciTech Services, Inc. 1998. Old Chemical Weapons Reference Guide. U.S. Army.
2. Dugway Proving Ground. 1954. Dugway Proving Ground Trial Report, DPGTR 131. Technical Library.

7.9 Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8)

Figures

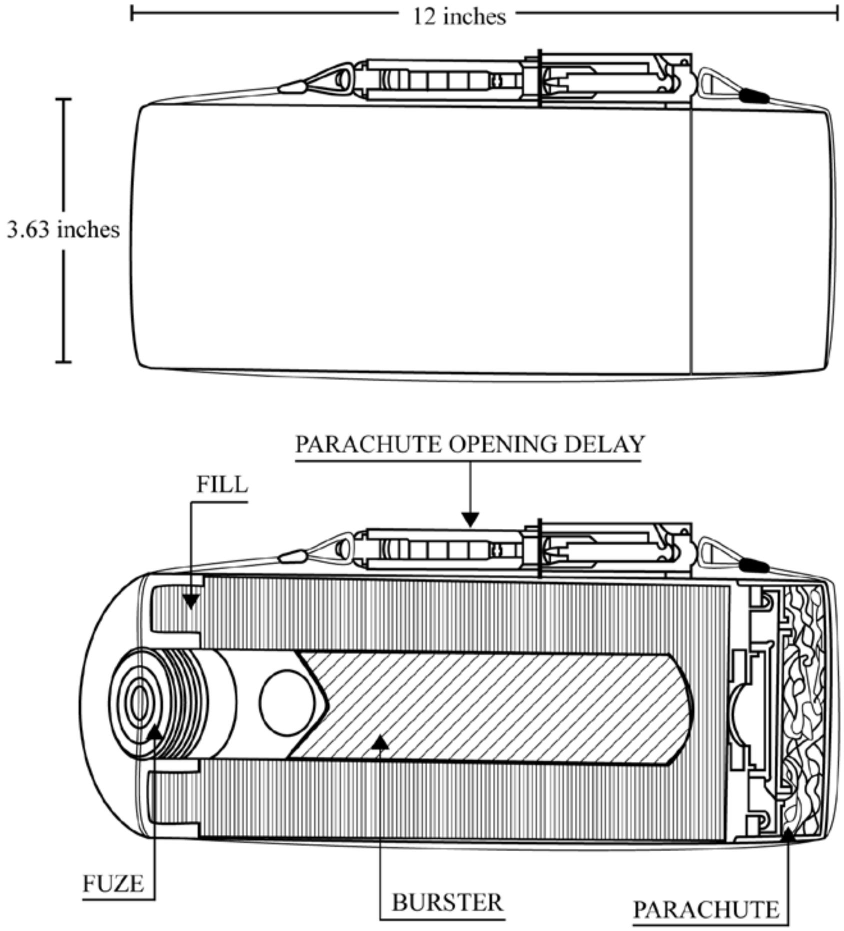

Figure 57: Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8) - Line Drawing

Figure 58: Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8) - Recovered Item

Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8)

Specifications

Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8) - Specifications and Other Data		Citation
Historical Name	Bomb, Gas: Nonpersistent, GB, 10-Pound, M125A1 and M125 (E54R6)	1 (p. 2-57)
Type	Bomblet	2 (p. 3)
Size	10-pound	1 (p. 2-57), 2 (p. 25), 3 (p. 7)
Conflict	Cold War	2 (p. 3)
Service	Air Force	3 (p. 7), 4 (p. 4-20)
Diameter	3.63 inches (9.22 cm)	1 (p. 2-57), 2 (p. 25), 4 (p. 4-20), 5 (p. 4-19)
Length	12 inches (30.48 cm)	1 (p. 2-57), 2 (p. 25), 4 (p. 4-20), 5 (p. 4-19)
Other Engineering Data	During development, the M125 was designated E54R6 and the M125A1 was designated E54R8.	4 (p. 4-20), 5 (p. 4-19), 6
Body Construction Material	Sheet steel	2 (p. 25)
B/M Dwg	D14-5-1369 (M125) D14-5-2184 (M125A1)	6

General Use and Description

The M125 10-pound bomb was designed to provide toxic chemical offensive capability (4 p. 4-19), (5 p. 4-18).

The M125 was identical to the M125A1 except that the M125 used the parachute-opening delay M1 instead of the M1A1 delay. The M125 differed from the M125A1 in that a spring-loaded lock pin, which was restrained by the arming bar, held the firing pin in the delay instead of a detent (part of an external arming bar.

The body of the M125A1 was a sheet steel cylinder with a burster well and fuze at the front end, and a parachute at the rear. The cloth parachute opened to a diameter of 14 inches and was packed in the tail of the bomb. The parachute was packed under a metal tail cap which was held in place by a stranded steel cable attached to the bomb parachute-opening delay. The parachute-opening delay M1A1 was fastened to the outside of the bomb. The delay was held on the bomb by a stranded steel cable, which is wrapped around the long axis of the bomb and fastened at each end of the delay (1 p. 2-57 - 2-59), (2 p. 25-26), (4 p. 4-19), (5 p. 4-18).

Explosive Train

The M125 bombs were arranged in the cluster so that the arming bars on all parachute-opening delays were depressed by contact with other bombs in the cluster. When the bomb was released from the cluster, the arming bar would spring away from the parachute-opening delay, and the firing pin in the delay would fire the primer. The primer ignited the delay charge, which would burn for three to seven seconds, then set off the explosive charge in the parachute opening delay. The explosion would break the stranded steel cable, freeing the tail cup and removing restraint from the fuze arming ring. The parachute opened and abruptly slowed the descent of the bomb. The rapid deceleration caused the arming ring to fall from the fuze, thus arming the fuze. When the bomb impacted, the fuze initiated the burster, which ruptured the body and released the bomb filler (1 p. 2-59), (2 p. 26), (4 p. 4-19), (5 p. 4-18).

Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8)

Fuzing

Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8) - Fuzing		
Fuze	**Note**	**Citation**
M196	Point detonating, containing an ordnance MM15A2 detonator. It was used with M1A1 Parachute Arming Assembly.	4 (p. 4-20), 5 (p. 4-19), 6 (p. 67)

Booster, Adapter-Booster, or Burster

Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M31	0.55 pounds	Tetryl	The M31 had a 1.337-inch diameter and was 7.5 inches long.	1 (p. 2-57), 6 (p. 67)

Fills

Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	2.60	1.17	8.50	3.85	-	1 (p. 2-57), 2 (p. 25), 3 (p. 7), 4 (p. 4-20), 5 (p. 4-20)

Shipping/Packing

The bomblets were shipped as part of the M34 bomb cluster (2 p. 26).

Miscellaneous Information

The bomblets were used with cluster assembly M34 and M34A1.

A total of 362,000 (Type A) and 2,488,000 (Type B) M125 bomb bodies were produced but the Type B were the preferred type (1 p. 2-57), (4 p. 4-19), (5 p. 4-18), (6 p. 66-67), (7 p. 122).

Key Dates

Bomblet, 10-pound, M125 (E54R6), M125A1 (E54R8) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1954	CCTC 2947 (M125 Limited Standard, M125A1 Standard)	8
Standardized	1958	CCTC 3408 (M125A1 GB-fill-Limited Standard-Air Force)	9
Standard Modernization	1959	CCTC 3525 (GB-fill Standard-C-Air Force)	7
Obsoleted	1969	AMCTC 7028 (M125A1 and M125)	6

Sources

1. Departments of the Army, Navy, and Air Force. 1966. Technical Manual, TM 9-1325-200/Ordnance Pamphlet, OP 3530/Technical Order, TO 11-1-28, Bombs and Bomb Components. U.S. Government Printing Office.

2. Departments of the Army and Air Force. 1957. Technical Manual, TM 3-400/Technical Order, TO 11C2-1-1, Chemical Bombs and Clusters. Department of the Army.

3. Chemical Corps. 1952. Quarterly Historical Report, 1 April - 30 June 1952. Chemical and Radiological Laboratories.

4. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

5. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

6. Chemical-Biological-Nuclear Subcommittee. 1969. AMCTC Item # 7028, Reclassification of Clusters, Gas Bomb, Nonpersistent GB, 1000-lb., M34 & M34A1 from Standard-A and Standard-C USAF-Types to Obsolete Types. U.S. Army Materiel Command.
7. Chemical Corps Technical Committee. 1954. CCTC Item # 2947, Classification of Clusters, Gas Bomb, GB, 1000-lb., M34 (E101R3) & M34A1 (E101R5) as Limited Standard and Standard Types, Respectively. Department of the Army.
8. Chemical Corps Technical Committee. 1958. CCTC Item # 3525, Reclassification of Development and Limited Standard items in Accordance with Revised AR 705-6. Department of the Army.
9. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

7.10 Bomblet, BLU-19/B23

Figures

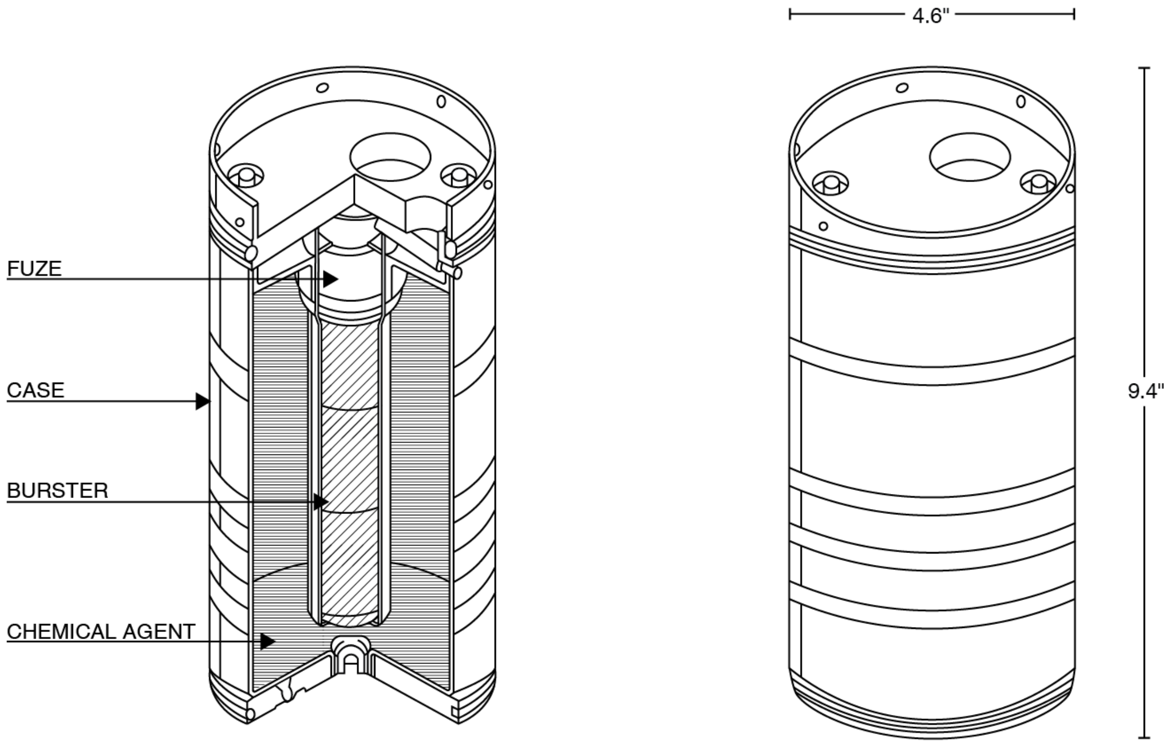

Figure 59: Bomblet, BLU-19/B23 - Line Drawing

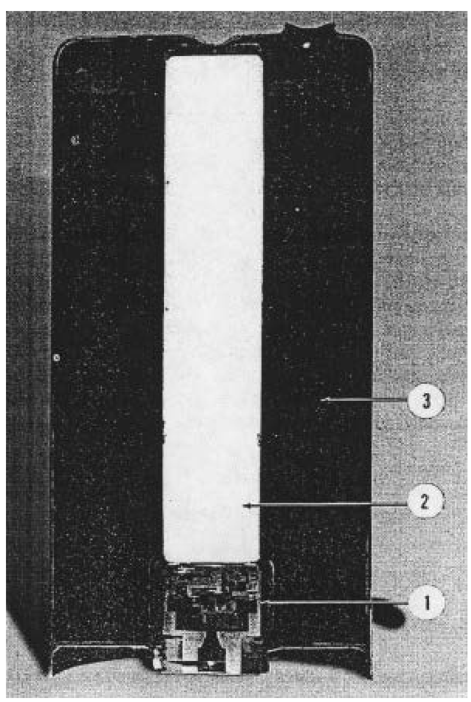

Figure 60: Bomblet, BLU-19/B23 - Photograph - Cutaway View (showing FMU-50/B Fuze, Burster Pellets, and Simulant Fill)

Bomblet, BLU-19/B23

Specifications

Bomblet, BLU-19/B23 - Specifications and Other Data		**Citation**
Historical Name	BLU-19/ B23 Bomblet	1 (p. 9-11, Appendix A)
Type	Bomblet	2
Service	Air Force	2 (p. 5)
Diameter	4.6 inches (11.68 cm)	2 (p. 2)
Length	9.44-9.77 inches (23.97-24.82 cm)	1 (p. 9, Appendix A), 2 (p. 2)
Other	Wall thickness: 0.05 inch (1.27-mm)	2 (p. 5)
Other Engineering Data	Wall thickness: 0.05 inches The SUU-13/A dispenser held 40 each BLU-19/B23 bomblets.	2 (p. 5)
Body Construction Material	Steel plate	2 (p. 2)

General Use and Description

The SUU-13/A dispenser-BLU-l9/B23 bomblet weapon system was designed to provide a capability of delivering appropriate concentrations of agent by high performance aircraft (2 p. 2-5).

The BLU-19/ B23 was a cylindrical, thin walled, unstabilized munition. The bomblet, made of steel plate, was fabricated in four basic parts: 1) an outer shell, 2) a centrally-placed agent load, 3) a central burster composed of plastic bonded RDX, and 4) a modified M551 fuze. The BLU-19/D23 bomblet is designed to be ejected from the SUU-13/A dispenser, which holds 40 bomblets (1 p. 9-10, Appendix A), (2 p. 2-5).

Explosive Train

The BLU-19/ B23 was equipped with a modified M551 fuze with bore rider arming mechanism that fully armed the bomblet 0.5 second after ejection from the SUU-13/A dispenser. The firing train was initiated by impact in any direction when the fuze was armed. Impact in any orientation caused one or more striking weights to drive the firing pin initiating the primer and burster which aerosolized the agent fill (2 p. 5).

Fuzing

Bomblet, BLU-19/B23 - Fuzing		
Fuze	**Note**	**Citation**
M551	Modified fuze with bore rider arming mechanism	2 (p. 3)

Booster, Adapter-Booster, or Burster

Bomblet, BLU-19/B23 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	0.3 pounds	Plastic bonded RDX	Central burst	2 (p. 3)
Not designated	0.63 pounds	Plastic bonded RDX	Central burst	1 (p. 10, Appendix A)

Fills

Bomblet, BLU-19/B23 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	3.70-4.40	1.68-2.00	8.40-9.70	3.81-4.40	-	1 (p. 10, Appendix A), 2 (p. 2)

Shipping/Packing

Available references did not provide this information.

Bomblet, BLU-19/B23

Miscellaneous Information

The BLU-19/ B23 bomblets were used in the SUU-13/A dispenser. The dispenser was equipped with 40 tubes each loaded with a single bomblet (1 p. 10, Appendix A).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. SciTech Services, Inc. 1998. Old Chemical Weapons Reference Guide. U.S. Army.

2. Taylor, W., & Stone, H. 1965. Dugway Proving Ground Report, DPGR C440, Final Report of Engineering Design Test of the USAF Bomblet, Nonpersistent Agent, USATECOM Project 5-4-0005-01. USATECOM.

7.11 Bomblet, Chemical, BLU 50/B

Figures

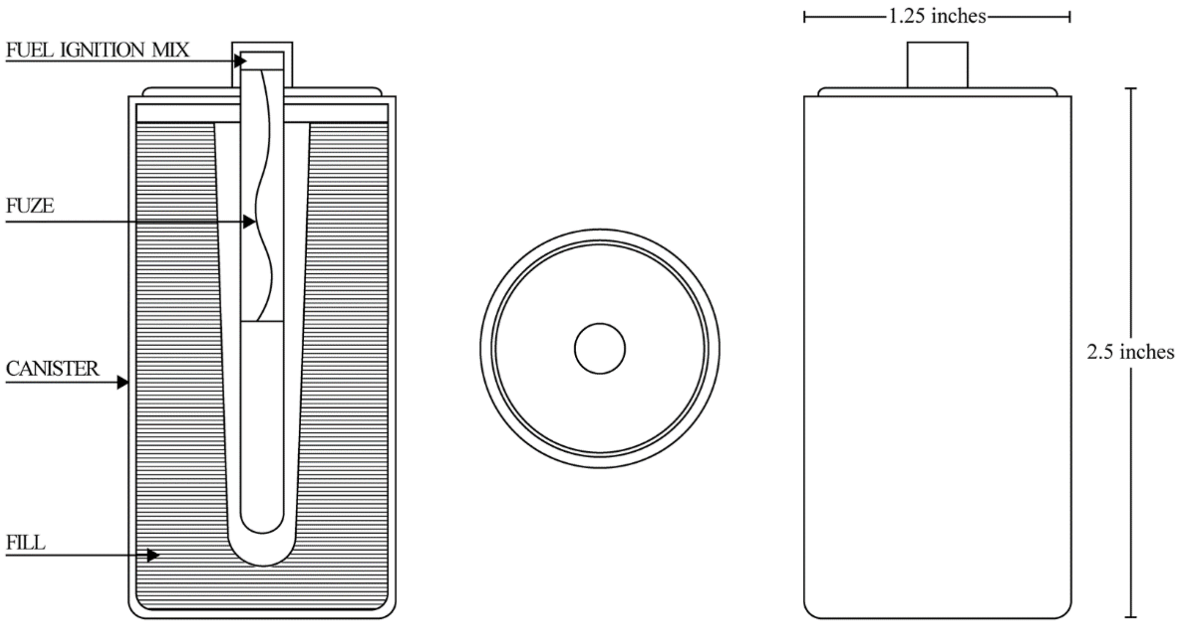

Figure 61: Bomblet, Chemical, BLU 50/B - Line Drawing

Specifications

Bomblet, Chemical, BLU 50/B - Specifications and Other Data		**Citation**
Historical Name	BLU 50/B Bomblet	1 (p. 1)
Type	Bomblet	1 (p. 1), 2 (p. 2-4)
Service	Air Force, Army	2 (p. v)
Diameter	1.25 inches (3.18 cm)	1
Length	2.5 inches (6.35 cm)	1
Other Engineering Data	There were 32 bomblets per canister and 1,280 bomblets per SUU-13/A dispenser.	1 (p. 5), 2 (p. 2-4)

General Use and Description

Available references did not provide information on specific use.

The BLU 50/B bomblet was identical in design to the BLU 39/B bomblet; the only difference was the chemical agent fill. The bomblet was approximately the size of a D cell battery. The outer shell was composed of ABS (acrylonitrile-butadiene-styrene) plastic and was held in place by 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 (55% BZ, 20.25% potassium chlorate, 7.95% percent sulfur, 6.0% percent sodium bicarbonate and 10.8% 233 resin) 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 on the ground, and into the air, after initial impact with the ground. The BLU-50/B disseminated BZ for approximately 17 seconds (1 p. 7), (3 p. 1-181).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Bomblet, Chemical, BLU 50/B - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Pyrotechnic delay fuze	3 (p. 1-182)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Bomblet, Chemical, BLU 50/B - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BZ	0.07	0.03	0.13	0.05	-	1 (p. 1), 2 (p. 2-4)
CS	0.07	0.03	0.13	0.06	BLU-39/B	3 (p. 1-182)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

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. Each canister in the SUU-13/A contained 32 BLU-50/B bomblets. There were up to 1,280 BLU-50/B bomblets in the CBU-16A/A dispenser.

The BLU-50/B was identical in design to the BLU-39/B bomblet (CBU30/A) except for the fill (1 p. 5), (2 p. 2-4).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Department of the Army. 1967. Dugway Proving Ground Letter Report, DPGLR C765, Limited Feasibility Test of the BLU-50/B Bomblet, USATECOM Project No. 5-7-5005-01 (U). USATECOM.

2. Deseret Test Center. 1972. Joint [Chemical- Biological] CB Technical Data Source Book (U), Volume II, Riot Control and Incapacitating Agents (U), Part Three: Agent BZ (U). U.S. Army.

3. SciTech Services, Inc. 1998. Old Chemical Weapons Reference Guide. U.S. Army.

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8 CAIS

Chemical Agent Identification Sets are military training aids containing small quantities of various chemical agents and or other chemicals. All CAIS are assumed to be handled as CWM until definitive assessment identifies the specific contents. As provided for in a 2007 memorandum from the Deputy Under Secretary of the Army for Environment, Safety, and Occupational Health, CAIS determined to contain only industrial chemicals (e.g., CG) or small quantities of dilute blister agents (H or L) can be managed as hazardous waste. CAIS K941, toxic gas set M1; and CAIS K942, toxic gas set M2/E11 are forms of CAIS always considered to be CWM because they contain neat agent. All CAIS containing a nerve agent at any concentration are considered CWM.

8.1 CAIS, Chemical Agent Identification, Simulants, M72A1, M72A2, SCAITS

Figures

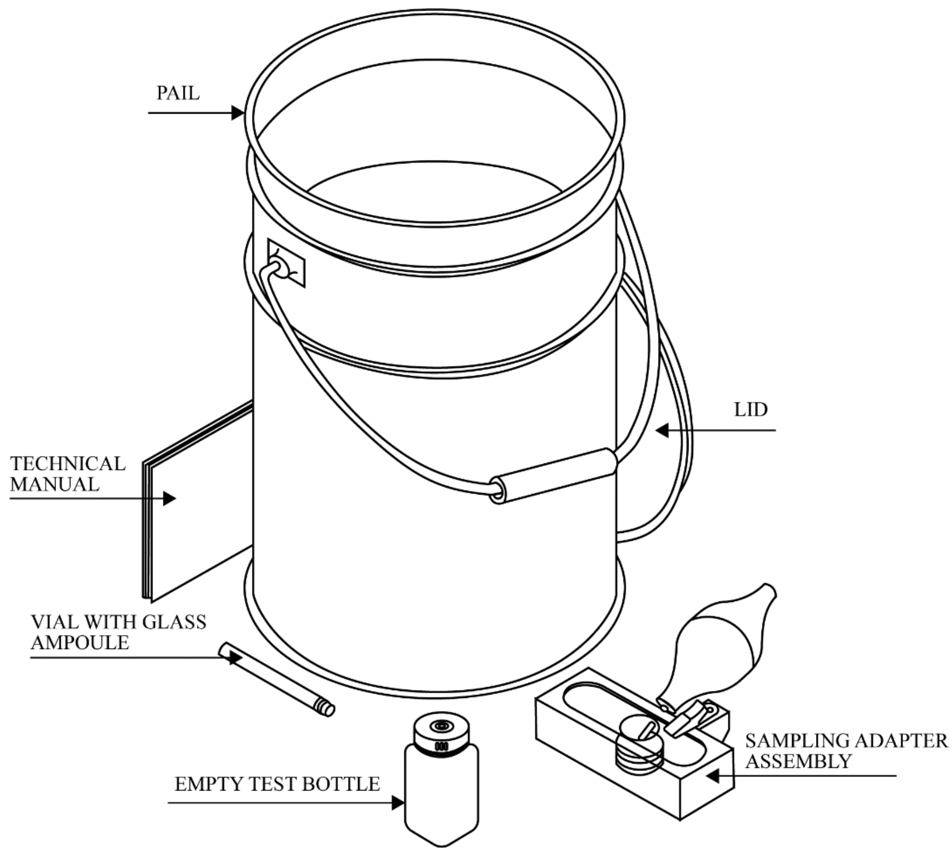

Figure 62: CAIS, Chemical Agent Identification, Simulants, M72A1, M72A2, SCAITS - Line Drawing - M72A1 SCAITS

Specifications

CAIS, Chemical Agent Identification, Simulants, M72A1, M72A2, SCAITS - Specifications and Other Data		**Citation**
Historical Name	Training Set, Chemical Agent Identification, Simulant, M72A1	1 (p. 14-11)
Type	CAIS	-
Service	Army, Navy	1 (p. 14-11), 2 (p. 1-1)
Diameter	Available references did not provide this information.	-
Length	Available references did not provide this information.	-
Width	Available references did not provide this information.	-
Height	Available references did not provide this information.	-
Body Construction Material	Steel pail, plastic vials, glass ampules	2 (p. 2-2)
NSN	6910-00-106-4800 (M72A1) 6910-01-04302090 (M72A2)	1 (p. 14-11), 3

General Use and Description

The M72A1 Simulant Chemical Agent Identification Training Set (SCAITS) was a training device intended for use by qualified instructors to demonstrate color changes associated with chemical detectors, such as detector tubes, tickets, and paper. Although the SCAITS contained only agent simulants, the color changes produced were the same as those obtained with toxic chemical agents under field conditions (1 p. 14-11).

The SCAITS consisted of a steel pail with handle and removable lid, eight empty test bottles, three bottles of liquid simulants, 250 vials of agent simulants, one sampling adapter assembly, and one copy of Technical Manual, TM 3-6910-227-10. The test bottles and vials containing ampules of vapor simulants had corresponding colored markings to assure proper matching during use. The sample adapter assembly was provided with a rubber squeeze bulb and was threaded to receive a test bottle when performing tests (1 p. 14-11).

Explosive Train

This item required no explosive train. When using the M72A1 SCAIT set, small quantities of agent simulants were used with detectors to demonstrate color changes associated with surface contamination (1 p. 14-11).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

CAIS, Chemical Agent Identification, Simulants, M72A1, M72A2, SCAITS - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
Simulant-AC	N/A	N/A	N/A	N/A	AC and CK-1 Simulant. 1.0 milliliters (mL) per ampule. Sodium hypochlorite	3 (p. E-5)
Simulant-CG	N/A	N/A	N/A	N/A	Phenyl chloroformate. 0.3 mL per ampule.	3 (p. E-6)
Simulant-CK-2	N/A	N/A	N/A	N/A	Sodium thiocyanate. 1.0 mL per ampule.	3 (p. E-6)
Simulant-G	N/A	N/A	N/A	N/A	G- and Cx Simulant. 0.3 mL per ampule. Benzoyl chloride and benzene sulfonyl chloride	3 (p. E-4)
Simulant-G	N/A	N/A	N/A	N/A	Bottle: hexylene glycol (13.5 ml) and methoxy ethanol (6.5 ml). Total 20 mL per bottle.	3 (p. E-1)
Simulant-H	N/A	N/A	N/A	N/A	Ampoule: Dimethyl sulfate. 0.3 mL per ampule.	3 (p. E-3)
Simulant-H	N/A	N/A	N/A	N/A	Bottle: hexylene glycol (13.5 mL) and methoxy ethanol (6.5 mL). 20 mL per bottle.	3 (p. E-1)
Simulant-L	N/A	N/A	N/A	N/A	Phenyl hydrazine. 0.3 mL per ampule.	3 (p. E-4)
Simulant-V	N/A	N/A	N/A	N/A	Glacia acetic acid. 1 mL per ampule.	3 (p. E-5)
Simulant-V	N/A	N/A	N/A	N/A	Bottle: Tetrahydrofurfuryl alcohol (70 gm), N-methyglucamine (16 gm), and diethylene glucol (300 gm). Total 20 mL per bottle.	3 (p. E-2)

Shipping/Packing

The training set was packaged one per steel pail. The filled pail weighed approximately 14 pounds (1 p. 14-11).

Miscellaneous Information

The M72A1 were physically similar to the K945 Chemical Agent Identification Training Sets (CAITS) (M72). The discovery of a set resembling this description should provoke a careful comparison of labels to determine if it is really SCAITS M72A1 or K945 CAITS M72 (4 p. 15).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.
2. Department of the Army. 1979. Technical Manual, TM 3-6910-227-10, Operators Manual Training Set, Chemical Agent Identification: Simulants, M72A2. U.S. Government Printing Office.
3. Department of the Army. 1985. Technical Manual, TM 3-6910-226-10, Operators Manual, M72A1 Simulants Chemical Agent Identification Training Set (NSN 6910-00-106-4800). Headquarters, Department of the Army.
4. U.S. Army Program Manager for Chemical Demilitarization. 1995. Chemical Agent Identification Sets (CAIS) Information Package. Department of Defense.

8.2 CAIS, Gas Identification Set, Instructional, K955, M1

Figures

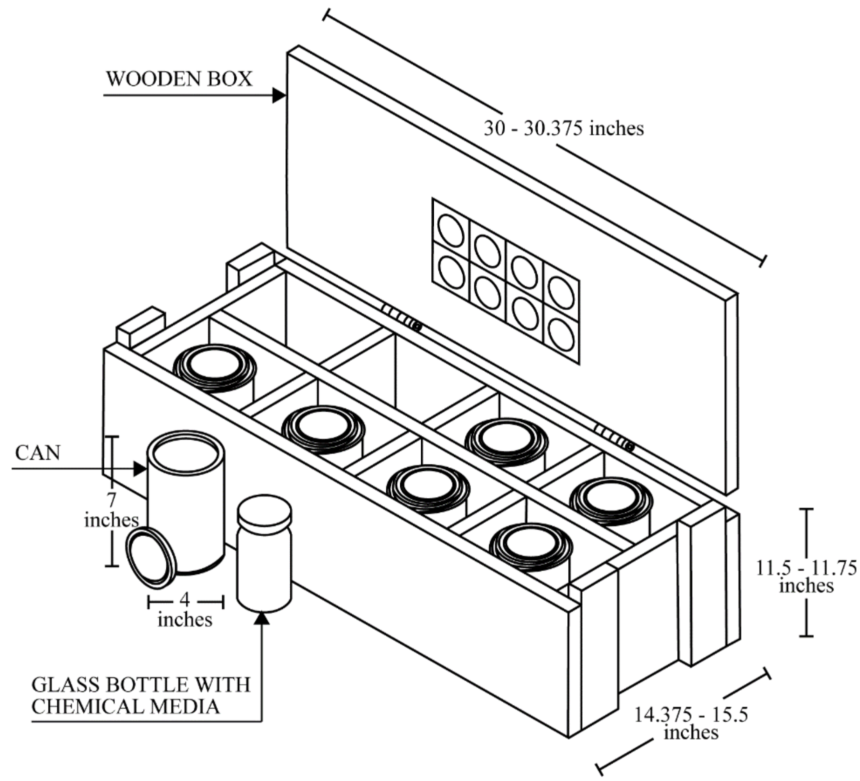

Figure 63: CAIS, Gas Identification Set, Instructional, K955, M1 - Line Drawing

Figure 64: CAIS, Gas Identification Set, Instructional, K955, M1 - Photograph - Left: K955 Components in Box, Right: Navy M1 Replacement

CAIS, Gas Identification Set, Instructional, K955, M1

Specifications

CAIS, Gas Identification Set, Instructional, K955, M1 - Specifications and Other Data		Citation
Historical Name	Set K955 Set, Gas Identification, Instructional, M1 (Navy Set)	1 (p. 27)
Type	CAIS	1 (p. 27)
Conflict	WWII	1 (p. 27)
Diameter	Metal can: 4 inches (10.16 cm)	1 (p. 27)
Length	Wood box: 14.375-15.5 inches (36.52-39.37 cm)	2
Width	Wood box: 30-30.375 inches (76.2-77.15 cm)	2
Height	Wood box: 11.5-11.75 inches (29.21-29.85 cm) Metal can: 7 inches (17.78 cm)	2
Spec/PD No	MIL-S-10333	3 (p. 15-17)
NSN	1365-00-025-3273	1 (p. 27), 3 (p. 15-17)
FSN	1365-368-6154	-

General Use and Description

These sets were used by military to train soldiers to identify chemical agents in the field (3 p. 15-13).

This set was often called a "Sniff Set." It consisted of actual agents in individual glass bottles with glass stoppers ground to make an airtight fit. Each bottle was etched on the side to show the symbol of the agent. Each K955 CAIS contained seven glass bottles with agent. Four contained 3 ounces of active charcoal on which 25 mL (0.85 fluid ounces) of agent (H, PS, L) was absorbed. Of the seven bottles, one bottle contained L/M-1, one bottle contained PS, and two bottles contained HS, one contained 3 grams of triphosgene (a simulant for CG), one contained 15 grams of CN, and one with 15 grams of DM (2 p. 2).

Explosive Train

This item required no explosive train.

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

CAIS, Gas Identification Set, Instructional, K955, M1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	0.01	0.00	0.01	0.00	The bottle contained solid triphosgene, which off-gases CG. Weight is per bottle.	1 (p. 27), 2, 3
CN	0.03	0.01	0.03	0.01	CN agent used as fill. Weight is per bottle.	2, 3
DM	0.03	0.01	0.03	0.01	DM was in a cloth bag. Weight is per bottle.	2, 3
HS	0.07	0.03	0.14	0.06	Bottles may be marked as H or HS. Weight is per bottle.	1 (p. 27), 2, 3
L	0.10	0.04	0.10	0.04	Could be labeled "M-1", L absorbed by activated charcoal. Weight is per bottle.	1 (p. 27), 2, 3
PS	0.09	0.04	0.09	0.04	PS absorbed by activated charcoal. Weight is per bottle.	1 (p. 27), 2, 3

CAIS, Gas Identification Set, Instructional, K955, M1

Shipping/Packing

These sets were packed in a hinged covered wood box that resembles a foot locker and measured 30 inches wide, 15.5 inches long and 11 inches high. The inside of the box was divided into eight sections. Seven of the sections contained sealed metal cans in sawdust and the eighth held instructions. The cans were 4 inches in diameter and 7 inches high and had a paint can-type lid. Inside each can was one round bottle with a large screw top or glass stopper which was usually wax coated (1 p. 27), (2(p. 2).

Miscellaneous Information

These bottles are frequently found loose in WWII disposal/burial sites. Their contents are easily identified by the letter and number code etched into the side of the glass bottle. Older sets use the code "M-1" for lewisite, while newer sets use the code "L." The CG bottles contain solid triphosgene, which off-gases CG.

Between 1941 and 1943, 25,395 sets were procured. Between 1941 and 1943, 25,395 sets were procured (1 p. 27), (4 p. 59).

Key Dates

CAIS, Gas Identification Set, Instructional, K955, M1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Type Classified	1927	CCTC 1927-21	5
Adopted	1928	CCTC 1928-02-02	6
Standardized	1935	CCTC 1935-23	7
Standardized	1944	CCTC 1291 (M1 - Reclassified Limited Standard)	4
Standardized	1944	CCTC 1291 (M2 - Standard)	4
Standardized	1955	CCTC 3010 (Limited-Standard)	8
Obsoleted	1958	CCTC 3188 (M2)	9
Standard Modernization	1959	CCTC 3525 (Standard-B-Bureau of Ordnance)	10
Obsoleted	1970	AMCTC 8234 (M1)	4

Sources

1. U.S. Army Program Manager for Chemical Demilitarization. 1995. Chemical Agent Identification Sets (CAIS) Information Package. Department of Defense.

2. Department of the Navy. 1945. Ordnance Pamphlet, OP 1447, Gas Identification Sets. Department of the Navy.

3. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

4. Chemical-Biological-Nuclear-Subcommittee. 1971. AMCTC Item # 8234, Reclassification of War Gas Identification Set, Instructional: Nondetonation, MI from Standard-B BuOrd Type to Obsolete Type. U.S. Army Materiel Command.

5. Chemical Corps Technical Committee. 1927. CCTC Item # 1927-21, Adoption as to Type - (b) Chemical Warfare Service Sniffing Set. U.S. Army Materiel Command.

6. Chemical Corps Technical Committee. 1928. CCTC Item # 1928-2-2, Adoption as to Type (b) Chemical Warfare Service Gas Service Sniffing Set. U.S. Army Materiel Command.

7. Chemical Corps Technical Committee. 1935. CCTC Item # 1935-23, Set, Gas Identification, Instructional – Recommendation of Classification and Basis of Issue. U.S. Army Materiel Command.

8. Chemical Corps Technical Committee. 1955. CCTC Item # 3010, Cancellation of Army Requirements for Sets, Gas Identification, Instructional, MI & M2 (Sniff Sets). U.S. Army Materiel Command.

9. Chemical Corps Technical Committee. 1956. CCTC Item # 3188, Reduction of Chemical Corps Items in the Supply System. U.S. Army Materiel Command.

10. Chemical Corps Technical Committee. 1958. CCTC Item # 3525, Reclassification of Development and Limited Standard items in Accordance with Revised AR 705-6. Department of the Army.

8.3 CAIS, Replacement Set, Gas Identification, Instructional, Navy X Sets

Figures

No figures available.

Specifications

CAIS, Replacement Set, Gas Identification, Instructional, Navy X Sets - Specifications and Other Data		**Citation**
Historical Name	Navy X Sets, Replacement Set, Gas Identification, Instructional, (Navy)	1 (p. 31)
Type	CAIS	1 (p. 31)
Conflict	Other	1 (p. 31)
Service	Navy	1 (p. 31)
Diameter	Can: 4 inches (10.16 cm)	1 (p. 31)
Length	Wooden box: 16 inches (40.64 cm)	2
Width	Wooden box: 7.5 inches (19.05 cm)	2
Height	Wooden box: 11.75 inches (29.84 cm) Can: 7 inches (17.78 cm)	2
Spec/PD No	CWS 197-54-99	3 (p. 94-95)
NSN	1365-038-5138, 1365-608-5327, 1365-608-5328, 1365-608-5323, 1365-608-5322, 1365-608-5324, 1365-608-5325, 1365-608-5326, 1365-608-5329	1

General Use and Description

These sets were used by military to train soldiers to identify chemical agents on the field. The replacement materials for the K955 evolved as the agents and training requirements changed. The MI (K955) Set was originally a nonexpendable item, and provision was made for replacement of sample bottles in which the agent concentration had diminished due to evaporation. Replacement was accomplished by means of the “Set, Sample Replacement, for Gas Identification Set, Instructional, MI” which consisted of two component bottles in a separate shipping box 16.625 x 11.75 x 8.5 inches in size and weight of 23 pounds. Requisitioners of new agent bottles returned the exhausted bottles in the nonexpendable shipping box (1 p. 31), (4).

There were several other configurations for the replacement kits as well. These include nine different types of replacement CAIS used by the Navy to replace components of the K955 CAIS and the Navy’s supplemental set which included HN.

The X302 contained one bottle with 25 mL (0.85 fluid ounces) of HN1, and one 25 mL (0.85 fluid ounces) bottle of HN3 absorbed in three ounces of activated charcoal.

The sample replacement sets X545 through X552 contained two bottles with either a total of 1.7 fluid ounces of liquid agent absorbed in activated charcoal or solid agent (2).

Explosive Train

This item required no explosive train.

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

CAIS, Replacement Set, Gas Identification, Instructional, Navy X Sets - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	0.01	0.00	0.01	0.01	triphosgene CG simulant used with set X545. Weight is per bottle.	1 (p. 31)
CN	0.03	0.01	0.07	0.03	Set X546. Weight is per bottle.	1 (p. 31)
DM	0.03	0.01	0.07	0.03	Set X549. Weight is per bottle.	1 (p. 31)
HN-1	0.06	0.02	0.12	0.05	HN-1 absorbed in 3 ounces of activated charcoal. Used in X302 and X550. Weight is per bottle.	1 (p. 31), 2
HN-3	0.07	0.03	0.14	0.06	HN-3 absorbed in 3 ounces of activated charcoal. Used in X302 and X551. Weight is per bottle.	1 (p. 31), 2
HS	0.07	0.03	0.14	0.06	Set X547. Weight is per bottle.	1 (p. 31)
L	0.10	0.04	0.21	0.09	Set X548. Weight is per bottle.	1 (p. 31)
PS	0.09	0.04	0.19	0.08	Set X552. Weight is per bottle.	1 (p. 31)

Shipping/Packing

Each X-Set was packaged in a wooden box with a hinged cover. The replacement set weighed 18 pounds and measured 7.5 inches wide by 16 inches long by 11.75 inches high. The box was divided into two sections. Each section contained a can with a paint can-type top packed with sawdust. Each contained one round bottle with a large screw top or glass stopper which was usually wax coated (2 p. 5).

Key Dates

CAIS, Replacement Set, Gas Identification, Instructional, Navy X Sets - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Classified	1946	CCTC 1683 (MI Replacement reclassified as a spare part)	3
Obsoleted	1971	AMCTC 8234 (M1)	4

Sources

1. U.S. Army Program Manager for Chemical Demilitarization. 1995. Chemical Agent Identification Sets (CAIS) Information Package. Department of Defense.

2. Department of the Navy. 1945. Ordnance Pamphlet, OP 1447, Gas Identification Sets. Department of the Navy.

3. Chemical Corps Technical Committee. 1946. CCTC Item # 1683 Cancellation of Miscellaneous Experimental Items. Department of the Navy.

4. Chemical-Biological-Nuclear-Subcommittee. 1971. AMCTC Item # 8234, Reclassification of War Gas Identification Set, Instructional: Nondetonation, MI from Standard-B BuOrd Type to Obsolete Type. U.S. Army Materiel Command.

8.4 CAIS, Toxic Gas Set, K941, M1

Figures

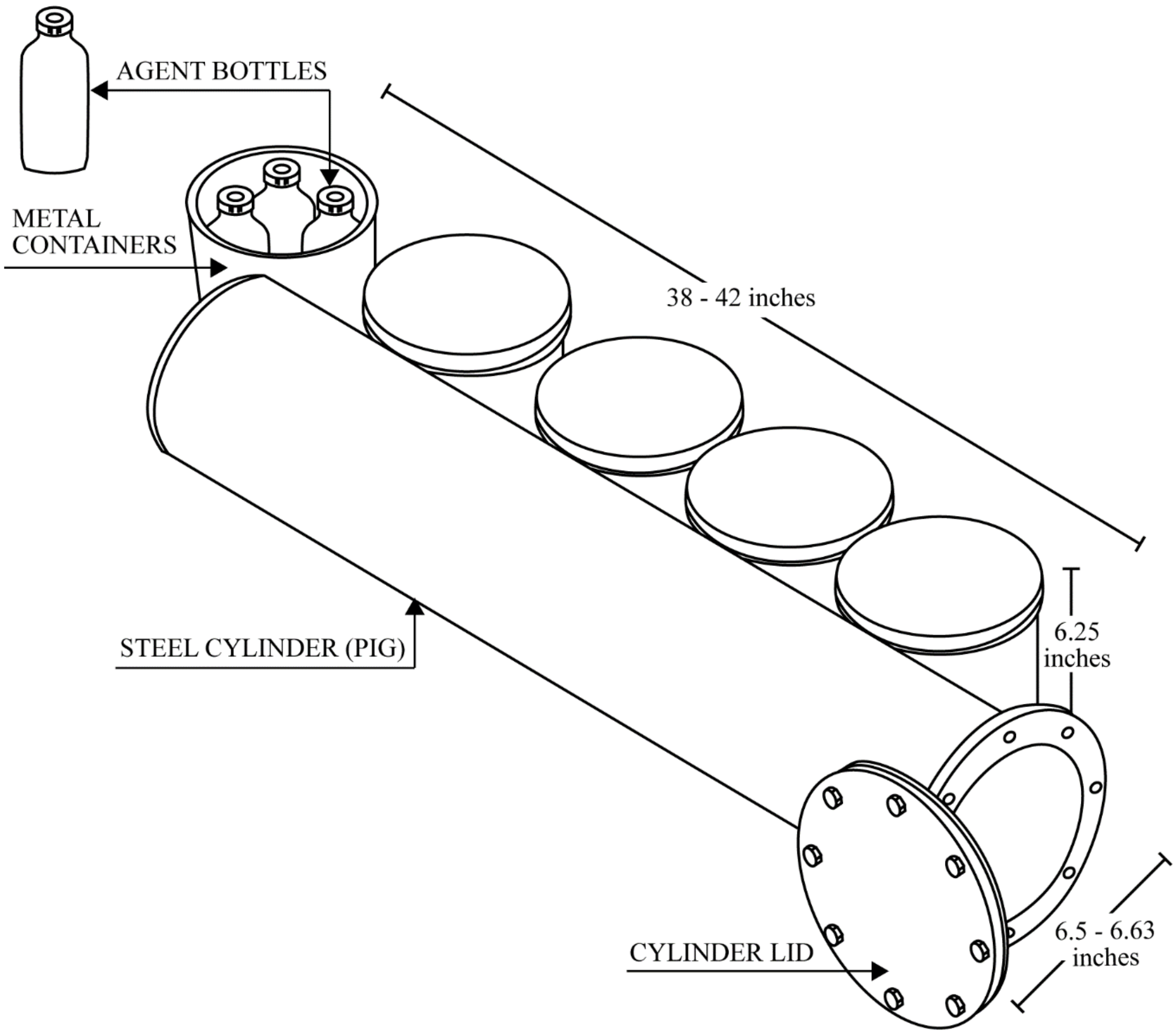

Figure 65: CAIS, Toxic Gas Set, K941, M1 - Line Drawing - CAIS, Toxic Gas Set M1, K941

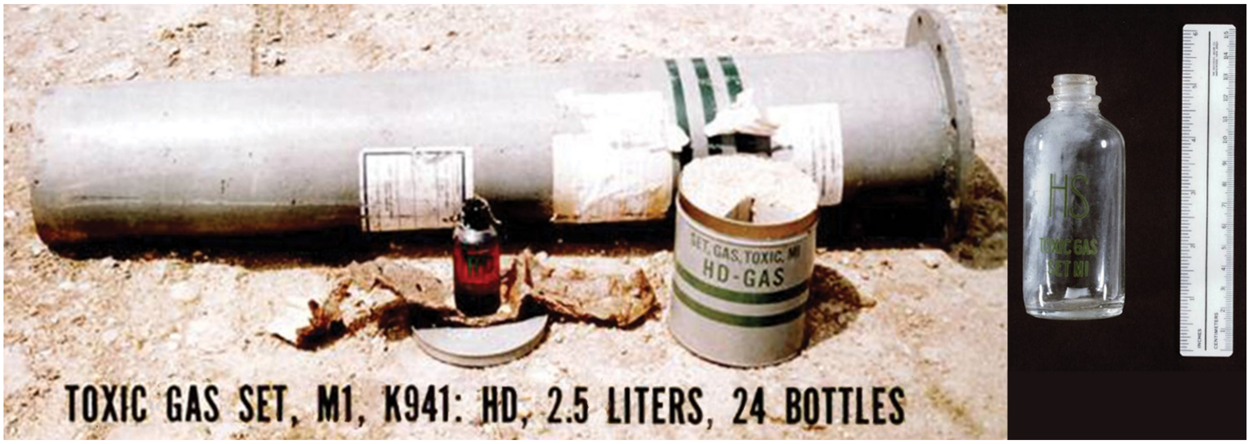

Figure 66: CAIS, Toxic Gas Set, K941, M1 - Photograph, Left: Toxic Gas Set, M1, K941, Right: Bottle

Specifications

CAIS, Toxic Gas Set, K941, M1 - Specifications and Other Data		Citation
Historical Name	K941 Toxic Gas Set, M1	1 (p. 4)
Type	CAIS	1 (p. 5)
Conflict	Cold War, WWII	1 (p. 5), 2
Service	Air Force, Army, Navy	3 (p. 253), 4 (p. 15-27)
Diameter	6.5-6.63 inches (16.51-16.83 cm)	3 (p. 15-27), 4 (p. 253)
Length	38-42 inches (96.52-106.68 cm)	3 (p. 253), 4 (p. 15-27)
Height	Can: 6.25 inches (15.88)	1 (p. 5)
Spec/PD No	MIL-S-10333	3 (p. 253), 4 (p. 15-27)
B/M Dwg	D18-58-2	3 (p. 253)
NSN	1365-00-219-8574	1 (p. 5), 3 (p. 253), 4 (p. 15-27)
FSN	1365-219-8574, 6910-219-8574	1 (p. 5), 5 (p. 209)

General Use and Description

The K941 sets were used by the military to train soldiers in the identification of mustard agent (1 p. 5), (3 p. 253), (4 p. 15-27).

The K941 CAIS contained 24 glass bottles, each contained 3.5 fluid ounces of mustard (H and HS) or HD (133.5 grams assuming a liquid density of 1.27 grams/milliliter) for a total of 84 fluid ounces (2.48 liters or 3.16 kilograms) per set.

The bottles were round and had a small screw top. Heat resistant paint on the bottles indicates "H", "HS", "HD", or "Toxic Gas Set, M1." Four bottles were packed in a one-half inch layer of sawdust within a sealed metal can. The cans were pressure sealed, 6.25 inches high and had a removable roll-type key on the bottom (i.e., the keys were similar to those found on cans of fish or meat). Six of these metal cans were fit into a steel shipping cylinder that was 6-5/8 inches in diameter, approximately 38 inches long, and 0.145-inch thick. The open end of this container was closed by a flanged end cover, which was secured by eight bolts tightened over a 1/8-inch thick lead gasket.

Whenever encountered, individual bottles or complete CAIS K941 are considered CWM (1 p. 5), (3 p. 253), (4 p. 15-27).

Explosive Train

This item required no explosive train.

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

CAIS, Toxic Gas Set, K941, M1

Fills

CAIS, Toxic Gas Set, K941, M1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
H	0.29	0.13	6.96	3.15	Weight is per bottle (24 bottles).	3 (p. 253), 4 (p. 15-27), 5 (p. 209)
HD	0.29	0.13	6.96	3.15	Weight is per bottle.	1, 3, 4

Shipping/Packing

The sets were packed in a steel cylinder that weighed 83 pounds and was 2.1 cubic feet.

The steel shipping container was air-tight and would stand 250 pounds per square inch (psi) internal pressure when bolted tight. The nuts were hexagonal and could be removed with a standard 1 1/4-inch wrench.

The six containers were packed in a steel shipping cylinder, 42 inches long and 6.5 inches in diameter. The cylinder was sealed with a steel cover that was bolted over a lead gasket (3 p. 253), (4 p. 15-27).

Miscellaneous Information

During WWII, 23,001 M1 toxic gas sets were procured with an additional 3,531 sets procured between 1949 and 1952. As of 1971, the Army reportedly had 46 sets on hand (2 p. 125).

In former WWII training areas, K941 shipping containers (also called PIGS) or loose K941 bottles are frequently found buried. Loose bottles should be handled carefully by field personnel during recovery using appropriate protective measures as the plastic/bakelite tops on these bottles are prone to leak (1 p. 5), (2 p. 125).

Key Dates

CAIS, Toxic Gas Set, K941, M1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1942	CCTC 567	3 (p. 253)
Standardized	1955	CCTC 3125 (Limited Standard)	2 (p. 122)
Standardized	1956	CCTC 3242 (Limited Standard)	3 (p. 253)
Standard Modernization	1958	CCTC 3408 (Standard-B)	3 (p. 253), 6 (p. 117)
Obsoleted	1971	AMCTC 8515	2 (p. 120), 7 (p. 1-2)

Sources

1. U.S. Army Program Manager for Chemical Demilitarization. 1995. Chemical Agent Identification Sets (CAIS) Information Package. Department of Defense.
2. Chemical-Biological-Nuclear Subcommittee. 1971. AMCTC Item # 8515, Reclassification of Toxic Gas Sets: M1 and M2 from Standard-B and Standard-A Types to Obsolete Types. U.S. Army Materiel Command.
3. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.
4. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.
5. Department of the Army. 1961. Technical Manual, TM 3-500, Chemical Corps Equipment Data Sheets. U.S. Government Printing Office.

6. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

7. Chemical-Biological-Nuclear Subcommittee. 1971. AMCTC Item # 8516 (CBN Item #4868), Reclassification of War Gas Identification Sets, Instructional; Detonation, M1 & AN-M1A1; and Detonating Equipment, War Gas Identification: M1 from Standard-A/B Types to Obsolete Types. U.S. Army Materiel Command.

8.5 CAIS, Toxic Gas Set, K942, M2 (E11)

Figures

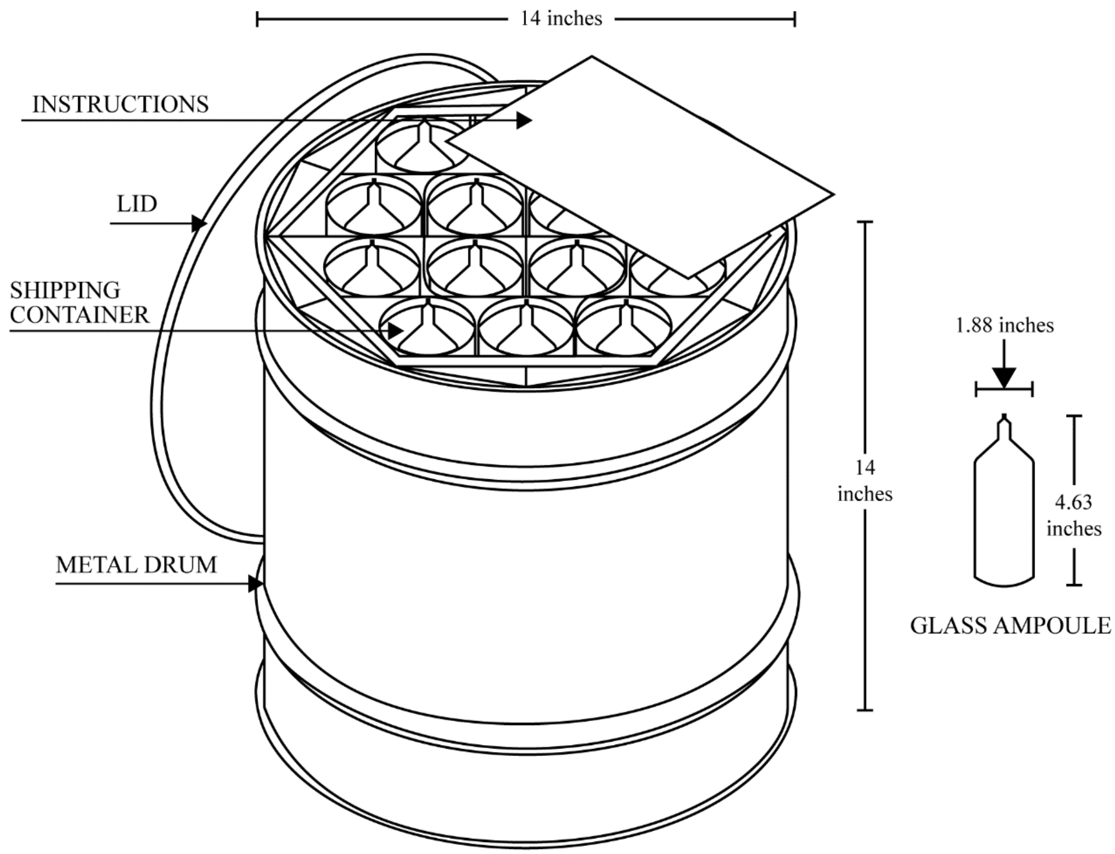

Figure 67: CAIS, Toxic Gas Set, K942, M2 (E11) - Line Drawing - CAIS, Toxic Gas Set, M2, K942

Figure 68: CAIS, Toxic Gas Set, K942, M2 (E11) - Photograph – Left: K942 Toxic Gas Sets Can and Contents, Right: Toxic Gas Set, M2, K942, 28 Ampules

CAIS, Toxic Gas Set, K942, M2 (E11)

Specifications

CAIS, Toxic Gas Set, K942, M2 (E11) - Specifications and Other Data		**Citation**
Historical Name	Set K942 Toxic Gas Set, M2/E11	1 (p. 9)
Type	CAIS	1 (p. 9)
Conflict	Other	1 (p. 9)
Service	Army, Navy	2 (p. 15-29), 3 (p. 254)
Diameter	Ampule: 1.87 inches (4.76 cm) Drum: 14 inches (35.56 cm)	1 (p. 9-10), 3 (p. 254)
Length	Ampule: 4.62 inches (11.74 cm) Drum: 14 inches (35.56 cm)	1 (p. 9-10), 2 (p. 15-29)
Height	Drum: 14 inches (35.56 cm)	1 (p. 10), 2 (p. 15-29), 3 (p. 254)
Spec/PD No	MIL-S-51058	3 (p. 15-29)
B/M Dwg	C18-58-31	2 (p. 15-29), 3
NSN	1365-00-563-4146	1 (p. 9), 2 (p. 15-29)
FSN	1365-563-4146	1 (p. 9), 3 (p. 254)

General Use and Description

The K942 sets were used by military to train soldiers to identify chemical agents in the field.

The M2 gas set was used to familiarize trainees with HD. Small quantities of HD were used to contaminate designated training areas. Personnel were trained in recognizing the effects of HD and the proper decontamination procedures (1 p. 9), (2 p. 15-29), (3 p. 254).

The K942 CAIS contained 28 heat-sealed ampules, each containing 3.8-4.0 fluid ounces of mustard (H, HD, or HS) for a total of 106.4 fluid ounces. Assuming a liquid density of 1.27 grams/mL, each ampule contained 142.7 grams of H.

Each ampule was packed in its own can, 28 cans were packed in a steel drum. Ampules were flame sealed at the neck to produce a leak proof container for the mustard. Each ampule was stored in a hermetically sealed metal tear strip container made of tinplate. The ampules were protected from movement and breakage by foam rubber disks at the ends and a corrugated fiberboard lining.

Whenever encountered, individual ampules or complete CAIS K942 are considered CWM (1 p. 9), (2 p. 15-29), (3 p. 254).

Explosive Train

This item required no explosive train.

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

CAIS, Toxic Gas Set, K942, M2 (E11)

Fills

CAIS, Toxic Gas Set, K942, M2 (E11) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
H	0.31	0.14	8.81	3.99	3.8 fluid ounces / 112 mL per ampule with 28 ampules per set	1 (p. 9)
H	0.25	0.11	6.94	3.14	3.8 fluid ounces / 112 mL per ampule with 28 ampules per set	1 (p. 9)
HD	0.31	0.14	8.81	3.93	3.8 fluid ounces / 112 mL per ampule with 28 ampules per set	1 (p. 9), 2 (p. 15-29), 3 (p. 254)

Shipping/Packing

The 28 cans forming the kit were packed in a cold rolled carbon steel drum that was 14 inches in diameter, 14 inches high, and 0.0375 inches thick in two layers. There were 14 cans per layer. The cans were separated into individual compartments by fiberboard packaging. The drum was sealed by a bolted ring closure cover seated on a rubber gasket (1 p. 9), (3).

Miscellaneous Information

It is reported that 20 M2 toxic gas sets were procured in 1953 and none remained on hand as of 1971. The M2 Toxic Gas Set was no longer in use by the Navy by 1985 (2 p. 15-29), (4 p. 125).

Key Dates

CAIS, Toxic Gas Set, K942, M2 (E11) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1956	CCTC 3242 (Standard)	4
Standard Modernization	1958	CCTC 3408 (Standard-A)	3 (p. 254), 5
Obsoleted	1971	AMCTC 8515	4 (p. 120)

Sources

1. U.S. Army Program Manager for Chemical Demilitarization. 1995. Chemical Agent Identification Sets (CAIS) Information Package. Department of Defense.

2. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

3. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

4. Chemical-Biological-Nuclear Subcommittee. 1971. AMCTC Item # 8515, Reclassification of Toxic Gas Sets: M1 and M2 from Standard-B and Standard-A Types to Obsolete Types. U.S. Army Materiel Command.

5. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

8.6 CAIS, Training Set, Chemical Agent Identification, K945, M72, CAITS

Figures

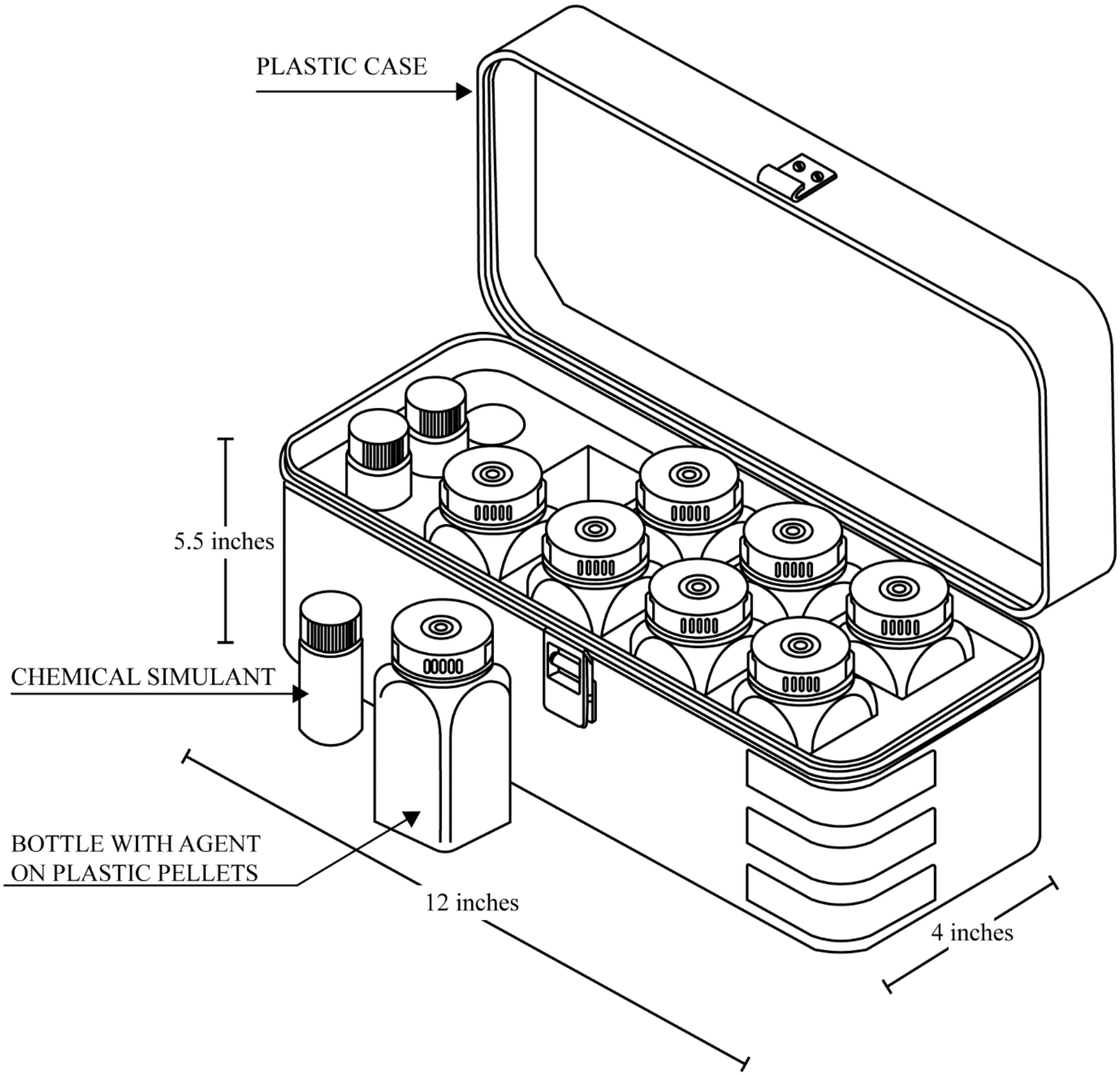

Figure 69: CAIS, Training Set, Chemical Agent Identification, K945, M72, CAITS - Line Drawing

Figure 70: CAIS, Training Set, Chemical Agent Identification, K945, M72, CAITS - Photograph - Open Tackle Box

Specifications

CAIS, Training Set, Chemical Agent Identification, K945, M72, CAITS - Specifications and Other Data		Citation
Historical Name	Set K945 Training Set, Chemical Agent Identification, M72	1 (p. 15)
Type	CAIS	1 (p. 15)
Conflict	Cold War	1 (p. 15)
Service	Army, Marine Corps, Navy	2
Length	Carrying case: 4 inches (10.16 cm)	1 (p. 15), 3 (p. 15-31)
Width	Carrying case: 12 inches (30.48 cm)	1 (p. 15), 3 (p. 15-31)
Height	Carrying case: 5.5 inches (13.97 cm)	1 (p. 15), 3 (p. 15-31)
Other Engineering Data	Designated XM-72 and E18 during development.	3 (p. 15-31), 4
Spec/PD No	MIL-T-51321	3 (p. 15-31)
NSN	1365-00-051-1807	1, 3 (p. 15-31)
FSN	1365-051-1807	1 (p. 15)

General Use and Description

The M72 CAITS was a training device intended for use by qualified instructors to demonstrate color changes associated with chemical detectors, such as detector tubes, tickets, and paper (1 p. 15), (3 p. 15-31).

The K945 CAITS contained four bottles of nerve agent GB (3 mL agent [5.67 grams assuming a 1.89 grams/mL] in 12 grams of polystyrene pellets), one bottle of L (3 mL agent [3.27 grams assuming a 1.09 grams/mL] in 15 grams of polystyrene pellets), one bottle of triphosgene (solid chemical that breakdowns to off-gases CG, 5 grams), one bottle of potassium cyanide (KCN) (5 grams and 1 mL water), and one bottle of H (1 mL agent in 15 grams Plexiglass pellets). Each K945 CAITS bottle contained about 0.7 fluid ounce of agent absorbed in plastic pellets. The K945 CAITS also had three plastic coated, one-ounce, clear glass vials (1.1 inches in diameter and 2.88 inches high) with screw caps containing simulants. The eight 2-ounce bottles in the set were originally round (1.75 inches in diameter by 3.125 inches) but specifications were changed to be square bottles.

Eight square bottles and three small round bottles were enclosed in a plastic carrying case measuring 12 by 5.5 by 4 inches and weighing about three pounds. This case was described as "tackle box" type. The plastic case was sealed in two-layer laminated plastic bags that were packed in a fiberboard box that was in turn packed into a wooden box sealed with metal straps (1, p. 15) (3, p. 15-31) (4) (5).

When encountered, individual bottles or complete CAIS K945 are considered CWM (1 p. 15), (3 p. 15-31), (5).

Explosive Train

This item required no explosive train.

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

CAIS, Training Set, Chemical Agent Identification, K945, M72, CAITS - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	0.01	0.00	0.01	0.00	Triphosgene was used as a simulant for CG. Weight is per bottle. The set contained one bottle of triphosgene.	3 (p. 15-31)
GB	0.00	0.00	0.03	0.01	Weight is per bottle. There were 4 bottles of GB per set.	1 (p. 15), 3 (p. 15-31)
HD	0.01	0.00	0.01	0.00	The set contained one bottle of H. weight is per bottle.	1 (p. 15)
L	0.01	0.00	0.01	0.00	Weight is per bottle. The set contained one bottle of L.	1, 3
Simulant-AC	0.01	0.00	0.01	0.00	KCN was used as a simulant of AC. Weight is per bottle. The set contained one bottle.	3 (p. 15-31)
Simulant-G	0.05	0.02	0.05	0.02	13.5 mL hexylene glycol & 6.5 mL 2-methoxyethanol. Weight is per vial.	4 (p. 13)
Simulant-H	0.05	0.02	0.05	0.02	20 mL isoamylsalicylate. Weight is per vial.	3 (p. 15-31), 4 (p. 13)
Simulant-V	0.05	0.02	0.05	0.02	20 mL saturated solution of N-methylglucamine in tetrahydrofurfuryl alcohol & diethylene glycol. Weight is per vial.	4 (p. 13)

Shipping/Packing

The M72 CAITS was packaged one per metal drum. The filled drum weighed approximately 15 pounds (3 p. 15-31).

Miscellaneous Information

These sets are believed to have all been destroyed in disposal operations at Rocky Mountain Arsenal between 1979 and 1982. It is unlikely that any remain. They are physically similar to the M72A1 SCAITS. The discovery of a set resembling this description should provoke a careful comparison of labels to determine if it is really a K945 CAITS (M72) or a SCAITS (M72A1) (1 p. 15).

Key Dates

CAIS, Training Set, Chemical Agent Identification, K945, M72, CAITS - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1967	AMCTC 5507 (Standard-A)	4

Sources

1. U.S. Army Program Manager for Chemical Demilitarization. 1995. Chemical Agent Identification Sets (CAIS) Information Package. Department of Defense.
2. Chemical-Biological-Nuclear Subcommittee. 1967. AMCTC Item # 5647, Minutes of ET/ST Review (IPR #5) on Training Set, Chemical Agent Identification: M72 (SM72) (E18) (CAITS) (Task 1B643606D02209) (AMCMS 5666.12.022.009). U.S. Army Materiel Command.
3. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.
4. Chemical-Biological-Nuclear Subcommittee. 1967. AMCTC Item # 5507, Reclassification of Training Set, Chemical Identification: M72 (XM72) (E18) (CAITS) from Development Type to Standard-A Type; Completion of RDT&E Task. U.S. Army Materiel Command.
5. U.S. Army. 1972. Technical Manual, TM 3-1365-2000-10, Operators Manual, Training Set, Chemical Agent Identification: M72. U.S. Army Materiel Command.

8.7 CAIS, War Gas Identification Set, Instructional and Detonation, K953/K954, AN-M1A1

Figures

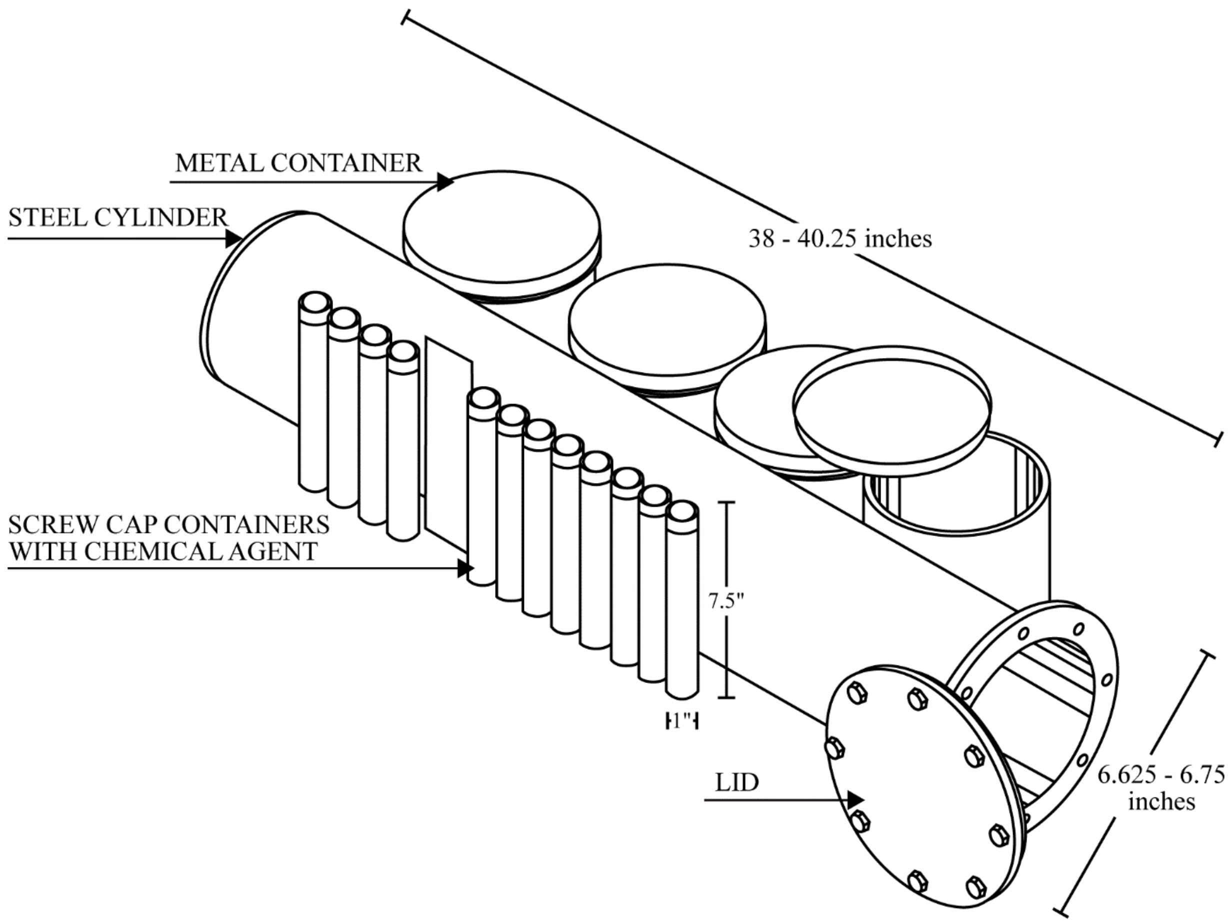

Figure 71: CAIS, War Gas Identification Set, Instructional and Detonation, K953/K954, AN-M1A1 - Line Drawing

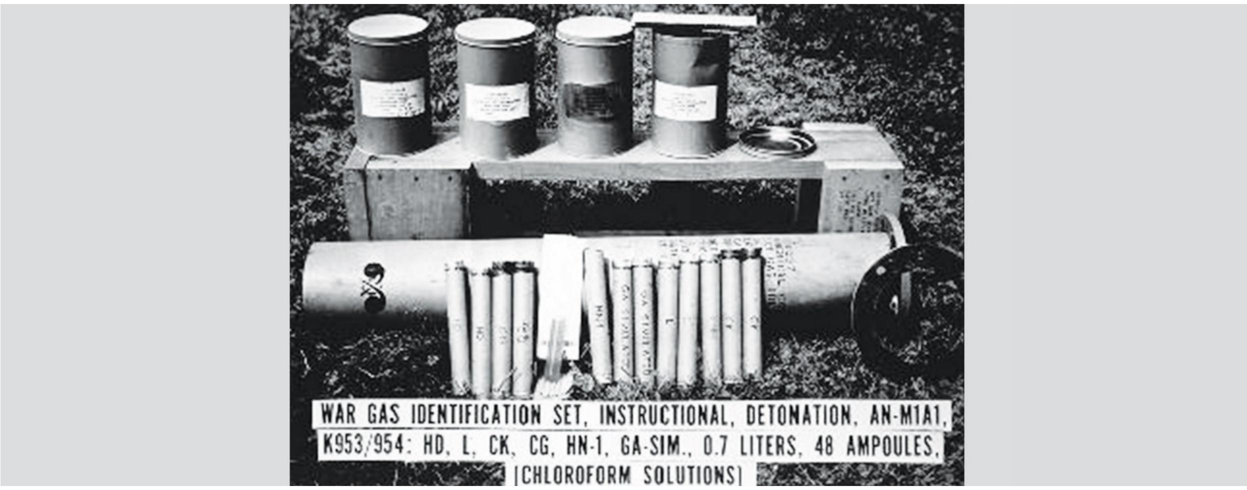

Figure 72: CAIS, War Gas Identification Set, Instructional and Detonation, K953/K954, AN-M1A1 - Photograph - War Gas Identification Set, Instructional, Detonation, AN-M1A1, K953/K954

Specifications

CAIS, War Gas Identification Set, Instructional and Detonation, K953/K954, AN-M1A1 - Specifications and Other Data		**Citation**
Historical Name	Set K953/ K954 Was Gas Identification Set, Instructional, AN-M1A1	1 (p. 25)
Type	CAIS	1 (p. 25)
Conflict	Other	1 (p. 25)
Service	Air Force, Army, Navy	2 (p. 256)
Diameter	Ampule: 1-inch (2.54 cm) Steel cylinder: 6.62-6.75 inches (16.83-17.15 cm)	3 (p. 15-25)
Length	Ampule: 7.5 inches (19.05 cm) Steel cylinder: 38-40.25 inches (96.52-102.24 cm)	3 (p. 15-25)
Other	Flange Diameter: 9.25 inches (23.49 cm)	3
Other Engineering Data	The only difference between the K953 and the K954 CAIS was that the K953 was issued with blasting caps. During development, this was known as the E7.	1 (p. 25), 4
Spec/PD No	MIL-S-11149 MIL-S-12398 (detonation accessories) MIL-S-12281 (AN-M1A1 detonation), MIL-W-12281	2 (p. 256), 3 (p. 15-25), 4 (p. 1-2, 2-3)
B/M Dwg	C18-21-54	2 (p. 256)
FSN	1365-323-7782 (K953) with blasting caps 1365-338-0735 (K954) without blasting caps	1 (p. 25), 4 (p. 6-7)

General Use and Description

These sets were used by military to train soldiers to identify chemical agents in the field. The AN-M1A1 provided sample tubes of common chemical agents for outdoor training of group personnel by developing a small agent cloud by detonation using the M1 accessory set (2 p. 256), (3 p. 15-23), (4 p. 6-7).

The K953/K954 were identical in configuration to the K951/K952 except that they only contained eight ampules each of CG, L (5% in chloroform), HD (5% in chloroform), CK, HN-1 (10% in chloroform) and GA simulant for a total of 23.8 fluid ounces of agent, less the chloroform, per set.

These sets were packed in containers identical to the K951 and K952. The only difference between the K953 and K954 CAIS is that the K953 was issued with blasting caps. These were not packaged in the steel cylinder, and were in a separate box.

Whenever encountered, individual bottles or complete sets K953/K954 are considered CWM (2 p. 256), (3 p. 15-23).

Explosive Train

There was no explosive train in the agent-containing container. Seventy No. 6 Blasting Caps with lead wire were shipped separately for use with this set and the original model. No. 8 Blasting Caps associated with the K951 set were available as alternate types (4 p. 4-5).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

CAIS, War Gas Identification Set, Instructional and Detonation, K953/K954, AN-M1A1

Fills

CAIS, War Gas Identification Set, Instructional and Detonation, K953/K954, AN-M1A1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	0.13	0.05	1.04	0.47	8 each 40 mL ampules of CG. Weight is per ampule.	1 (p. 25), 2 (p. 256), 3 (p. 15-23)
CK	N/A	N/A	0.84	0.38	8 each 40 mL ampules of CK. Weight is 1.4 fluid ounces / 41.4 mL per ampule.	1 (p. 25), 2 (p. 256), 3 (p. 15-23)
HD	0.01	0.00	0.04	0.02	8 each 40 mL ampules with 2 mL of HD. Weight is per ampule.	2 (p. 256), 3 (p. 15-23)
HN-1	0.01	0.00	1.00	0.45	8 each 40 mL ampules with 4 mL of HN. Weight is per ampule.	1 (p. 25), 2 (p. 256), 3 (p. 15-23)
L	0.01	0.00	0.07	0.03	8 each 40 mL ampules with 2 mL of L. Weight is per ampule.	1 (p. 25), 2 (p. 256), 3
Simulant-GA	0.09	0.04	0.70	0.31	8 each 40 mL ampules of GA simulant. Weight is per ampule.	1 (p. 25), 2 (p. 256)

Shipping/Packing

The AN-M1A1 set was packaged in one steel cylinder, weighing 110 pounds, and a cubage of 2.1 cubic feet. There were 48 tubes in each set (2 p. 256), (3 p. 15-25).

Miscellaneous Information

It was reported that a total of 1,518 AN-M1A1 sets had been procured between 1958 and 1959 (958 by the Air Force, and 560 by the Marine Corps). As of 1971, there was a total of 785 M1 and AN M1A1 sets remaining in Marine Corps inventory (4 p. 3, 8).

Key Dates

CAIS, War Gas Identification Set, Instructional and Detonation, K953/K954, AN-M1A1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1954	CCTC 2930 (Air Force)	4
Standardized	1955	CCTC 3125	4
Standard Modernization	1958	CCTC 3408 (Standard-A)	5
Obsoleted	1971	AMCTC 8516	4

Sources

1. U.S. Army Program Manager for Chemical Demilitarization. 1995. Chemical Agent Identification Sets (CAIS) Information Package. Department of Defense.

2. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

3. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

4. Chemical-Biological-Nuclear Subcommittee. 1971. AMCTC Item # 8516 (CBN Item #4868), Reclassification of War Gas Identification Sets, Instructional; Detonation, M1 & AN-M1A1; and Detonating Equipment, War Gas Identification: M1 from Standard-A/B Types to Obsolete Types. U.S. Army Materiel Command.

5. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

8.8 CAIS, War Gas Identification Set, Instructional, K951/K952, M1

Figures

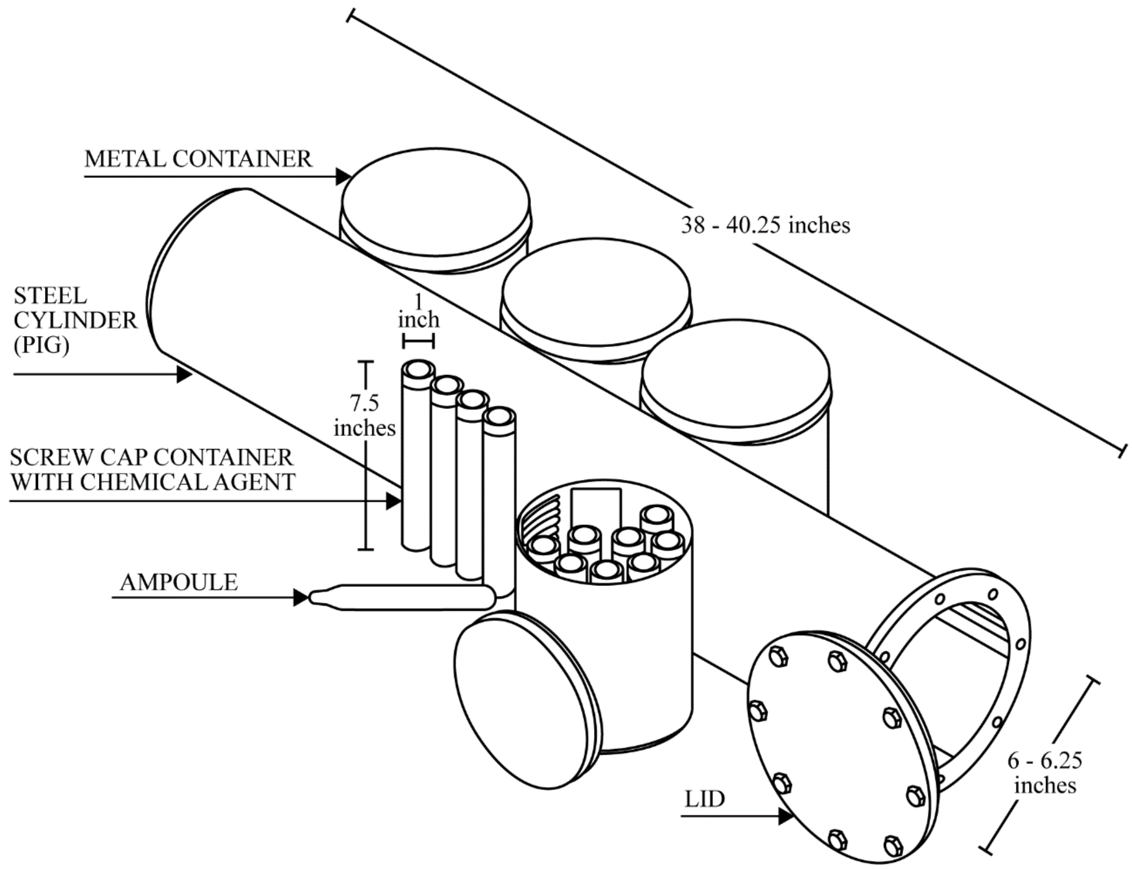

Figure 73: CAIS, War Gas Identification Set, Instructional, K951/K952, M1 - Line Drawing

Figure 74: CAIS, War Gas Identification Set, Instructional, K951/K952, M1 - Photograph - K951/K952 Steel Cylinder (PIG) and Contents

CAIS, War Gas Identification Set, Instructional, K951/K952, M1

Specifications

CAIS, War Gas Identification Set, Instructional, K951/K952, M1 - Specifications and Other Data		**Citation**
Historical Name	Set K951/ K952 War Gas Identification set, Instructional M1	1 (p. 19)
Type	CAIS	1
Conflict	WWII	1 (p. 19)
Service	Air Force, Army, Navy	2 (p. 255)
Diameter	Ampule: 1-inch (2.564 cm) Steel cylinder: 6.62 (16.82 cm)	1 (p. 19), 3 (p. 15-21)
Length	Ampule: 7.5 inches (19.05 cm) Steel cylinder: 38.0-40.25 inches (96.52-102.23 cm)	1 (p. 19), 3 (p. 15-21)
Other	Flange Diameter: 9.25 inches (23.49 cm)	3 (p. 15-21)
Spec/PD No	MIL-S-11149	3 (p. 15-21)
B/M Dwg	D18-21-22	3 (p. 15-21)
FSN	1365-025-3272 (K951) with blasting caps 1365-025-3783 (K952) without blasting caps	1 (p. 19), 3 (p. 15-21)

General Use and Description

The M1 Instructional Gas Identification Set was a training device for use by qualified instructors to identify chemical agents by their odors (1 p. 19), (3 p. 15-13).

The K951/K952 CAIS M1 contained 48 Pyrex, flame sealed ampules (approximately 7.5 inches long and 1-inch in diameter), 12 each containing a 40 milliliter (1.4-ounce) solution of H (5% in chloroform), L (5% in chloroform), PS (50% in chloroform), or CG for a total of 26 ounces of agent, less the chloroform, per set.

Each ampule was packed in a cardboard screw cap container (mailing tube-type) with agent type indicated by letters on the cardboard container. Twelve cardboard containers each were packaged into metal inner packages. The open end of the shipping cylinder was closed by a flanged end cover that was secured by eight bolts.

The only difference between K951 and K952 was that K951 was issued with blasting caps that were packed and shipped in a separate container (1 p. 19), (3 p. 15-19), (4).

Explosive Train

There was no explosive train in the agent-containing container. There was an associated container holding No. 8 blasting caps (5 p. 139).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

CAIS, War Gas Identification Set, Instructional, K951/K952, M1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	0.13	0.05	1.50	0.68	The set held 12 40 mL ampules of CG. Weight is per ampule.	1 (p. 19), 3 (p. 15-19), 4
H	0.01	0.00	0.07	0.03	Weight is per ampule.	1 (p. 19), 3 (p. 15-21), 4
L	0.01	0.00	0.10	0.04	Weight is per ampule.	1 (p. 19), 3 (p. 15-19), 4
PS	0.07	0.03	0.89	0.04	Weight is per ampule.	1 (p. 19), 3 (p. 15-19), 4

Shipping/Packing

The steel shipping container (110 pounds; 2.1 cubic feet) known as a PIG included strips of adhesive tape and instructions for use. Four metal, inner containers were packed into the shipping container. Inside each inner container were 12 cardboard screw cap containers, each containing a hermetically sealed glass ampule. Double-faced corrugated cardboard fillers were placed on top of the containers, and a double face corrugated strawboard filler was placed on the bottom so that well-cushioned packing was supplied when the blind flange with its gasket was bolted down tight on the shipping container flange. This packing was airtight and would withstand 250 psi internal pressure when bolted tight. The nuts were hexagonal and can be removed with a standard 1 1/4-inch wrench (2 p. 15-21).

Miscellaneous Information

In 1933, authority for the limited procurement of 120 M1 sets was approved with their issue to the Army posts for extended service testing under supervision of Post Chemical Warfare officers. Ultimately, 81,120 M1 sets were procured. The Army procured 216 in 1935 to 1936, 52,047 in 1940 to 1944, and 21,357 in 1951 to 1953. The Navy procured 7,500 sets in 1951. When the sets were obsoleted in 1971, the Army had 3,258 on hand in depots (6, p. 143).

The K951/K952 ampules (also called vials) are frequently found in burial sites at old WWII training areas. They are sometimes found loose, sometimes found in their original steel cylinders (also called "PIGS"), and are sometimes found in drums, cans, or other disposal containers. When found loose the agent type cannot be readily identified without sophisticated spectrographic equipment, and a worst-case assumption of CG should be made by field personnel (1 p. 19), (5 p. 143).

Key Dates

CAIS, War Gas Identification Set, Instructional, K951/K952, M1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1934	CCTC 1934-57	6
Standardized	1941	CCTC 334 (Standardization of an Accessories Set for Use With Set, Gas Identification, Detonation, MI)	5
Standardized	1955	CCTC 3125 (Ltd Standard)	5
Standardized	1958	CCTC 3408 (Detonation Standard-B, M1 Instructional Navy Limited-Standard)	7
Obsoleted	1971	AMCTC 8516, CBN 4868	5

Sources

1. U.S. Army Program Manager for Chemical Demilitarization. 1995. Chemical Agent Identification Sets (CAIS) Information Package. Department of Defense.

2. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

3. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

4. Department of the Navy. 1945. Ordnance Pamphlet, OP 1447, Gas Identification Sets. Department of the Navy.

5. Chemical-Biological-Nuclear Subcommittee. 1971. AMCTC Item # 8516 (CBN Item #4868), Reclassification of War Gas Identification Sets, Instructional; Detonation, M1 & AN-M1A1; and Detonating Equipment, War Gas Identification: M1 from Standard-A/B Types to Obsolete Types. U.S. Army Materiel Command.

6. Chemical Corps Technical Committee. 1935. CCTC Item # 1935-14, Set, Gas Identification, Detonation, M1 - Standardization of, 24 Dec 34, approved 28 Mar 35. U.S. Army Materiel Command.

7. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

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9 Dispenser

A dispenser, or cluster bomb, is a bomb that is designed to dispense smaller bombs, or bomblets, to cover a wider area than a single large (greater than 100-pound) bomb.

9.1 Dispenser, 750-pound, Universal Bomb, MK 15 Mod 0, Sadeye

Figures

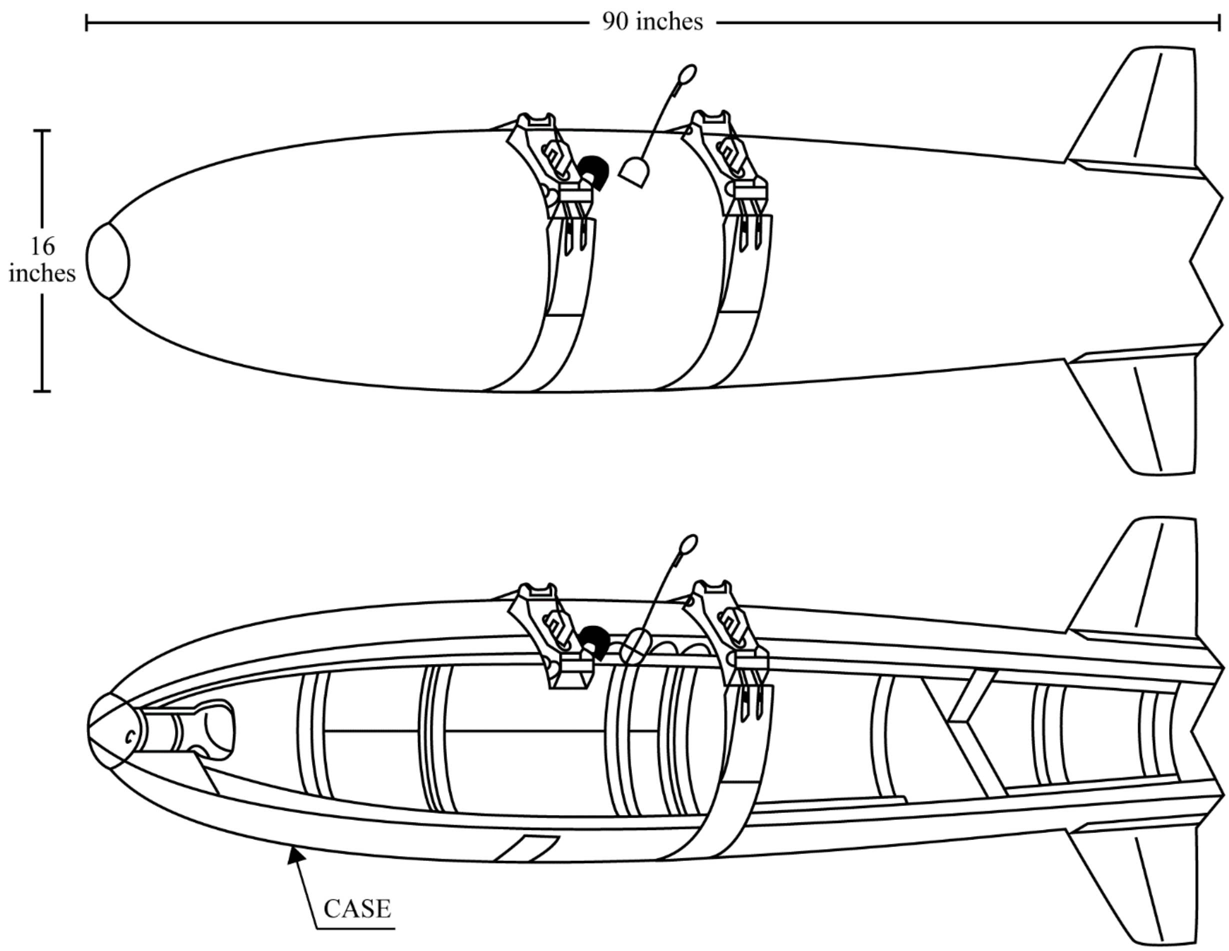

Figure 75: Dispenser, 750-pound, Universal Bomb, MK 15 Mod 0, Sadeye - Line Drawing

Specifications

Dispenser, 750-pound, Universal Bomb, MK 15 Mod 0, Sadeye - Specifications and Other Data		**Citation**
Historical Name	Sadeye (Dispenser, Universal Bomb)	1 (p. 4-27a)
Type	Dispenser	1 (p. 4-27a)
Size	750-pound	1 (p. 4-27b)
Diameter	16 inches (40.64 cm)	1 (p. 4-27b), 2 (p. 1-1)
Length	88-90 inches (223.52-228.6 cm)	1 (p. 4-27b), 2 (p. 1-1)
Other Engineering Data	Empty weight: 150 pounds Total weight: 750 pounds	1 (p. 4-27b), 2 (p. 1-1)
Body Construction Material	The skin of the dispenser was low carbon steel. The fins were cast aluminum.	2 (p. 2-1)

General Use and Description

The MK 15 Mod 0 "Sadeye" weapons system was used for delivery of small, tactical devices and bomblets by high-performance aircraft, equipped with single and multiple-carriage bomb racks; to include a toxic and biological offensive capability. The two halves of the dispenser were locked together by a nose locking ring and an end plate screwed to the aft end (1 p. 4-27a), (2 p. 1-1).

The Sadeye was a low-drag, cluster bomb that could be delivered by all modern, high performance aircraft, equipped with single and multiple-carriage bomb racks. The weapon consisted of a semi-monocoque, skin-stressed container in longitudinal half sections, which separated for dispersion of the payload. An aircraft locking mechanism; the burster charge, and the switching unit (safe separation and firing timer) were housed in the ogive fuze well. The two halves of the dispenser were locked together by a nose locking ring and an end plate screwed to the aft end (1 p. 4-27a), (2 p. 1-1).

Explosive Train

When the fuze functions, the fuze booster was ignited and the fuze and nose locking ring were blown forward, which would unlock the forward end of the dispenser (2 p. 3-1).

Fuzing

Dispenser, 750-pound, Universal Bomb, MK 15 Mod 0, Sadeye - Fuzing		
Fuze	**Note**	**Citation**
M907	Nose- air-armed, airburst, mechanical time	2 (p. 2-1)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Dispenser, 750-pound, Universal Bomb, MK 15 Mod 0, Sadeye - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
UNKNOWN	N/A	N/A	N/A	N/A	Fill agent and weight were dependent on the bomblet used.	

Shipping/Packing

The dispenser and fins were shipped in a MK 320 MOD 0 shipping and storage container (2 p. 2-3).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
2. Naval Ordnance Test Station. 1964. NOTS-TP-3431-Revision 1, Cluster Bomb Mark 15 MOD 0 (Sadeye Weapon System), Description and Operation (A Preliminary Manual), AD361203. Bureau of Naval Weapons.

9.2 Dispenser, 900-pound, Bomb, XMC-1

Figures

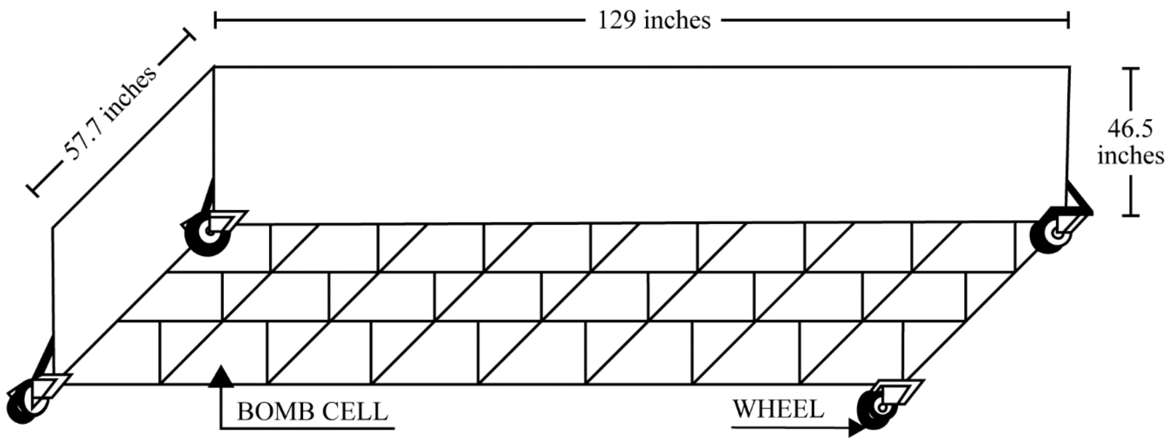

Figure 76: Dispenser, 900-pound, Bomb, XMC-1 - Line Drawing

Specifications

Dispenser, 900-pound, Bomb, XMC-1 - Specifications and Other Data		Citation
Historical Name	Dispenser, Bomb, 900-Pound, XMC-1	1 (p. 4-47)
Type	Dispenser	1 (p. 4-48)
Size	900-pound	1 (p. 4-47)
Conflict	Cold War	1
Service	Air Force, Navy	1 (p. 4-47), 2 (p. 4-48)
Length	129.4 inches (328.68 cm)	1 (p. 4-49), 2 (p. 4-49)
Width	57.7 inches (146.56 cm)	1 (p. 4-49), 2 (p. 4-49)
Height	46.5 inches (118.11 cm)	1 (p. 4-49), 2 (p. 4-49)
Other Engineering Data	The dispenser was designed for use with E120R1, E120R2, E132 cube, E134, and Flettner bomblets. The total system weighed 7,000-10,000 pounds (3,175-4,536 kilograms). There were 24 cells in the dispenser.	1 (p. 4-49), 2 (p. 4-49)

General Use and Description

The XMC-1 provided large area coverage for biological and chemical weapons (1 p. 4-47), (2 p. 4-48).

This dispenser was composed of 24 cells, each 15.54 inches square. A single suspension lug at the top of the dispenser above the center of gravity engaged the U-2 shackle on the aircraft. To release the cells, a rotary solenoid was activated allowing the cell door and cartons to fall free. Final models were planned to have electric heaters to maintain a constant temperature control. There was a fiberglass or steel carton closure with timer and opening mechanism (1 p. 4-47), (2 p. 4-48).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Dispenser, 900-pound, Bomb, XMC-1 - Fuzing		
Fuze	**Note**	**Citation**
Not designated	One dispersion per cell to initiate package separation after a timed release. The fuze sub system consisted of a control group, dispersion unit, and bomb fuze, all connected to the aircraft power supply.	1 (p. 4-47)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Dispenser, 900-pound, Bomb, XMC-1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BM (Berger mixture)	N/A	N/A	N/A	N/A	-	2 (p. 4-48)
GB	N/A	N/A	N/A	N/A	-	2 (p. 4-48)
VX	N/A	N/A	N/A	N/A	-	2 (p. 4-48)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

Various biological and chemical weapons were used in the XMC-1; see bomblet details for agent fills.

Munition capacity:

- E120R1, E120R2- 27 per carton, 81 per cell, 1,944 per dispenser.
- E134- 64 per carton, 192 per cell, 4,608 per dispenser.
- Flettner bomblet- 176 per carton, 176 per cell, 4,224 per dispenser.
- E132 cube- 1 per carton, 3 per cell, 72 per dispenser (1 p. 4-49), (2 p. 4-48)

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

9.3 Dispenser, 1,000-pound, Universal Bomb, MK 4 Mod 0, Gladeye

Figures

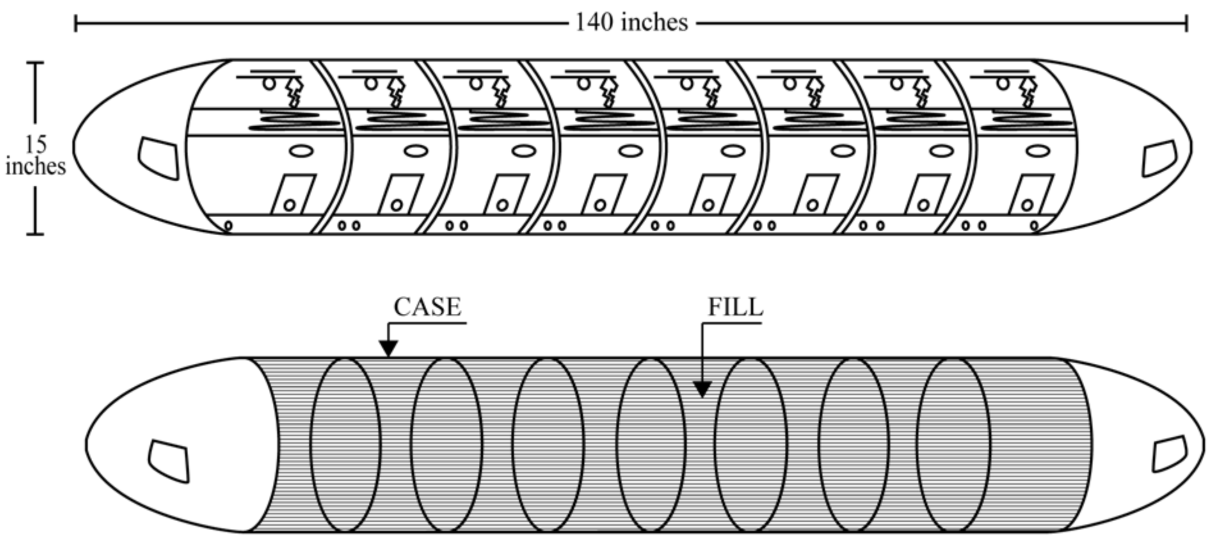

Figure 77: Dispenser, 1,000-pound, Universal Bomb, MK 4 Mod 0, Gladeye - Line Drawing

Specifications

Dispenser, 1,000-pound, Universal Bomb, MK 4 Mod 0, Gladeye - Specifications and Other Data		**Citation**
Historical Name	Gladeye (Dispenser, Universal Bomb, MK 4 Mod 0)	1 (p. 4-27)
Type	Dispenser	1 (p. 4-27)
Size	1,000-pound	1 (p. 4-27c)
Service	Air Force, Army, Marine Corps, Navy	1 (p. iv)
Diameter	15 inches (38.1 cm)	1 (p. 4-27d)
Length	140 inches (355.6 cm)	1 (p. 4-27d)
Other Engineering Data	The gross weight of the dispenser and canisters was about 1,000 pounds.	1 (p. 4-27)

General Use and Description

The Gladeye was a free-fall-general purpose dispenser designed for delivery of small, tactical devices; to include a toxic chemical and biological offensive capability (1 p. 4-27c).

Gladeye was a modular dispenser (Bomb Dispenser MK 4 Mod 0) that consisted of a special rack or hardback fitted with seven jettisonable containers called canisters (Canisters MK 2 Mod 0) plus an aerodynamic nose and tail fairing, and the dispenser assembly (Bomb Dispenser Mk 4 Mod 0) to which the canisters are attached and which incorporates the rack adapter. The canisters were designed to disperse a variety of munitions safely from subsonic and supersonic aircraft. Each canister was ejected separately either at pilot option or at any of three preselected intervals. These intervals were obtained using an intervalometer within the strongback.

Each canister acted as a self-contained shipping container for the munitions. The system was mounted on any Aero 7A or Aero 20A rack, and connected electrically to the rocket firing circuit of the aircraft. If it became necessary to jettison the loaded Gladeye weapon over friendly territory, the entire assembly including the strongback could be dropped. The canisters would not open and the munitions load would not arm. The Bomb Dispenser Canister loaded gross weight varied from 32 to 195 pounds total weight depending on the payload used (1 p. 4-27c), (2 p. 1).

Explosive Train

Each canister assembly was actuated by two Bomb Ejection Cartridges MK 2 Mod 1 that were wired to provide a sympathetic, redundant ignition system. The canister retaining hooks were released by a gas-operated sear (2 p. 1).

Fuzing

Available references did not include information regarding fuzes for this item.

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Dispenser, 1,000-pound, Universal Bomb, MK 4 Mod 0, Gladeye - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	N/A	N/A	33.6-299	15.2-135	Weight is for canister.	1 (p. 4-27d)
PT	N/A	N/A	102	46.2	Weight is for canister.	1 (p. 4-27d)
WP	N/A	N/A	85.4-112	38.7-50.8	Weight is for canister.	1 (p. 4-27d)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The Gladeye was used with:

- M15 grenade (WP) (44-58 each, 1.94 pounds/grenade),
- E61R4 bomblet (biological) (64-81 each, 1.4 pounds/bomblet),
- E134 bomblet (biological) (26-32 each, 1.0 pound/bomblet),
- E130R2 bomblet (GB) (14-16 each, 2.4 pounds/bomblet),
- M134 bomblet (GB) (12-16 each, 3.4 pounds/bomblet),
- M74A1 bomblet (PT1) (12 each, 8.5 pounds/bomblet) (requires a double length canister), and
- M125A1 bomblet (GB) (27 each, 11.0 pounds/bomblet) (requires a double length canister) (1 p. 4-27d).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

2. Glendenning, Dennis E. (Weapons Development Department). 1963. NAVWEPS Report 8439, Aircraft Qualification Information Package Gladeye Weapon System (Bomb Dispenser MK 4 Mod 0 and Bomb Dispenser Canister MK 2 Mod 0). U.S. Naval Ordnance Test Station.

9.4 Dispenser, SUU-13/A

Figures

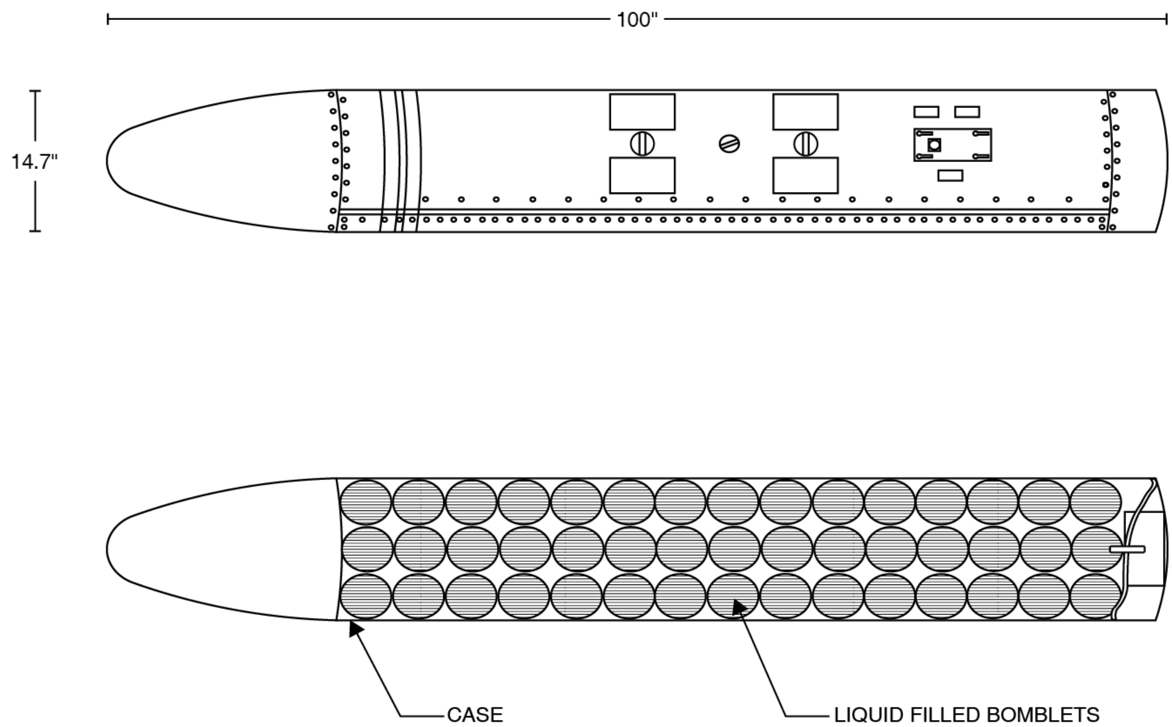

Figure 78: Dispenser, SUU-13/A - Line Drawing

Figure 79: Dispenser, SUU-13/A - Photograph - SUU-13/A Dispenser

Dispenser, SUU-13/A

Specifications

Dispenser, SUU-13/A - Specifications and Other Data		Citation
Historical Name	SUU-13/A Dispenser	1 (p. 2)
Type	Dispenser	1 (p. 2), 2 (p. 1), 3 (p. 16)
Conflict	Cold War	2, 4
Service	Air Force, Army	1, 2, 3 (p. 16)
Diameter	Tube: 4.8 inches (12.19 cm)	1 (p. 3)
Length	Dispenser: 90.4 inches (229.61 cm) Tube: 11.3 inches (28.7 cm)	1 (p. 2, 3)
Width	Dispenser: 14.7 inches (37.34 cm)	1 (p. 2)
Height	Dispenser: 13.7 inches (34.80 cm)	1 (p. 2, 3)
Other Engineering Data	The SUU-13/A dispenser weighed 115 pounds empty (i.e., without tubes), 186 pounds with tubes, and 382 pounds fully loaded with 1,280 BLU-39/B23 bomblets.	1 (p. 2)

General Use and Description

The SUU-13/A, as part of the CBU-30/A munition, disseminated riot control agent. Each SUU-13/A dispenser had 40 tubes with 40 CDU-9/B canisters, each of which contained 32 BLU-50/B or 32 BLU-39/B23 bomblets. A fully loaded dispenser could carry 1,280 bomblets. The SUU-13/A could also be loaded with 40 BLU-19/B23 bomblets (1 p. 2), (2).

The carrier was externally suspended from tactical aircraft by means of standard 355.6-millimeter (14-inch) lugs. The dispenser was equipped with an intervalometer that was preset to permit a specific bomblet discharge rate. The concept of employment was to discharge bomblets simultaneously from several dispensers attached to low flying aircraft (1 p. 2, 3), (4 p. 2-4, 6-6).

Explosive Train

The bomblets were discharged in a preset firing order by initiation of a squib at the head of each tube. This action produced a gas pressure, which would permit the expanding gas to force the bomblet out of the tube in a direction perpendicular to the line of flight (5 p. 10, Appendix A).

Fuzing

Dispenser, SUU-13/A - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Impact	3 (p. 16)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Dispenser, SUU-13/A

Fills

Dispenser, SUU-13/A - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BZ	62.0-76.0	28.0-34.4	N/A	N/A	-	2 (p. 2), 4 (p. 2-4), 6 (p. 16)
CS	65.0	29.5	382	173	Gross weight was fully loaded with 1,280 BLU-39/B23 bomblets.	1 (p. 1), 2 (p. 2)
GB	160-176	72.6-79.8	497-2,251	225-1,021	-	2 (p. 2), 5 (p. 10. Appendix A)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Maxwell, E.C., Jr. 1968. APGC-TR-68-6, First Article Test of the CBU-30/A Munition (SUU-13/A Dispenser with BLU-39/B23 Bombs). U.S. Air Force.
2. Campbell, D., & Seigh, J. 1964. CRDL Technical Memorandum 83-8, A Theoretical Study of the Area Coverage Potentials of the SUU-7A/A. SUU-13/A, and SUU-14/A Dispenser Systems (U). Chemical Research and Development Laboratories.
3. Departments of the Army, Navy, and Air Force. 1966. Field Manual, FM 3-10, Employment of Chemical and Biological Agents. Department of the Army.
4. Deseret Test Center. 1972. Joint [Chemical- Biological] CB Technical Data Source Book (U), Volume II, Riot Control and Incapacitating Agents (U), Part Three: Agent BZ (U). U.S. Army.
5. SciTech Services, Inc. 1998. Old Chemical Weapons Reference Guide. U.S. Army.
6. Secretary of the Army. 1962. Field Manual, FM 3-10, Chemical and Biological Weapons Employment. Department of the Army.

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10 Grenade

Grenades are a class of ammunition used in close quarters. Within certain limitations, grenades augment primary infantry weapons with a missile similar in action to a small shell or bomb. Chemical grenades that produce clouds of irritant gases are also effective in dispersing mobs, quelling riots, etc. (War Department 1944a, 234, 253-254).

Grenades are classified according to their method of projection: hand or rifle. They are also identified according to use as service, practice, or training; and filler as explosive, chemical, illuminating inert or with a spotting charge. Certain grenades are designed to be thrown by hand and others are designed to be projected from a rifle by means of grenade launcher and a special grenade-launching weapon (e.g., M203 grenade launcher) (Department of the Army, 1966b, pp. 1-1). The various types of hand grenades are used to supplement small arms for effect against an enemy in close combat. They may be used for producing a harassing effect, for smoke screening and signaling, and for incendiary purposes. The various types of rifle grenades are for use against armored targets and for screening and signaling smokes (Department of the Army, 1966b, pp. 1-9).

Time grenades have a delay of five to seven seconds until detonation after the grenade is projected. They are the most common type of grenade. The delay prevents premature functioning and gives the thrower time to provide for his safety after the grenade is thrown. Percussion grenades have no delay. The impact of the grenade when it strikes its objective is sufficient to set the firing mechanism in motion and to cause immediate functioning. The objection to the percussion grenade is that it sometimes strikes a hard object at the instant of firing and functions prematurely. Both hand and rifle grenades can be either time or percussion.

Hand grenades are designed to be thrown by the human arm, unassisted by any device not a part of the grenade itself. The fill for hand grenades can be HE, gas, smoke, and incendiary. They are limited in size by the hand-grasp and in weight by the throwing power of the average man.

Rifle grenades are designed to be thrown by the regular service rifle of the period. Rifle grenades can be filled with HE, gas, smoke, or incendiary. Their size and shape are designed to conform to the convenience of the soldiers and the method of their use. One variety is furnished with a stem which is placed in the barrel of the rifle; the other is fired by means of a special tromblon attachment adapted to the end of the barrel. The stem type is no longer used.

The gas grenade frequently took the place of the HE grenade, accomplishing by its suffocating, blinding, poisoning, and demoralizing action what the other grenade accomplished by force. The smoke grenade was essential to intricate tactical maneuvering, either offensive or defensive. It gave the Army using it the advantage of obscuration from the enemy (Department of the Army 1966b, 1-9, War Department 1944a).

10.1 Grenade, Hand, MK1

Figures

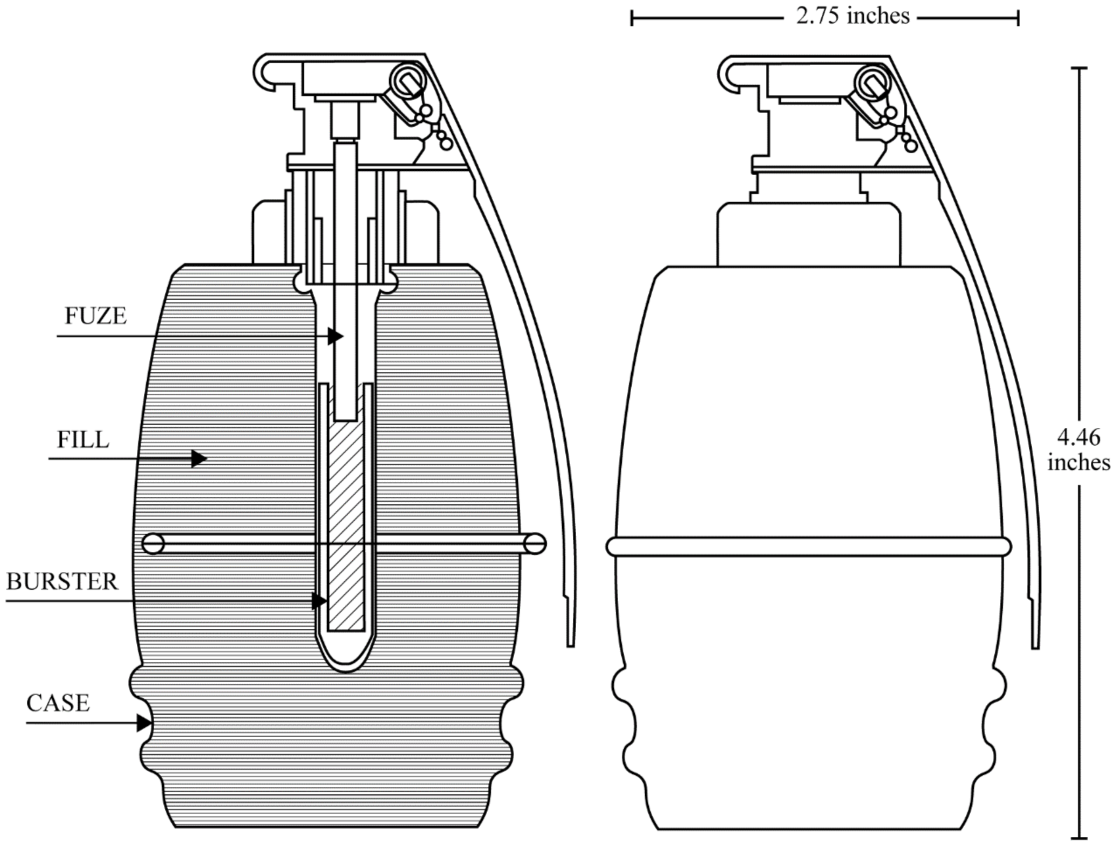

Figure 80: Grenade, Hand, MK1 - Line Drawing

Figure 81: Grenade, Hand, MK1 - Photograph - Rifle projected, Inert without Fuze (note the long rod attached to the base is part of the grenade as designed)

Grenade, Hand, MK1

Specifications

Grenade, Hand, MK1 - Specifications and Other Data		Citation
Historical Name	B.M. Smoke Hand Grenade, MK. I.	1
Type	Grenade	1, 2 (p. 1-3)
Diameter	2.75 inches (6.98 cm)	1
Height	4.47 inches (11.34 cm)	1
Other Engineering Data	Could be used with the M1A1 and M1A2 grenade projection adapter	2 (p. 2-11)
Body Construction Material	Steel	1

General Use and Description

The Mark I grenade was designed to provide close range, offensive, chemical capabilities (1).

The MK I grenade was semi-ovoid in shape with a smooth surface. It was similar in form to the phosphorus grenade, save for the two annular corrugations on the body, near the bottom, to serve as a distinguishing mark (1).

Explosive Train

Upon release of the lever, the striker would be impelled by its stiff spring, which would rotate around the hinge pin, force up the lever, and strike the primer, first perforating the tinfoil disc, which was sealed over the top of the cap to waterproof the primer. The end of the fuze was tipped with a priming powder composition, which ignited by the primer and in turn ignited the fuze. In five seconds the flame from the fuze would spit into the fulminate composition of the detonator causing it to explode. The explosion of the detonator was sufficient to burst the body of the grenade and scatter the contents in all directions (1).

Fuzing

Grenade, Hand, MK1 - Fuzing		
Fuze	**Note**	**Citation**
Bouchon assembly MK III	2-inch fuze and No. 8 detonator	1

Booster, Adapter-Booster, or Burster

Grenade, Hand, MK1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
No. 8 Detonator	N/A	N/A	-	1

Fills

Grenade, Hand, MK1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BM	N/A	N/A	1.87	0.84	-	1

Shipping/Packing

The grenades were packed 24 to a wooden box (1).

Miscellaneous Information

This grenade did not go into production (1).

Grenade, Hand, MK1

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Pankey, A.V. n.d. Monograph on Hand Grenades, Volume 51. War Department American University Experiment Station Chemical Warfare Service.

2. Headquarters Departments of the Army and the Navy. 1995. Technical Manual, TM 9-1330-200-12, Operators and Organizational Maintenance Manual for Grenades, Change 15. Headquarters Departments of the Army and the Navy.

10.2 Grenade, Hand, MK II

Figures

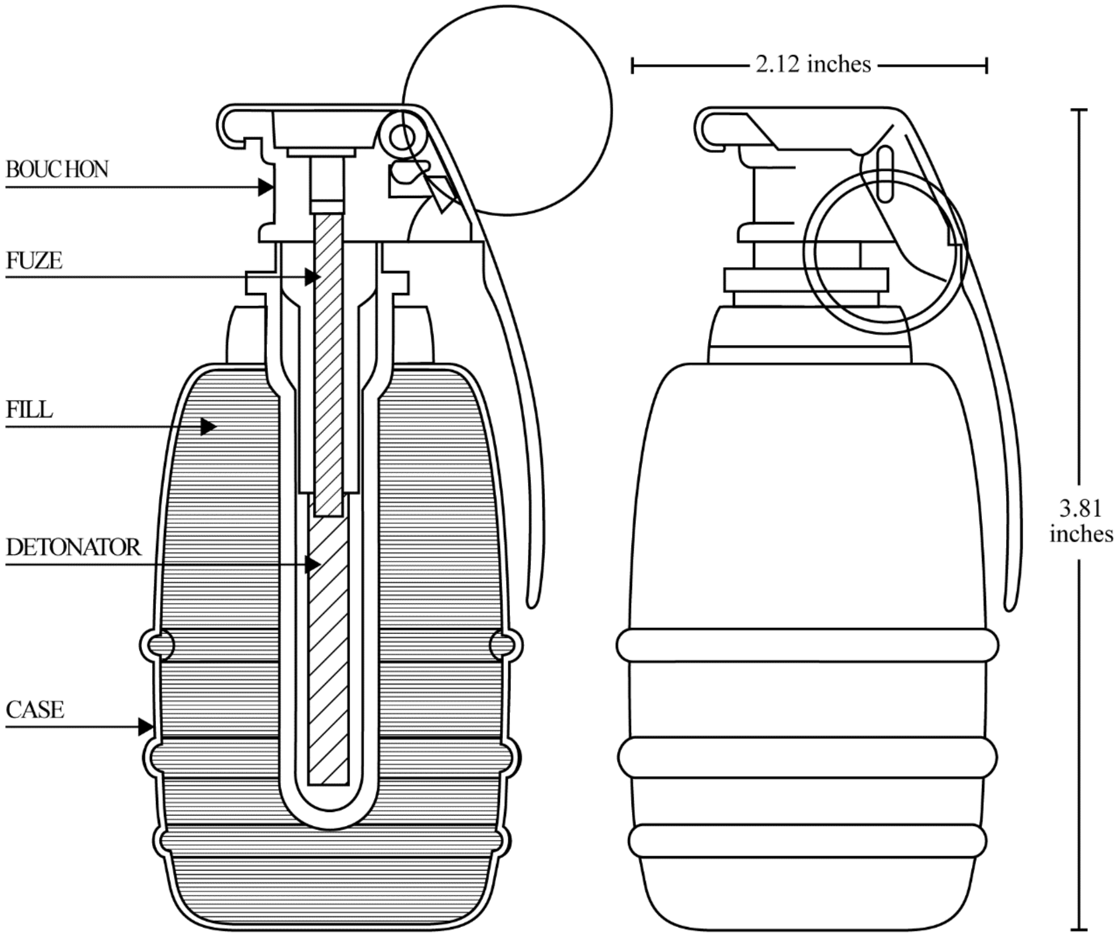

Figure 82: Grenade, Hand, MK II - Line Drawing

Figure 83: Grenade, Hand, MK II - Photograph: Left: Inert, without Fuze, Middle: Gas. Right: Phosphorus

Grenade, Hand, MK II

Specifications

Grenade, Hand, MK II - Specifications and Other Data		Citation
Historical Name	Gas Hand Grenade, Mark II	1 (p. 12)
Type	Grenade	2
Conflict	WWI	3 (p. 296)
Service	Army	4
Diameter	2.12 inches (5.39 cm)	2
Length	3.81 inches (9.68 cm)	2
Body Construction Material	Sheet steel welded body	2

General Use and Description

The gas cloud produced by the MK II grenade was intensely irritating to the eyes and respiratory passages and caused lacrimation and violent coughing (3 p. 297).

The Mark II grenade was the same as the French "Suffocante et Lachrymogene" hand grenade. This grenade consisted of a sheet steel body, steel bushing, detonator thimble, detonator, and automatic firing mechanism (bouchon). The gas grenade was similar in form to the phosphorus grenade, except for the two annular corrugations on the body, near the bottom, to serve as a distinguishing mark (1 p. 13), 3 p. 297), (4).

Explosive Train

Upon release of the lever, the striker would be impelled by its stiff spring rotating around the hinge pin, forcing up the lever, and striking the primer, first perforating the tinfoil disc, which was sealed over the top of the cap to waterproof the primer. The end of the fuze was tipped with a priming powder composition, which ignited by the primer and in turn would ignite the fuze. In five seconds the flame from the fuze would spit into the fulminate composition of the detonator causing it to explode. The explosion of the detonator was sufficient to burst the body of the grenade and scatter the contents in all directions (1 p. 13).

Fuzing

Grenade, Hand, MK II - Fuzing		
Fuze	**Note**	**Citation**
Mk II bouchon and fuze assembly	2-inch fuze	2

Booster, Adapter-Booster, or Burster

Grenade, Hand, MK II - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
No. 8 detonator	N/A	N/A	-	2

Fills

Grenade, Hand, MK II - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
KJ (Stannic chloride)	0.61	0.28	1.37	0.62	-	3 (p. 298), 4 (p. 224)

Shipping/Packing

The grenades were packed 24 grenades per wooden box (2).

Grenade, Hand, MK II

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. American Expeditionary Forces. 1919. Gas Manual Part IV, Use of Gas by Infantry, A.E.F. No. 1475-4 G-5. General Headquarters American Expeditionary Forces.
2. Pankey, A.V. n.d. Monograph on Hand Grenades, Volume 51. War Department American University Experiment Station Chemical Warfare Service.
3. Prentiss, Augustin M. 1937. Chemicals in War: A Treatise on Chemical Warfare. McGraw-Hill Book Company, Inc.
4. Office, Chief of Ordnance. 1918. No. 1861, Handbook of Ordnance Data. Government Printing Office.

10.3 Grenade, Hand, M6

Figures

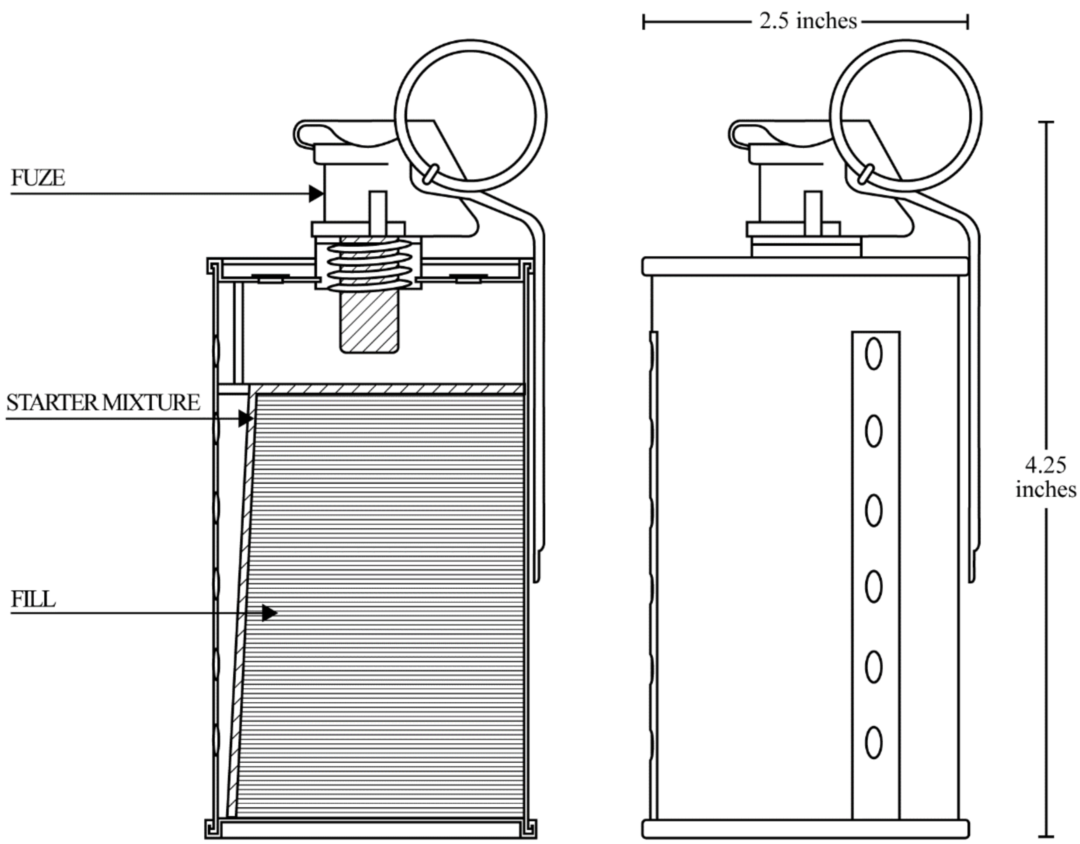

Figure 84: Grenade, Hand, M6 - Line Drawing

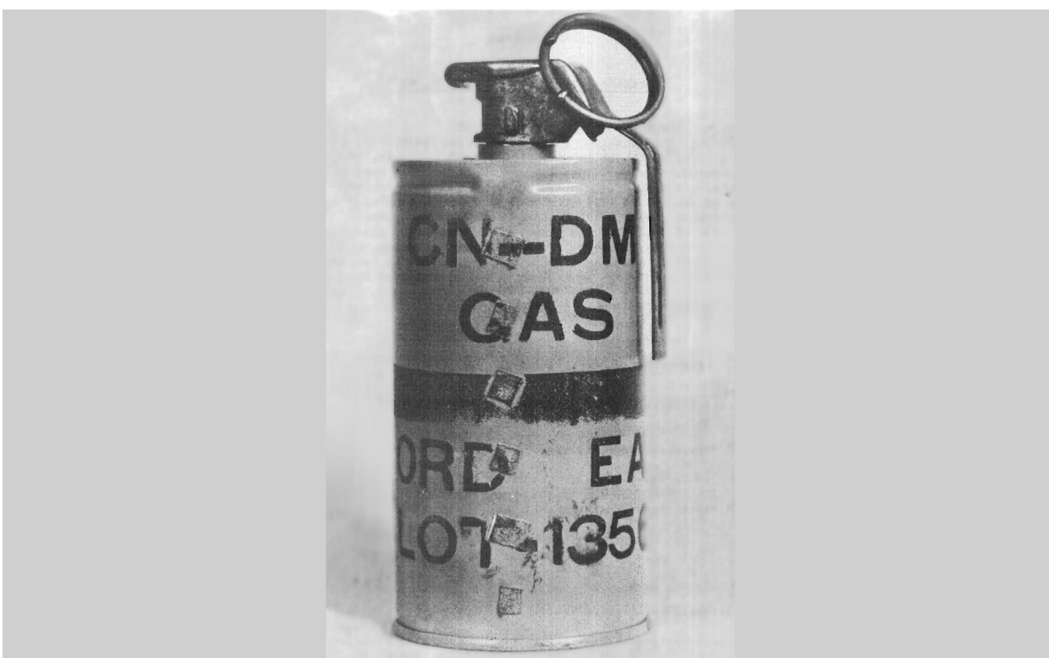

Figure 85: Grenade, Hand, M6 - Photgraph

Specifications

Grenade, Hand, M6 - Specifications and Other Data		Citation
Historical Name	Grenade, Hand, Irritant, CN-DM, M6	1 (p. 31)
Type	Grenade	1 (p. 31), 2 (p. 62-63), 3 (p. 3-2), 4 (p. 23)
Service	Air Force, Army, Navy	2 (p. 62-63), 3 (p. 2-12)
Diameter	2.37-2.5 inches (6.03-6.35 cm)	1 (p. 31), 2 (p. 62-63), 3 (p. 3-2), 5 (p. 13)
Height	4.25-4.75 inches (10.8-12.06 cm)	1 (p. 31), 3 (p. 3-2), 4, 5 (p. 13)
Other Engineering Data	The M6 grenade could be launched from a rifle or carbine with the use of the M2A1 grenade projection adapter.	1 (p. 33)
Body Construction Material	Sheet metal	1 (p. 31), 4 (p. 23)
Spec/PD No	MIL-G-10124 (M6) MIL-G-4501 (M6A1)	2 (p. 62-63), 3 (p. 3-2)
B/M Dwg	B13-22-2 C13-22-2 (M6) D13-22-8 (M6A1)	2 (p. 62-63), 3 (p. 3-2)
FSN	1330-219-8579 (M6) 1330-555-5373 (M6A1)	2 (p. 62), 6 (p. 71)

General Use and Description

The M6 grenade was used to cause vomiting and tear formation (1 p. 32), (3 p. 3-2).

The M6 CN-DM grenade was essentially a cylindrical container filled with 10-1/4 ounces of CN-DM mixture and fitted with an M201A1 grenade igniting fuze. The body of the grenade was a thin sheet metal cylinder. There were six emission holes in its top and 18 holes in its sides. The fuze was screwed into an adapter in the top of the grenade.

The CN-DM filling was a mixture of CN, DM, magnesium oxide, and smokeless powder. The filling was coated with a starter which aided ignition. The ignition holes were covered with adhesive tape to protect the filling from moisture (1 p. 31), (3 p. 3-2), (4 p. 24), (5 p. 13).

Explosive Train

Releasing the safety lever allowed the striker to hit the primer, which ignited a delay element, which would burn for 0.5 to 3 seconds. Upon expiration of the delay time, the delay element ignited the ignition mixture, which ignited the grenade starter mixture and grenade filling. The adhesive tape was blown off the emission holes and CN-DM gas was emitted for 20-60 seconds (1 p. 32), (2 p. 62-63), (3 p. 3-2), (4 p. 23-24).

Fuzing

Grenade, Hand, M6 - Fuzing		
Fuze	**Note**	**Citation**
M201A1	Grenade igniting fuze	1 (p. 32), 2 (p. 62-63), 3 (p. 3-2), 5 (p. 13)

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Grenade, Hand, M6

Fills

Grenade, Hand, M6 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CN	0.06	0.03	N/A	N/A	-	7 (p. 13)
CN-DM	0.62-0.64	0.28-0.29	1.00-1.06	0.45-0.48	-	1 (p. 32), 3 (p. 3-2), 4 (p. 23), 5 (p. 13)

Shipping/Packing

The M6 and M6A1 grenades were either packed 16 units per case, which weighed 33 pounds or 25 per case with the case weight being approximately 50 pounds (2 p. 62-63), (3 p. 3-2), (4 p. 23).

Miscellaneous Information

A total of 582,327 M6 grenades were procured between 1941 and 1944 and 103,000 M6A1 grenades were procured between 1959 and 1960. At the time they were obsoleted in 1970, there remained 75,000 serviceable and 13,000 unserviceable M6/M6A1 grenades in the inventory (6 p. 72).

Key Dates

Grenade, Hand, M6 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1933	CCTC 1933-14 (known as Candle, Irritant, Fast, MI)	6, 8
Standardized	1958	CCTC 3408 (M6 Standard-B; M6A1 Standard-A)	9
Obsoleted	1970	AMCTC 7865 (M6 & M6A1)	6

Sources

1. Department of the Army. 1956. Technical Manual, TM 3-300, Ground Chemical Munitions. U.S. Government Printing Office.
2. Department of the Army. 1961. Technical Manual, TM 3-500, Chemical Corps Equipment Data Sheets. U.S. Government Printing Office.
3. U.S. Naval Ordnance Laboratory. 1968. NAVORD Ordnance Pamphlet, OP 2217, Miscellaneous Chemical Munitions, Description and Operation, First Revision, Change 1. Naval Ordnance Systems Command.
4. Secretary of War. 1944. Technical Manual, TM 3-300, Miscellaneous Chemical Munitions. War Department.
5. School Munitions Department Redstone Arsenal. 1976. Chemical Munitions EOD/TE Study Guide. U.S. Army Missile and Munitions Center.
6. Chemical-Biological-Nuclear Subcommittee. 1970. AMCTC Item # 7865, Obsoletion of Riot Control Agents, Diphenylaminechlorarsine: DM & DM1.; Grenades Hand: Riot, CN-DM, M6 & M6A1; and Grenade, Hand: Riot, DM1, ABC-M25A2. U.S. Army Materiel Command.
7. Bouder, N.M., & Powell, H.C. 1931. Approximate Average Weights of Fillings in Chemical Munitions. Information Division.
8. Chemical Corps Technical Committee. 1933. CCTC Item # 1933-14, Standardization of Candle, Irritant, CN-DM, Fast, MI, [redesignated Grenade, Hand, Irritant, CN-DM, M6 when transferred to the Ordnance Dept. as recorded on OCM 10598, 6 Apr 33] approved 21 January. Chemical Warfare Service.
9. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

10.4 Grenade, Hand, M58 (XM58)

Figures

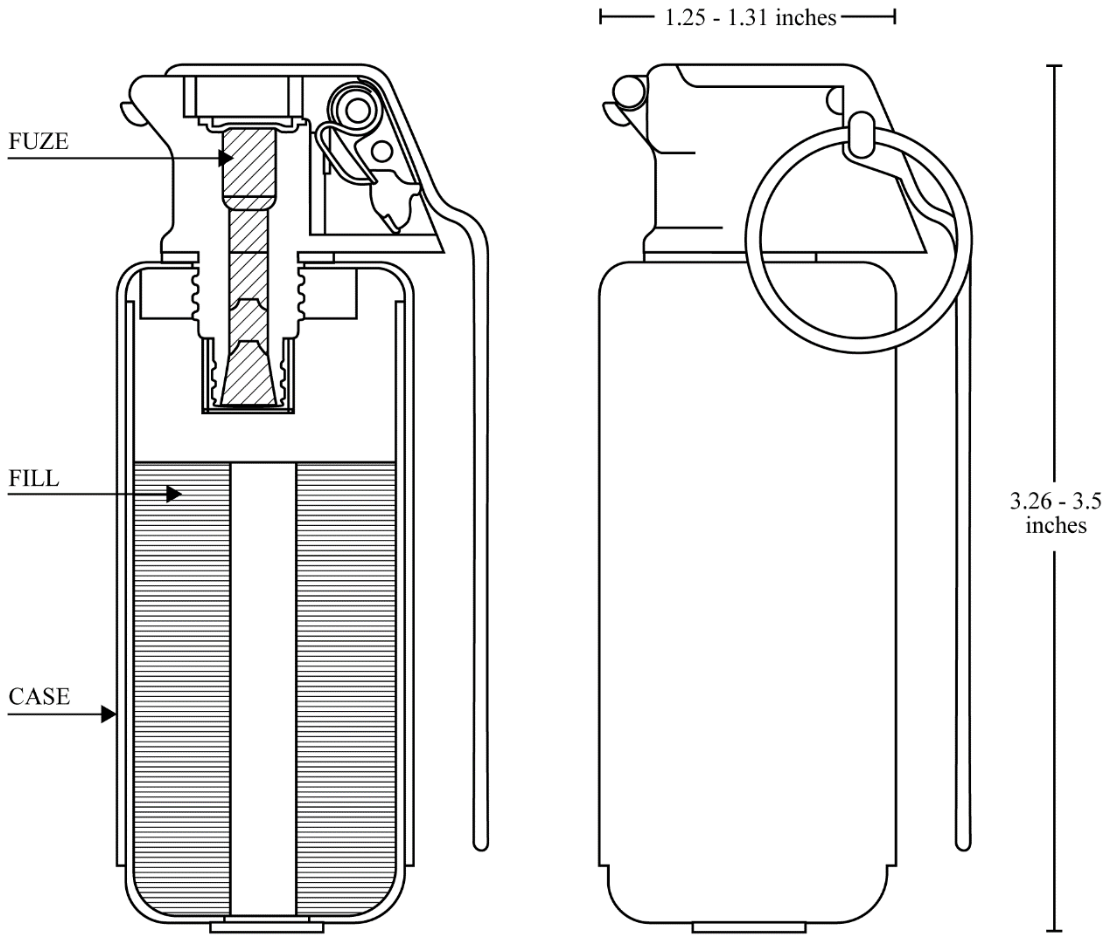

Figure 86: Grenade, Hand, M58 (XM58) - Line Drawing

Figure 87: Grenade, Hand, M58 (XM58) - Photograph

Grenade, Hand, M58 (XM58)

Specifications

Grenade, Hand, M58 (XM58) - Specifications and Other Data		**Citation**
Historical Name	Grenade, Hand: Riot, Pocket, CS, M58	1 (p. 2-53, 2-58)
Type	Grenade	1 (p. 2-53)
Service	Army	1 (p. 2-53)
Diameter	1.25-1.31 inches (3.17-3.33 cm)	1 (p. 2-53), 2
Height	3.26-3.5 inches (8.28-8.46 cm)	1 (p. 2-53), 2
Other Engineering Data	During development, this grenade was designated XM58.	3 (p. 2)
Body Construction Material	Aluminum	1 (p. 2-53)
B/M Dwg	Fuze: 13-21-23	1 (p. 2-54)
NSN	1330-00-143-7003	1 (p. 2-54)

General Use and Description

The M58 grenade was designed to simulate casualty agents during training by causing irritation to the upper respiratory passage, coughing, difficulty in breathing and chest tightness. Nausea and vomiting would also occur (1 p. 2-54), (4).

The grenade contained a CS-pyrotechnic composition. There was a hole in the base of the body that was used for agent emission after functioning.

The fuze in the M58 (i.e., hand grenade M201E1) was similar to the M201A1. The hand grenade fuze M201A1 was a pyrotechnic delay-igniting fuze. The body contained a primer, fire mixture, pyrotechnic delay column, and ignition mixture. Assembled to the body were a striker, striker spring, safety lever, and safety pin with pull ring. The split end of the safety pin had an angular spread.

Safety clips were not required with these grenades (1 p. 2-54), (2).

Explosive Train

Removal of the safety pin permitted release of the safety lever. When the safety lever was released, it was forced away from the grenade body by a striker acting under the force of a striker spring. The striker spring rotated on its own axis and struck the percussion primer. The primer initiated the first-fire mixture. The fire train, fuze delay element, ignition mixture, grenade starter mixture and filler were initiated in turn by preceding component. The pressure sensitive tape was blown off the emission holes and CS fill was emitted for 8 to 28 seconds (1 p. 2-54).

Fuzing

Grenade, Hand, M58 (XM58) - Fuzing		
Fuze	**Note**	**Citation**
M201A1E1	-	1 (p. 5-23), 2, 4

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Grenade, Hand, M58 (XM58)

Fills

Grenade, Hand, M58 (XM58) - Fill Types and Weights						
Chemical	Fill Weight		Gross Weight		Notes	Citation
	Pounds	Kilograms	Pounds	Kilograms		
CS	0.09	0.04	0.25	0.11	CS pyrotechnic composition.	1 (p. 2-53), 2

Shipping/Packing

The grenades were packed 10 per fiberboard packing box (1 p. 2-54).

Key Dates

Grenade, Hand, M58 (XM58) - Key Dates			
Activity	Year	Notes	Citation
Standardized	1969	AMCTC 7297	3 (p. 2)

Sources

1. Headquarters, Department of the Army. 1994. Technical Manual, TM 43-0001-29, Army Ammunition Data Sheet for Grenades. Headquarters, Department of the Army.
2. School Munitions Department Redstone Arsenal. 1976. Chemical Munitions EOD/TE Study Guide. U.S. Army Missile and Munitions Center.
3. Chemical Corps Technical Committee. 1969. Chemical Corps Book of Standards, 2nd Abridged Edition, Revision No. 29. Department of the Army.
4. Headquarters Departments of the Army and the Navy. 1995. Technical Manual, TM 9-1330-200-12, Operators and Organizational Maintenance Manual for Grenades, Change 15. Headquarters Departments of the Army and the Navy.

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11 Mine

Land mines may be hidden in the path of the enemy to hinder movement or to impede access to a certain area. Mines may produce casualties by blast overpressure, secondary impact (i.e., a body is thrown into a stationary object), thermal pulse, fragmentation, shaped charge effect, or by release of harassing or lethal agents (Department of the Army, 1964, p. 4). Chemical mines (e.g., harassing and lethal agent land mines) were designed to disperse fills from fixed locations, and to provide area contamination in barrier and nuisance minefields. The fill may be dispersed in liquid or vapor form. The chemical mine was also designed to be used in anti-tank minefields or elsewhere as an antipersonnel mine. Chemical mines are discussed in the subsections below (Department of the Army, 1964, p. 7). Chemical mines (e.g., harassing and lethal agent land mines) were designed to disperse fills from fixed locations, and to provide area contamination in barrier and nuisance minefields. In general, all chemical land mines consist of three parts: container, fill, and explosive train (War Department. 1942). Chemical landmines were containers of chemical agent (e.g., HD) designed to be planted in roads, fields, or buildings, or for use as booby traps. The mines were exploded to spread chemical agents that would hinder or harass the enemy and inflict casualties. They were cheap, had a high chemical efficiency, and, when the standard containers were not available, substitutes could be readily improvised. The fill may be dispersed in liquid or vapor form. The chemical mine was also designed to be used in anti-tank minefields or elsewhere as an antipersonnel mine (Department of the Army, 1964, p. 7). The land mines filled with simulants (e.g., MR) were used in training. Chemical mines are discussed in the subsections below.

11.1 Mine, 1-gallon, Land, M1

Figures

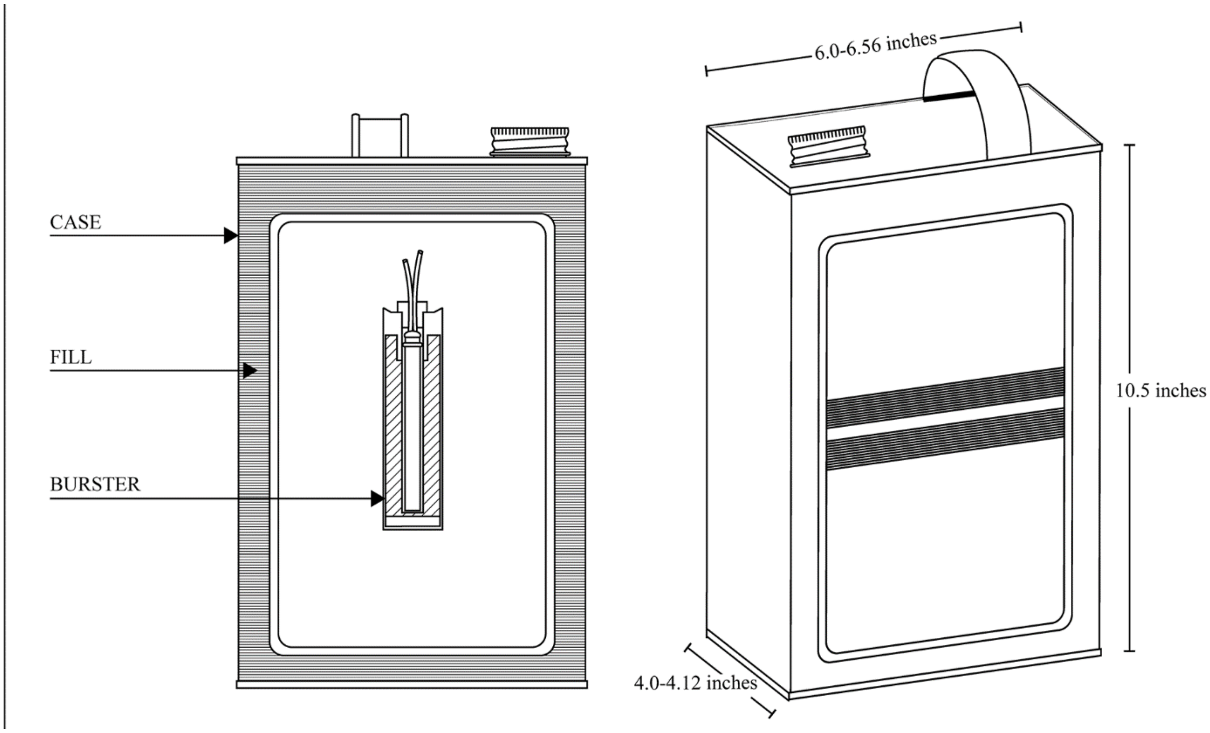

Figure 88: Mine, 1-gallon, Land, M1 - Line Drawing

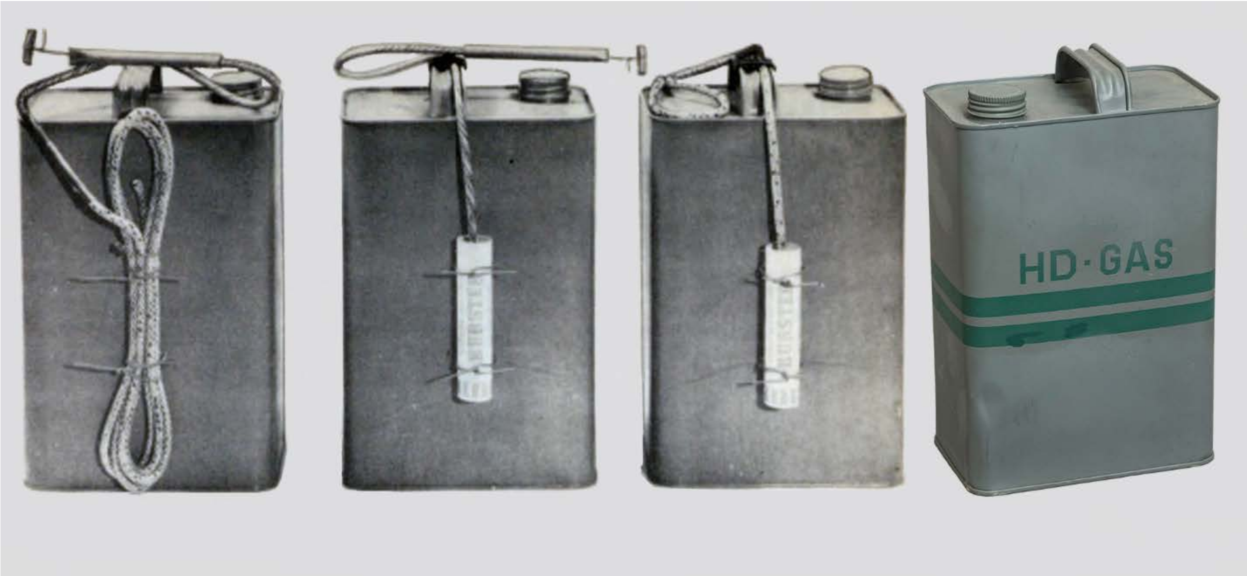

Figure 89: Mine, 1-gallon, Land, M1 - Photograph - Left to Right: With Primacord and Pull-Wire Fuze, With M4 Burster and Pull-Wire Fuze, With M4 Burster and Primacord Lead, and Front View

Mine, 1-gallon, Land, M1

Specifications

Mine, 1-gallon, Land, M1 - Specifications and Other Data		Citation
Historical Name	Mine, Land, Chemical, 1-Gallon	1 (p. 64)
Type	Mine	2 (p. 20)
Size	1-gallon	1 (p. 64), 3 (p. 101)
Conflict	WWII	2 (p. 20)
Service	Army	1 (p. 164), 4 (p. 16)
Length	4-4.12 inches (10.47 cm)	1 (p. 64), 2 (p. 20)
Width	6-6.56 inches (16.66 cm)	1 (p. 64), 2 (p. 20)
Height	10.5 inches (26.83 cm) including handle	1 (p. 64), 2 (p. 20)
Body Construction Material	Constructed of light gauge metal.	5 (p. 61)
Spec/PD No	MIL-C-10518	1 (p. 64), 5 (p. 60)
B/M Dwg	C37-5-5 D37-5-5	1 (p. 64), 3 (p. 101), 5 (p. 61)
FSN	1345-289-6938	5 (p. 61)

General Use and Description

The 1-gallon chemical landmine was used to provide area contamination in barrier and interdictory minefields. They were usually employed in combination with HE mines in mine fields (1 p. 64), (6 p. 64).

The M1 chemical land mine was a one-gallon can fitted with a carrying handle and a threaded cap. The can was painted gray with green markings. Two eight-inch short wires were soldered to the side of the can for use when attaching a burster. The one-inch opening was covered by a cap lined with a gasket made of cork or rubber and faced with lead foil. The capacity of the mine is 1.1 gallons, which allows for a 10% void when the mine was filled with one-gallon of liquid (2 p. 20), (6 p. 64).

Explosive Train

The 1-gallon land mine could be detonated with either a No.8 electric detonator or nonelectric detonator and safety fuze assembly. Two types of bursters were used PETN; and the M3 burster, an eight-foot length of detonating cord. The burster charge was a four-foot length of detonating cord (1 p. 64), (3 p. 101), (6 p. 65).

Fuzing

Mine, 1-gallon, Land, M1 - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Safety fuze - The firing component for the mine was a No. 8 blasting cap attached to a 19 3/8-inch safety fuze.	2 (p. 34)

Booster, Adapter-Booster, or Burster

Mine, 1-gallon, Land, M1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M3	N/A	N/A	The M3 was 0.75 inches in diameter and 3.75 inches long.	7
M4	N/A	N/A	-	7
Not designated	N/A	Blasting cap	Electrically functioning	2 (p. 32), 3 (p. 101)
Not designated	N/A	Detonating Cord (4 feet)	Nonelectrically functioning.	3 (p. 101)

Mine, 1-gallon, Land, M1

Fills

Mine, 1-gallon, Land, M1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
AS (asbestine suspension)	9.50	4.30	12.0	5.44	-	2 (p. 22)
HD	9.90	4.50	11.0	4.98	-	3 (p. 101)
HS	9.90-10.5	4.49-4.76	11.0-13.0	4.99-5.90	-	2 (p. 20), 8 (p. 102)
MR	9.50-10.4	4.30-4.71	10.0-11.5	4.53-5.21	Density of MR is 10.4 pounds per gallon.	2 (p. 22)

Shipping/Packing

The 1-gallon mines were shipped ten mines (empty) per fiberboard box. Each box weighed 15 pounds and displaced 2.3 cubic feet (1 p. 64), (6 p. 68).

Miscellaneous Information

During development, this was known as Chemical Mine E1.

The chemical mine was a post-WWI development. The chemical mine was first proposed in 1923 but the development was of a sporadic nature through fiscal year 1936 when test samples were prepared. The Chemical Warfare School conducted many tests with chemical land mines by prior to 1934. A comprehensive discussion of the military requirements for and the military characteristics of chemical mines was prepared in 1935. The Chemical Land Mine E2 was similar but used a round No. 10 fruit can readily available in Hawaii (9).

Key Dates

Mine, 1-gallon, Land, M1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1933	1933-02 (HS-fill)	10
Obsoleted	1946	CCTC 1601 (AS-fill)	11
Standard Modernization	1958	CCTC 3408 (Standard-B)	12
Standard Modernization	1958	CCTC 3450 (Standard-A)	13

Sources

1. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

2. Secretary of War. 1942. Technical Manual, TM 3-300, Irritant Candles, Tear Pots, Smoke Pots, and Chemical Land Mines. War Department.

3. Department of the Army. 1964. Technical Manual, TM 9-1345-200, Land Mines. U.S. Government Printing Office.

4. Secretary of the Army. 1962. Field Manual, FM 3-10, Chemical and Biological Weapons Employment. Department of the Army.

5. Department of the Army. 1961. Technical Manual, TM 3-500, Chemical Corps Equipment Data Sheets. U.S. Government Printing Office.

6. Department of the Army. 1956. Technical Manual, TM 3-300, Ground Chemical Munitions. U.S. Government Printing Office.

7. Chemical Warfare Service. 1943. Chemical Warfare Service Field Materiel Data. U.S. Government Printing Office.

8. War Department. 1942. Field Manual, FM 3-5, Chemical Warfare Service Field Manual: Tactics of Chemical Warfare. War Department.

9. Greene, L.W. 1937. Edgewood Arsenal Technical Report, EATR 247, HS Chemical Land Mines E1 and E2, Engineering Tests, Project B 7.1-1. War Department.

10. Chemical Corps Technical Committee. 1933. CCTC Item # 1933-02, Chemical Fillings for Munitions. Department of the Army.

11. Chemical Corps Technical Committee. 1946. CCTC Item # 1601, Obsoletion of Simulated Mustard AS. Department of the Army.

12. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

13. Chemical Corps Technical Committee. 1958. CCTC Item # 3450, Reclassification of 22 Standard-B Items to Standard-A Based on Revised Interpretation of Definitions Thereof. Department of the Army.

11.2 Mine, 2-gallon, M23

Figures

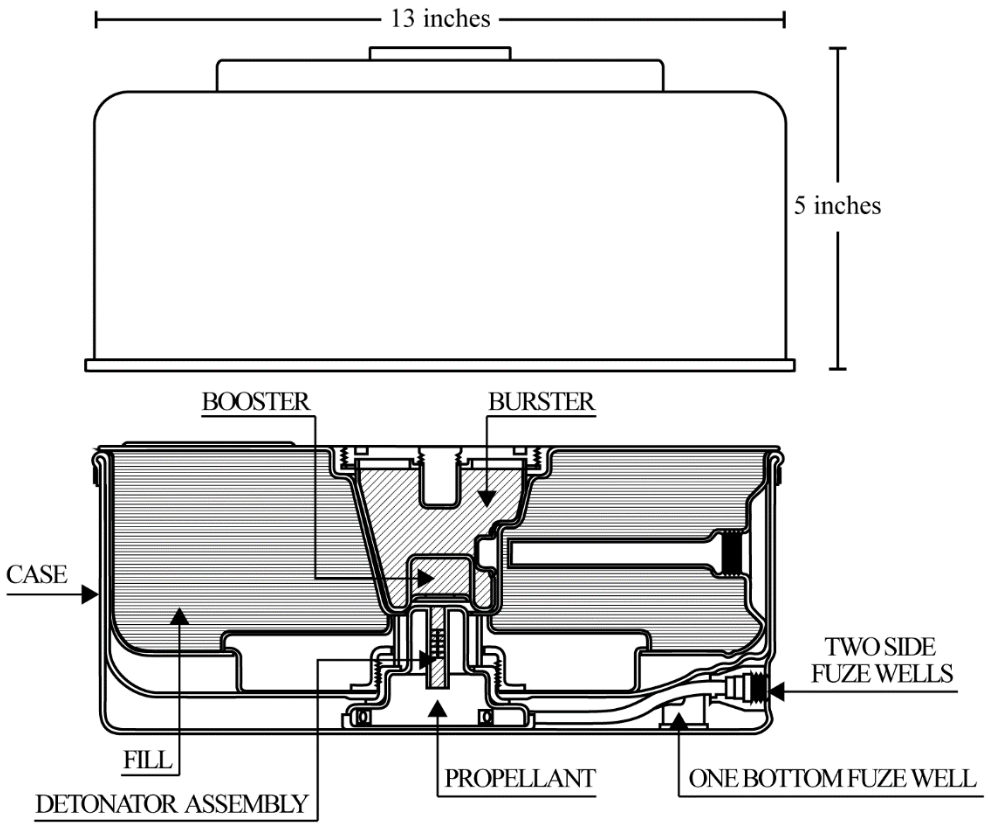

Figure 90: Mine, 2-gallon, M23 - Line Drawing

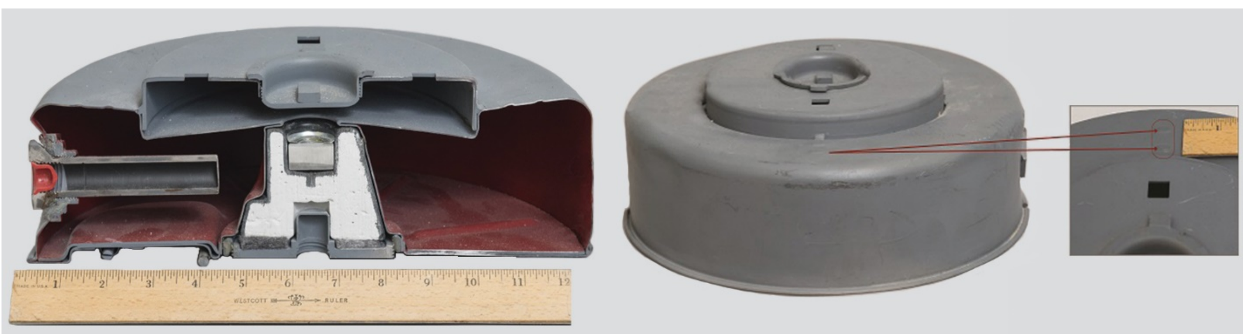

Figure 91: Mine, 2-gallon, M23 - Photograph - Inert, Left: Cutaway , Middle: Intact, Right: Raised projections

Mine, 2-gallon, M23

Specifications

Mine, 2-gallon, M23 - Specifications and Other Data		Citation
Historical Name	Mine, Chemical Agent, VX, M23	1 (p. 102)
Type	Mine	2 (p. 63), 3 (p. 4-189)
Size	2-gallon	2 (p. 63)
Conflict	Cold War	-
Service	Army	2 (p. 105)
Diameter	13 inches (3.3 cm)	1 (p. 103), 2 (p. 105), 4 (p. 83)
Height	5 inches (12.7 cm)	2 (p. 105), 5 (p. 4-4)
Other	Body construction material was steel.	2 (p. 103), 5 (p. 4-4)
Other Engineering Data	During development, the nomenclature for the mine was E-5. Later model mines used a coil spring instead of a Belleville spring.	1 (p. 102), 3 (p. 4-190)
Body Construction Material	Steel	1 (p. 102-104), 2 (p. 63, 105), 6 (p. 61), 7 (p. 33)
Spec/PD No	MIL-M-46984	2 (p. 63, 105)
B/M Dwg	LM 37-1-58 D37-1-14	2 (p. 105), 6 (p. 61)
NSN	1345-00-542-1580	7 (p. 33)
FSN	1345-542-1580	1 (p. 102-104), 2 (p. 105)

General Use and Description

The M23 was a two-gallon persistent VX-filled chemical agent mine designed to provide obstacles for restricting enemy movement. The mine was used for barrier and interdictory minefields and to contaminate demolition work (2 p. 105).

The mine consisted of a thin-walled, steel body that housed a pressure plate assembly, a primary fuze well, and two secondary fuze wells. Primary fuzing consisted of a top fuze. The pressure plate assembly consisted of a pressure plate, a Belleville spring, a fuze retainer spring, and an arming plug. Later model mines used a coil spring instead of a Belleville spring. The M23 mine was similar in size, shape, and function to the M15 anti-tank (AT) mine. The M23 chemical land mine can be distinguished visually and by touch from the M15 AT mine by eight raised projections spaced in pairs around the periphery of the top of the chemical mine (at 90-degree intervals) (1 p. 102), (2 p. 105), (3 p. 4-189).

Explosive Train

Primary, side, and bottom fuze wells were proved for fuzing the mine. The side fuze well was part of a burster tube that contained a tetryl burster held in place by a retaining ring. The bottom fuze well was part of a cover adapter plate, which held a Composition B burster cone in place.

The M603, an instantaneous mechanical-pressure type fuze, was the primary fuze for the M23 mine. The main fuze well had a M120 booster. When the shutter of the arming plug was in the armed position, the fuze was designed to function when a force of 300 to 400 pounds exerted on the pressure plate depressed the mine spring. As the pressure plate was depressed, the shutter depressed the pressure plate of the fuze. A force of 140 to 240 pounds on the fuze pressure plate, depressed the fuze Belleville spring, causing it to snap into a reversed position, driving the firing pin into the detonator. Initiation of the detonator caused the booster to function, which in turn initiated the burster and dispersed the agent. The initiator was tetryl or composition B.

Secondary fuzing consisted of side and bottom fuze wells designed to accept the standard M1 activator and an M1A1, M2, M3, or M5 firing device. Secondary fuzing provided an antipersonnel capability by booby trapping (1 p. 102).

Fuzing

Mine, 2-gallon, M23 - Fuzing		
Fuze	**Note**	**Citation**
M1	Delay type	1 (p. 103)
M1A1	Pressure	1 (p. 103)
M2	Pull-friction	1 (p. 103)
M3	Pull-release	1 (p. 103)
M5	Pressure-release	1 (p. 103)
M603	Primary, for AT use	1 (p. 103), 3 (p. 4-190), 4 (p. 84), 5 (p. 4-3, 4-4)
M608	Alternate for AT use	5 (p. 4-3)

Booster, Adapter-Booster, or Burster

Mine, 2-gallon, M23 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M120 booster	N/A	N/A	Used with M603 fuze.	1 (p. 103), 3 (p. 4-190)
M38	0.8 pounds	Composition B	Used with M603 fuze.	8 (p. A-7), 9 (p. 4-189)
M48 burster	N/A	N/A	-	3 (p. 4-190)

Fills

Mine, 2-gallon, M23 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
HD	14.5	6.58	27.5	12.5	E5-fill, gross weight estimated.	10 (p. 2)
VX	10.5-11.5	4.76-5.21	22.7-26.5	10.2-12.0	-	1 (p. 102), 2 (p. 105), 3 (p. 4-189), 4 (p. 83), 9 (p. 4-190)

Shipping/Packing

M23 mines were packaged and shipped three to a container. Three primary fuzes and three activators were included in the shipment, which weighed 115 pounds (1 p. 103), (2 p. 63, 105).

Miscellaneous Information

A "Pop-Up" adapter to the M23 chemical land mine was developed as an addition to the Standard A Type M23 to improve its efficiency. The "Pop-Up" adapter provided for airburst of the standard M23 mine, resulting in an increased area coverage (11 p. 2).

Key Dates

Mine, 2-gallon, M23 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1960	CCTC 3705	6 (p. 61)
Standardized	1960	CCTC 3750	9 (p. 4-189)
Classified	1960	CCTC 3710	-
Standard Modernization	1961	CCTC 3788 (standardized as ABC-M23)	12

Sources

1. Department of the Army. 1964. Technical Manual, TM 9-1345-200, Land Mines. U.S. Government Printing Office.
2. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.
3. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
4. Secretary of the Army. 1967. Technical Manual, TM 9-1385-51, Identification of Ammunition (Conventional) for Explosive Ordnance Disposal. Department of the Army.
5. Department of the Army. 1997. Technical Manual, TM 43-0001-36, Army Ammunition Data Sheets for Land Mines (FSC 1345), Change 2. U.S. Government Printing Office.
6. Department of the Army. 1961. Technical Manual, TM 3-500, Chemical Corps Equipment Data Sheets. U.S. Government Printing Office.
7. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.
8. Chu, S.C., Skinner, L.R., & Smith, W.H. 1987. Chemical Stockpile Disposal Program, Transportation of Chemical Agents and Munitions: A Concept Plan, Report No. SAPEO-CDE-IS-87003. PEO-PM Cml Demil.
9. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
10. Chemical Warfare Laboratories. 1956. Test Division Field Trials Report No. 11, Summary Report of Trials of the E5 Land Mine Detonation with Side and Bottom-attached Firing Devices and By Action on the Pressure Plate. Army Chemical Center.
11. Cornell Aeronautical Laboratory. 1967. Pop-Up Adapter for the M23 Chemical Land Mine. U.S. Army Chemical Research and Development Laboratory.
12. Chemical Corps Technical Committee. 1961. CCTC Item # 3788, Chemical Corps Items Designated ABC-Army Standard. Department of the Army.

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12 Miscellaneous

This category includes containers, cylinders, drone weapons systems, and tanks.

12.1 Container, Bulk, One-ton, Type A

Figures

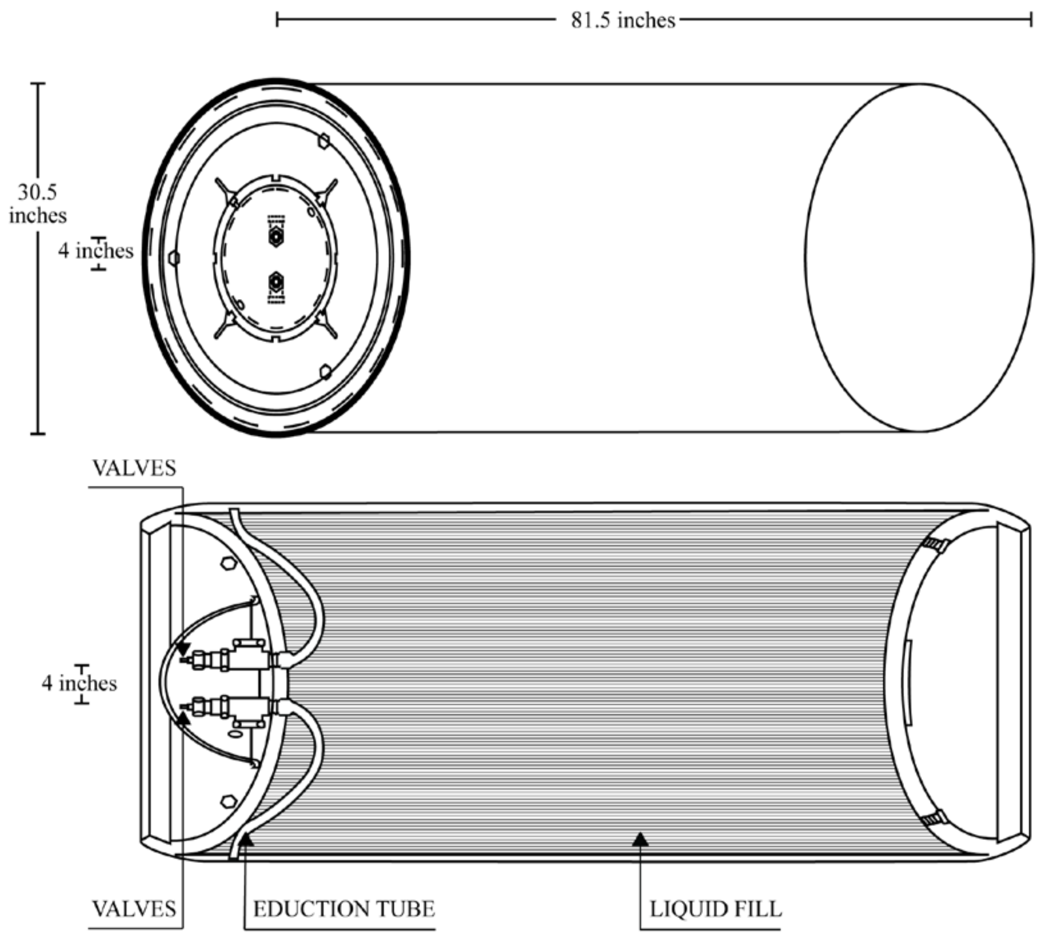

Figure 92: Container, Bulk, One-ton, Type A - Line Drawing

Figure 93: Container, Bulk, One-ton, Type A - Photograph - Cutaway View

Container, Bulk, One-ton, Type A

Specifications

Container, Bulk, One-ton, Type A - Specifications and Other Data		Citation
Historical Name	Container, One-Ton, Type A	1 (p. 12-14)
Type	Miscellaneous	1 (p. 12-14)
Size	Bulk, One-ton	1 (p. 12-14)
Service	Air Force, Army	2 (p. 4)
Diameter	30.5 inches (77.47 cm)	1 (p. 4-7), 2 (p. 4), 3 (p. 8-4)
Length	81.5 inches (207.01 cm)	1 (p. 4-7), 2 (p. 4), 3 (p. 8-4)
Other Engineering Data	Maximum gross weight: 3,500 pounds (1,587.57 kilograms) Weight Empty: 1,600 pounds (725.75 kg) Capacity: 170 gallons (643.52 liters) Eduction tubes spaced 4 inches apart.	1 (p. 4-7), 4 (p. 1), 5 (p. 8-4)
NSN	1365-277-3038 1365-277-3053	-

General Use and Description

The Type A, One-Ton Container was used primarily for transporting and storing bulk quantities of dangerous chemical agents that were gaseous at atmospheric pressure (2 p. 4), (3 p. 8-4).

The Type A container was a steel cylinder. The side walls were approximately 0.41 inches thick and could withstand a maximum internal pressure of 500 psi. The front head of the tank was a concave 0.75-inch thick sheet of steel. Two eduction tube outlets spaced four inches apart and threaded to receive 3/4-inch valves were located in the middle of the front head. Three tapered plugs were located in the middle of the front head as safety devices. The plugs were screwed into 0.75-inch holes. When the container was to be filled with chlorine, fusible plugs that melt at 175 degrees Fahrenheit were installed. When the container was filled with any other chemical agent, nonfusible plugs that would blow out at an internal pressure of 375 psi were installed. For protection during shipment, a metal shipping bonnet, similar to an auto hub cap was fastened over the valves by three bonnet clips and a bonnet-locking clip. A 0.75-inch Chlorine Institute valve was screwed into each eduction tube outlet. A cap covered with a gasket covered the valve outlet when the valve was not in use (1 p. 4-7), (3 p. 8-4).

Explosive Train

This item required no explosive train. In operation, the container was placed on a stand that was higher than the receptacle that was filled. The shipping bonnet was removed, and the container was rolled until the valves were aligned vertically and was then choked to prevent further rolling. When the valves were aligned one above the other, the end of the eduction tube leading to the upper valve was out of the liquid and could then be used for venting. The end of the other eduction tube was in the liquid, and the contents could be withdrawn through the lower valve. Instructions for the use of one-ton containers were included with the specific item (1 p. 4-7), (3 p. 8-5).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Container, Bulk, One-ton, Type A

Fills

Container, Bulk, One-ton, Type A - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
AC	1,000-1,900	453-861	3,100-3,500	1,406-1,587	-	1 (p. 4-7), 3 (p. 8-4), 4 (p. 5)
CG	1,600-1,900	725-861	3,200-3,500	1,451-1,587	-	1 (p. 4-7), 3 (p. 8-4), 6 (p. 2)
CK	1,600-1,900	725-861	3,200-3,500	1,451-1,587	-	1 (p. 4-7), 3 (p. 8-4), 6 (p. 2)
Cl	1,600-1,900	725-861	3,200-3,500	1,451-1,587	-	1 (p. 4-7), 3 (p. 8-4)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.
2. Departments of the Army and Air Force. 1955. Technical Manual, TM 3-255/Technical Order, TO 11C8-1-1, Chemical Filling and Handling Equipment. Departments of the Army and Air Force.
3. U.S. Naval Ordnance Laboratory. 1968. NAVORD Ordnance Pamphlet, OP 2217, Miscellaneous Chemical Munitions, Description and Operation, First Revision, Change 1. Naval Ordnance Systems Command.
4. Department of the Army. 1964. Technical Bulletin, TB CML 111, One-Ton Containers. Naval Ordnance Systems Command.
5. Department of the Navy. n.d. NAVWEPS Ordnance Pamphlet, OP 2212 Vol. 1 Aircraft Bombs, Fuzes and Associated Equipment. Department of the Navy.
6. Chemical Corps Technical Committee. 1959. Chemical Corps Book of Standards, Edition of 25 November 1959. Department of the Army.

12.2 Container, Bulk, One-ton, Type D

Figures

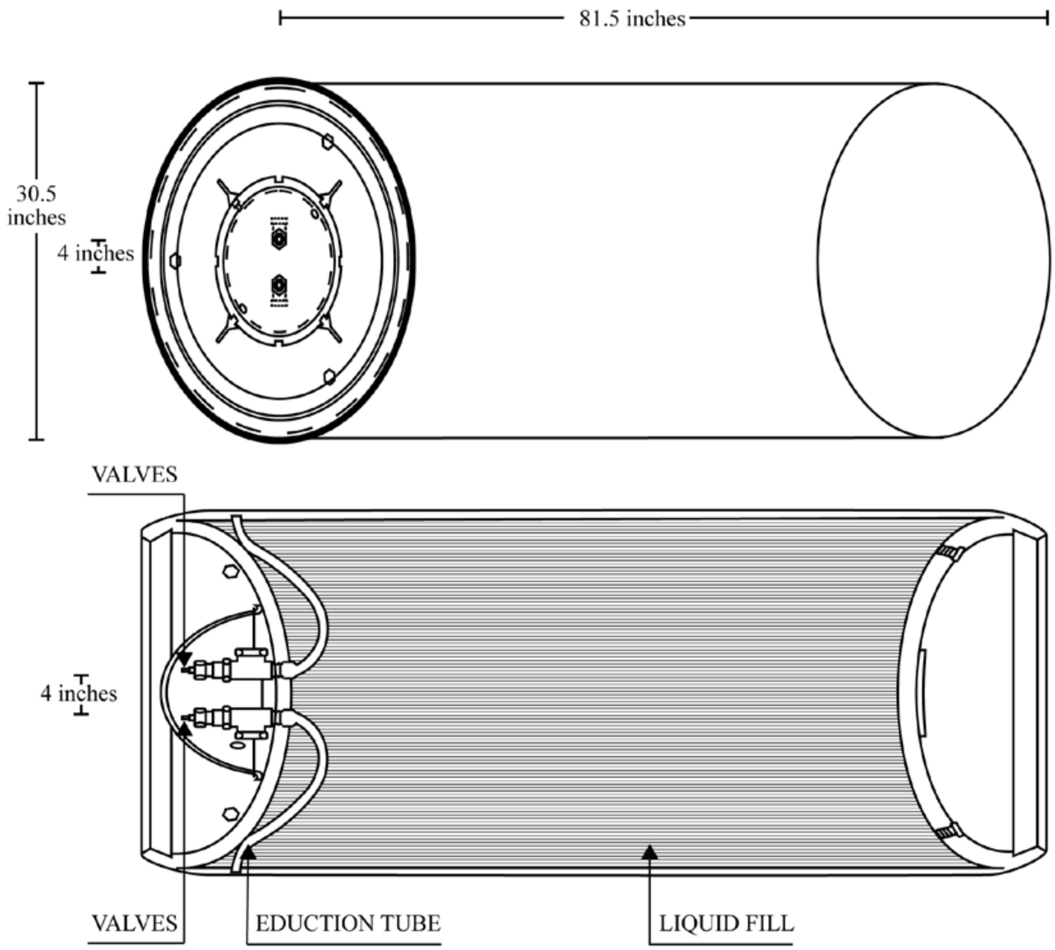

Figure 94: Container, Bulk, One-ton, Type D - Line Drawing

Figure 95: Container, Bulk, One-ton, Type D - Photograph - Container Replica, Cutaway View

Container, Bulk, One-ton, Type D

Specifications

Container, Bulk, One-ton, Type D - Specifications and Other Data		**Citation**
Historical Name	Container, One-Ton, Type D	1 (p. 12-6)
Type	Miscellaneous	2 (p. 1)
Size	Bulk, One-ton	2 (p. 1)
Diameter	30.5 inches (77.47 cm)	1, 3 (p. 8-7), 4 (p. 5)
Length	81.5 inches (207.01 cm)	1, 3 (p. 8-7), 4 (p. 5)
Other Engineering Data	Maximum gross weight: 3,500 pounds (1,587.57 kg) Empty weight: 1,600 pounds (725.75 kg) Capacity: 170 gallons (643.52 liters) Eduction tube spacing: 4 inches apart.	1, 3 (p. 8-7), 4 (p. 5)
B/M Dwg	Chemical Corps drawing: C6-10-8	2 (p. 2)
NSN	1365-293-9239 1365-277-3039 1365-277-3040 1365-277-3041	-

General Use and Description

The Type D One-Ton Container was used primarily for transporting and storing bulk quantities of chemical agents that were either liquid or gaseous at atmospheric pressure (1), (3 p. 8-8), (4 p. 1).

The Type D container was a steel cylinder 81.5-inches long and 30.5 inches in diameter. The Type D container was identical with the Type A container except for the inside diameter of the eduction tubes and eduction tube outlets. The inside diameter of the eduction tubes in the Type D container was one-inch. The two curved eduction tubes were welded inside the front head. Each tube was connected to its separate valve and the other ends of both tubes went in opposite directions to the side wall. The ends came within 0.25-inch of the side walls.

Chlorine Institute one-inch valves or one-inch angle valves were screwed into the eduction tube outlets. Angle valves were used only in containers under low internal pressure. Chlorine Institute valves were used in containers under high pressure.

Three tapered safety plugs were spread evenly around the outer edge (1), (3 p. 8-8), (4 p. 5).

Explosive Train

This item required no explosive train. The operation of the Type D container was the same as that for the Type A, except that there was a choice of Chlorine Institute one-inch valves or one-inch angle valves (1), (3 p. 8-8).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Container, Bulk, One-ton, Type D

Fills

Container, Bulk, One-ton, Type D - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
AC	1,000-1,900	453-861	2,600-3,500	1,179-1,587	Chlorine valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5), 5 (p. 3)
CG	1,600-1,900	725-861	3,200-3,500	1,451-1,587	Chlorine valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5), 5
CK	1,600-1,900	725-861	3,200-3,500	1,451-1,587	Chlorine valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5), 6
Cl	1,600	725	3,200	1,451	Chlorine valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5)
GA	1,400	635	3,000-635	1,360	-	5
GB	1,500-1,900	680-861	3,100-3,500	1,406-1,587	Angle valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5), 5
H	1,800-1,900	816-861	3,400-3,500	1,542-1,587	Angle valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5), 5
HD	1,800-1,900	816-861	3,400-3,500	1,542-1,587	Angle valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5), 5
HN-1	1,800-1,900	816-861	3,400-3,500	1,542-1,587	Angle valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5), 5
HT	1,800-1,900	816-861	3,400-3,500	1,542-1,587	Angle valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5), 5
VX	1,500	680	3,500	1,587	Angle valve	1 (p. 12-7), 3 (p. 8-7), 4 (p. 5)

Shipping/Packing

The containers were shipped uncrated (2 p. 5).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

2. Chemical Corps. 1949. Chemical Corps Tentative Specification No. 196-61-22, Container, One-Ton, Type D. Naval Sea Systems Command.

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4. Department of the Army. 1964. Technical Bulletin, TB CML 111, One-Ton Containers. Naval Ordnance Systems Command.

5. Chemical Corps Technical Committee. 1959. Chemical Corps Book of Standards, Edition of 25 November 1959. Department of the Army.

6. Chemical Corps Technical Committee. 1955. Chemical Corps Book of Standards, 1955. Department of the Army.

12.3 Container, Bulk, One-ton, Type E

Figures

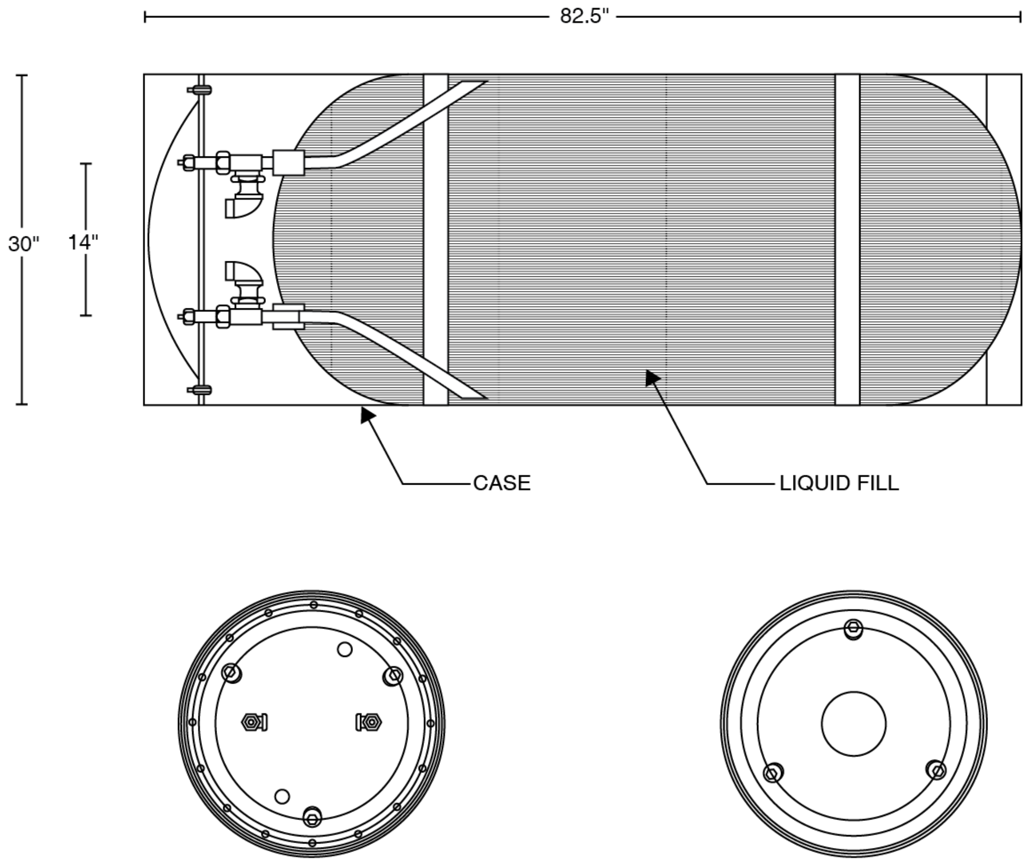

Figure 96: Container, Bulk, One-ton, Type E - Line Drawing

Container, Bulk, One-ton, Type E

Figure 97: Container, Bulk, One-ton, Type E - Photograph

Specifications

Container, Bulk, One-ton, Type E - Specifications and Other Data		Citation
Historical Name	Container, One-Ton, Type E	1 (p. 12-8)
Type	Miscellaneous	1 (p. 12-8), 2 (p. 1)
Size	Bulk, One-ton	1 (p. 12-8), 2 (p. 1)
Diameter	30 inches (76.2 cm)	1 (p. 12-9), 3 (p. 8-9), 4 (p. 3, 5)
Length	82.5 inches (210 cm)	1 (p. 12-9), 3 (p. 8-9), 4 (p. 3, 5)
Other	Wall thickness: 0.28 inch (0.71 cm)	1 (p. 12-9), 3 (p. 8-9), 4 (p. 3)
Other Engineering Data	Maximum gross weight: 3,500 pounds (1,587.57 kg) Empty weight: 900 pounds (408.23 kg) Capacity: 170 gallons (643.52 liters) Eduction tube spacing: 14 inches apart Capacity: 170 gallons	1 (p. 12-9), 4 (p. 5), 5 (p. 8-9)
Body Construction Material	Open hearth or electric furnace steel	2 (p. 1), 4 (p. 3)
B/M Dwg	CWS Drawing No. 06-10-14	2 (p. 1)
NSN	1365-277-3038	-

General Use and Description

The Type E One-Ton Container was used as a substitute for either Type A or Type D containers for transport and storage of gaseous agents or liquid chemical agents in bulk quantities (1), (3 p. 8-10), (4 p. 1).

The Type E container was a steel cylinder. Protective housings were welded to the front and rear ends of the container and projected beyond the front and rear heads.

The front head was a convex dome welded to the front end of the container. Two eduction tube outlets, 14 inches apart, were located in the front head. Each outlet was threaded to receive a one-inch valve. Three tapered plugs were screwed into 0.75-inch holes spaced equally around the outer edge of the front head. The plugs would blow out when the internal pressure became too high. Fusible plugs were installed when the container was filled with chlorine; nonfusible plugs were installed when it was filled with other chemical agents. A circular protective cover was bolted to the front protective housing (by 16 3/8-inch bolts) to protect the front head during shipment (1 p. 12-9), (3 p. 8-10).

Explosive Train

This item required no explosive train. The operation of the type E container is the same as that for the Type A or D, depending on the type of valve installed (1), (3 p. 8-10).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Container, Bulk, One-ton, Type E - Fill Types and Weights

Chemical	Fill Weight		Gross Weight		Notes	Citation
	Pounds	Kilograms	Pounds	Kilograms		
AC	1,000	453	3,500	1,587	Chlorine valve	1 (p. 12-9), 3 (p. 8-9), 4 (p. 5)
CG	1,600	726	3,500	1,586	Chlorine valve	1 (p. 12-9), 2 (p. 3), 3 (p. 8-9), 6 (p. 2)
CK	1,600	726	3,500	1,587	Chlorine valve	1, 3 (p. 8-9), 4 (p. 3, 5)
Cl	1,600	726	3,500	1,587	Chlorine valve	1 (p. 12-9), 2 (p. 3), 3 (p. 8-9)
GB	1,600	726	3,500	1,587	Angle valve	1 (p. 12-9), 3 (p. 8-9)
H	1,800	816	3,500	1,587	Angle valve	1 (p. 12-9), 3 (p. 8-9)
HD	1,800	816	3,500	1,587	Angle valve	1 (p. 12-9), 3 (p. 8-9)
HN-1	1,800	816	3,500	1,587	Angle valve	1 (p. 12-9), 3 (p. 8-9)
HT	1,800	816	3,500	1,587	Angle valve	1 (p. 12-9), 3 (p. 8-9)
VX	1,500	680	3,500	1,587	Angle valve	1 (p. 12-9), 3 (p. 8-9)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

2. Chemical Warfare Service. 1943. Chemical Warfare Service Specification No. 196-31-64, Container, One-Ton, Type E. Chemical Warfare Procurement.

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5. Department of the Navy. n.d. NAVWEPS Ordnance Pamphlet, OP 2212 Vol. 1 Aircraft Bombs, Fuzes and Associated Equipment. Department of the Navy.
6. Chemical Corps Technical Committee. 1955. Chemical Corps Book of Standards, 1955. Department of the Army.

12.4 Cylinder, Portable, MI, MIA1, MIA2

Figures

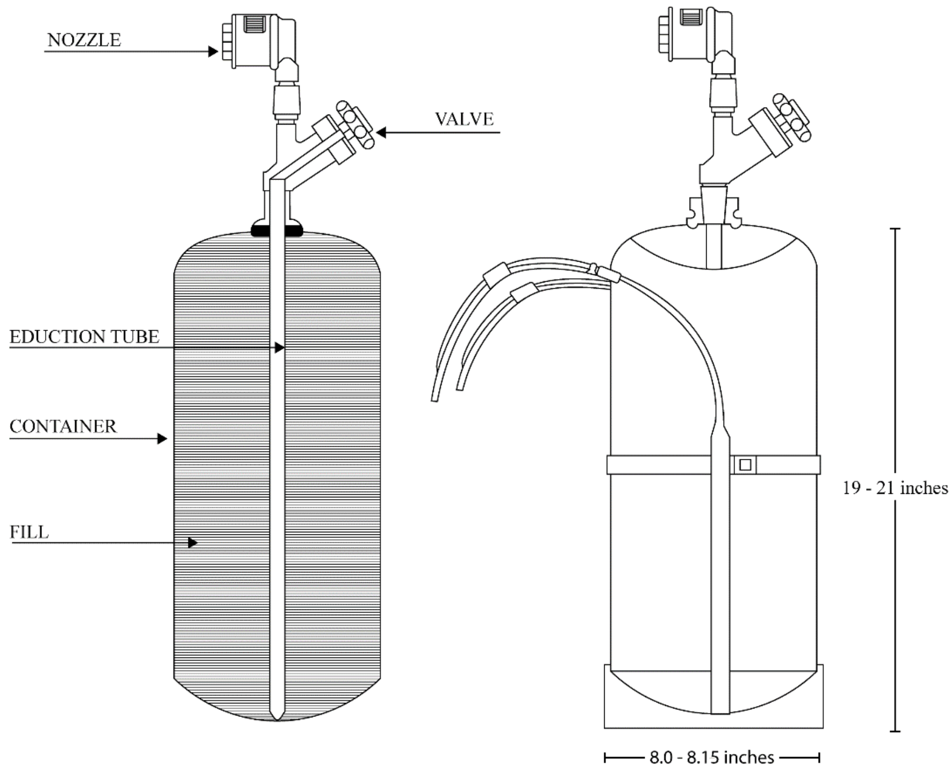

Figure 98: Cylinder, Portable, MI, MIA1, MIA2 - Line Drawing - M1A1, M1A2

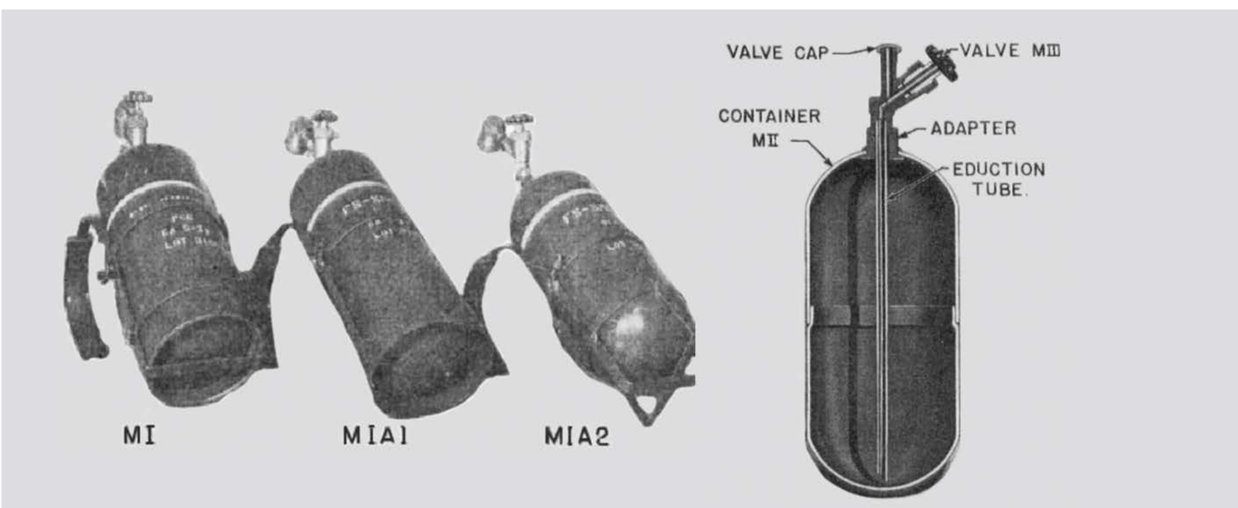

Figure 99: Cylinder, Portable, MI, MIA1, MIA2 - Photograph -

Figure 100: Cylinder, Portable, MI, MIA1, MIA2 - Photograph - Mark I

Specifications

Cylinder, Portable, MI, MIA1, MIA2 - Specifications and Other Data		Citation
Historical Name	Portable Chemical Cylinder, MI, MIA1, MIA2	1
Type	Miscellaneous	1
Diameter	MI, MIA1: 8 inches (20.32 cm) MIA2: 8.15 inches (20.72 cm)	1
Length	MI: 19.75 inches (50.16 cm) MIA1: 21 inches (53.34 cm) MIA2: 19 inches (48.26 cm)	1
Other Engineering Data	The MK 1 chemical cylinder was redesignated MI. During development, the MIA1 was designated E3. The empty weight of the cylinder was 22 pounds (9.98 kilograms).	1

General Use and Description

Cylinder was the name given to the gas container intended to be carried forward and discharged in or near the front line (2), (3), (4), (5), (6).

The portable chemical cylinder was a weapon of high mobility and chemical efficiency, but its use depended entirely upon opportunity, favorable weather, and terrain conditions. The MIA2 cylinder consisted of five parts:

1. Container MII: This was a steel cylinder that had a hemispherical top and bottom. The bottom half was joined to the upper half by a welded joint.
2. Eduction tube: The eduction tube was 19-9/16 inches long and consisted of standard black wrought-iron pipe. It was cut at its bottom at a 45-degree angle to insure free flow of liquid.
3. Valve MIII: The valve was of the Y-type. The brass body had the shape of an offset Y, and was provided with threads at the bottom to receive the eduction tube and to screw into the container

adapter, and at the top to receive the nozzle or outlet cap. The copper nickel valve stem operated by a screw thread along the inside of a brass packing gland to open or close the valve.

4. Carrier MIA2: Portable chemical cylinder carrier MIA2 was constructed of steel strips. The steel strips were 1/8-inch thick and 7/8-inch wide. Leather shoulder pads were slipped over the carrier hooks for comfort.
5. Nozzle MI: The nozzle was attached to the threaded end of the valve outlet and was designed to decrease the loud hissing noise caused by gas escaping under pressure. This nozzle was used only when the principle of surprise was to be utilized.

The limited standard cylinders were the MI and MIA1. They differed from the standard MIA2 cylinder only in the method of construction of the container, and a slight difference in the carrier dimensions. The bottom of the MI cylinder container was a lipped metal cup inserted into the container and welded at its bottom edge. The bottom of the MIA1 cylinder container was convex in shape and welded to the extreme bottom of the container without insertion (1), (2), (3), (4), (5), (6).

Explosive Train

This item required no explosive train. The standard method of releasing the contents of the cylinder was by a manually operated valve. One person could fire three to five cylinders by hand. The E4 nozzle could fire the cylinder electrically (1), (2), (3), (4), (5), (6).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Cylinder, Portable, MI, MIA1, MIA2 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	31.0-32.5	14.1-14.7	55.0-57.5	24.9-26.1	-	1, 7 (p. 12)
CG/Cl	N/A	N/A	N/A	N/A	50% CG, %0% Cl.	8 (p. 4)
CNB (chloroacetophenone solution)	23.0	10.4	48.0	21.8	Authorized for training	1, 9 (p. 56)
CNS	28.5-30.0	12.9-13.6	55.0	24.9	Authorized for training	1, 9 (p. 56)
FM	36.0	16.3	60.0	27.2	-	1
FS (Sulfur trioxide and chlorosulfonic acid)	36.0	16.3	60.0	27.2-27.1	-	1
PS/Cl	N/A	N/A	N/A	N/A	30% PS, 70% Cl.	8 (p. 4)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

In 1946 when the cylinders were recommended for obsolescence, there were 5 MI, 40,406 MIA1 and 4,239 MIA2 in the inventory (8 p. 8).

Cylinder, Portable, MI, MIA1, MIA2

Key Dates

Cylinder, Portable, MI, MIA1, MIA2 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1933	CCTC 1933-02 (GC, FM, and CN-solution fill)	10
Standardized	1942	CCTC 486 (CNB-fill)	
Obsoleted	1945	CCTC 1527 (CL-fill)	11
Obsoleted	1946	CCTC 1614 (M1, M1A1 and M1A2)	9

Sources

1. War Department. 1942. Technical Manual, TM 3-315, Portable Chemical Cylinder MIA2. War Department.

2. Perkins, George W. 1943. Chemical Warfare Board Project No. 362, Cylinder, Portable, Chemical M1A2. Chemical Warfare Board.

3. Liebig, George F., Jr. 1924. Department of Technique, Book IV, Materiel, Cylinders. Chemical Warfare School, Department of Technique.

4. Weaver, F.R. 1934. Edgewood Arsenal Technical Report, EATR 147, Portable Chemical Cylinder MIA1 (E3), A Final Report. War Department.

5. Greene, L.W. 1937. Edgewood Arsenal Technical Report, EATR 228, Portable Chemical Cylinder MIA2, Complete, Engineering Tests. War Department.

6. Powell, Hartley C. 1934. Edgewood Arsenal Technical Report, EATR 169, Portable Chemical Cylinder MII, A Status Report. War Department.

7. Bouder, N.M., & Powell, H.C. 1931. Approximate Average Weights of Fillings in Chemical Munitions. Information Division.

8. Chemical Corps Technical Committee. 1946. CCTC Item # 1545, Subject: Obsoletion of Cylinders, Portable, Chemical, MI, MIA1, MIA2 and Apparatus, Charging, Portable Chemical Cylinder, MI. Department of the Army.

9. Chemical Corps Technical Committee. 1946. CCTC Item # 1614, Subject: Obsoletion of Cylinders, Portable, Chemical, MI, MIA1, MIA2 and Apparatus, Charging, Portable Chemical Cylinder, MI. Department of the Army.

10. Chemical Corps Technical Committee. 1933. CCTC Item # 1933-02, Chemical Fillings for Munitions. Department of the Army.

11. Chemical Corps Technical Committee. 1945. CCTC Item # 1527, Cancellation of the Authorization to Use Cl as a Chemical Warfare Agent Filling. Department of the Army.

12.5 Drone Weapon System, Multipurpose, AN-USD-2

Figures

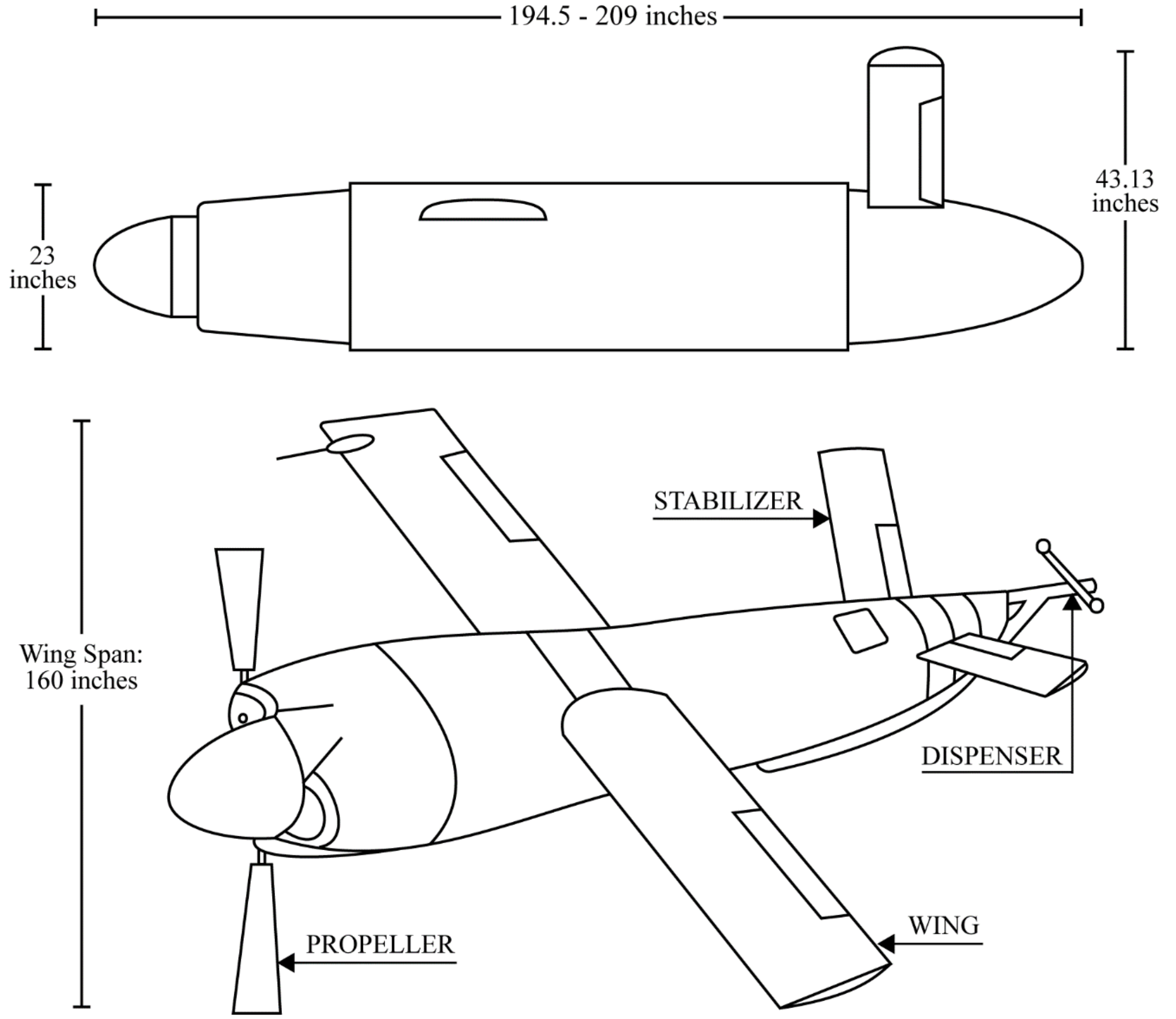

Figure 101: Drone Weapon System, Multipurpose, AN-USD-2 - Line Drawing

Specifications

Drone Weapon System, Multipurpose, AN-USD-2 - Specifications and Other Data		**Citation**
Historical Name	Drone Weapons System, Multipurpose, AN-USD2	1 (p. 4-88)
Type	Miscellaneous	1 (p. 4-88)
Diameter	23 inches (58.42 cm)	2 (p. 4-89), 3 (p. 4-88)
Length	194.5-209 inches (494.03-530.86 cm)	2 (p. 4-89), 3 (p. 4-88)
Height	43.13 inches (109.55 cm) including stabilizer	3 (p. 4-88)
Other	Wing span: 160 inches (406.4 cm)	2 (p. 4-89), 3 (p. 4-88)
Other Engineering Data	Operational Weight: 1,500 pounds (630.39 kg) Empty weight: 790 pounds (358.34 kg) Fill Payload: 210 pounds (95.25 kg) Drone Capacity: 25 gallons (94.64 liters)	2 (p. 4-88), 3 (p. 4-90)

Drone Weapon System, Multipurpose, AN-USD-2

General Use and Description

Developed for use in dissemination of biological and chemical agents, as well as for combat surveillance. 2 (p. 4-88), 3 (p. 4-90)

The AN-USD 2 was a remote controlled, low endurance, recoverable drone. The guidance system was line-of-sight command and pre-programming.

The dissemination nozzle was located in the tail section. Dispensing altitude was 100 to 250 feet (30.48-76.42 meters) (2 p. 4-88), (3 p. 4-87).

Explosive Train

This item required no explosive train.

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Drone Weapon System, Multipurpose, AN-USD-2 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
VX	210	95.2	1,500	680	-	2 (p. 4-88), 3 (p. 4-87)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

Sarin was not recommended for use in drones (2 p. 4-88).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1966. NAVWEPS Report 8566, Characteristics of Biological and Chemical Munitions and Delivery Systems. Naval Ordnance Laboratory.
2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
3. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

12.6 Drone Weapon System, Multipurpose, AN-USD-4

Figures

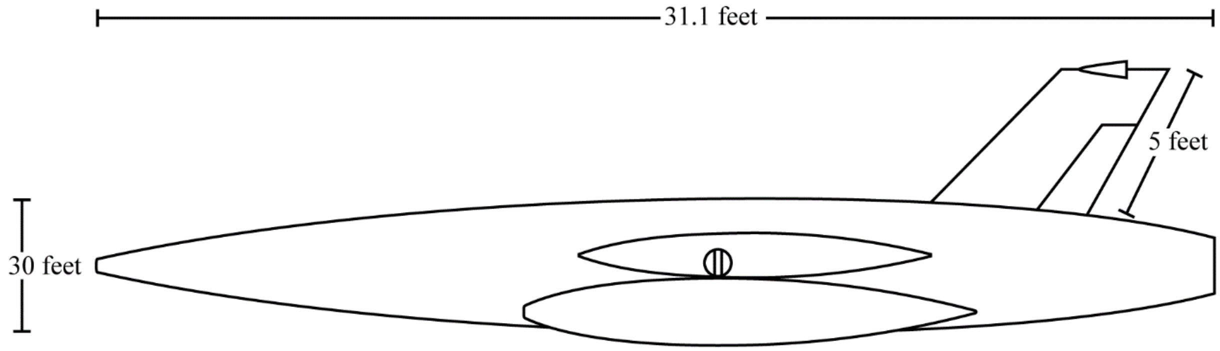

Figure 102: Drone Weapon System, Multipurpose, AN-USD-4 - Line Drawing

Specifications

Drone Weapon System, Multipurpose, AN-USD-4 - Specifications and Other Data		**Citation**
Historical Name	Drone Weapons System, Multipurpose AN-USD-4	1 (p. 4-89)
Type	Miscellaneous	1 (p. 4-89)
Diameter	Fuselage: 30 feet (9.14 meters) Tank: 18 inches (45.72 cm)	1 (p. 4-90)
Length	31.1 feet (9.47 meters)	1 (p. 4-90)
Width	Wing Span: 11.45 feet (3.48 meters)	1 (p. 4-90)
Other Engineering Data	Empty weight: 2,992 pounds (1,357.18 kilograms)	1 (p. 4-90)
Propellant	J-60 Turbojet engine.	1 (p. 4-90)

General Use and Description

The drone was used for dissemination of biological and chemical fills (1 p. 4-89).

The AN-USD-4 was a remote controlled, medium endurance, recoverable drone. The system was designed for either low or high penetration of enemy territory to disseminate biological or chemical agents and return the drone to its launch point for recovery by parachute. Guidance was by pre-programmed inertial system using a Minneapolis-Honeywell inertial platform. There was also a short range line-of-sight command guidance system employed. The drone could be launched from a zero launcher mounted on a flatbed trailer. Jet Assisted Take Off boosters were used for launching and were mounted beneath the drone. Two different size boosters were used. The drone could carry external tanks mounted under wings.

There was a nozzle located in the tail section for dissemination of agent (1 p. 4-89).

Explosive Train

This item required no explosive train.

Fuzing

There was no fuze for this item.

Drone Weapon System, Multipurpose, AN-USD-4

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Available references did not include information regarding fills for this item.

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

No specific fills provided in available references.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

12.7 Drone Weapon System, Multipurpose, AN-USD-5

Figures

No figures available.

Specifications

Drone Weapon System, Multipurpose, AN-USD-5 - Specifications and Other Data		Citation
Historical Name	Drone Weapons System, Multipurpose, AN-USD-5	1 (p. 4-91)
Type	Miscellaneous	1 (p. 4-91)
Length	36.58 feet (11.15 meters)	1 (p. 4-92)
Other	Wing span: 24.67 feet (7.52 meters)	1 (p. 4-92)
Other Engineering Data	Engine thrust: 2,900 pounds (1,315.42 kg) Payload: 1,260 pounds (571.53 kg) Fill Capacity: 200 gallons (757.08 liters) Engine: Pratt and Whitney-J60-P-2	1 (p. 4-92)

General Use and Description

The AN-USD-5 was used for the dissemination of biological and chemical weapons (1 p. 4-90).

The AN-USD-5 was a remote controlled, recoverable, long distance drone. It was capable of human incapacitation; the degree was dependent upon the agent used. For broad battlefield coverage and weapon effectiveness, timing for enemy incapacitation could be selected, and roads and facilities would not be destroyed in compromising the enemy.

The drone could change heading, altitude, speed, and commands to subsystem in a pre-programmed manner. There was a nozzle located in the tail section for dissemination of chemical fill (1 p. 4-91).

Explosive Train

This item required no explosive train.

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Available references did not include information regarding fills for this item.

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

No information regarding specific fills was contained in available references.

Drone Weapon System, Multipurpose, AN-USD-5

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

12.8 Tank, 23-gallon, Spraying Apparatus, E6R9

Figures

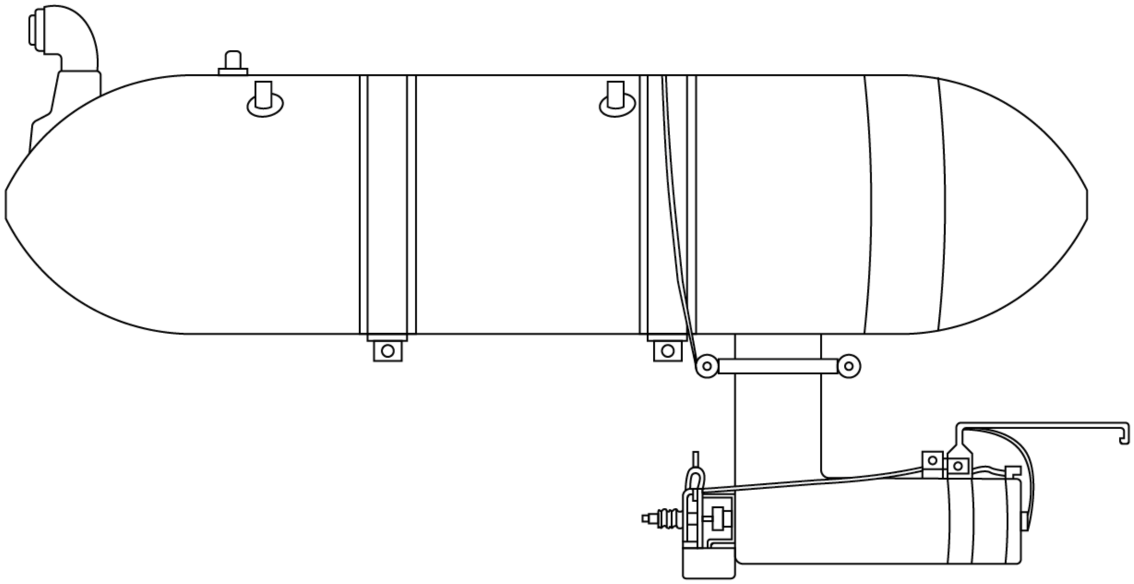

Figure 103: Tank, 23-gallon, Spraying Apparatus, E6R9 - Line Drawing

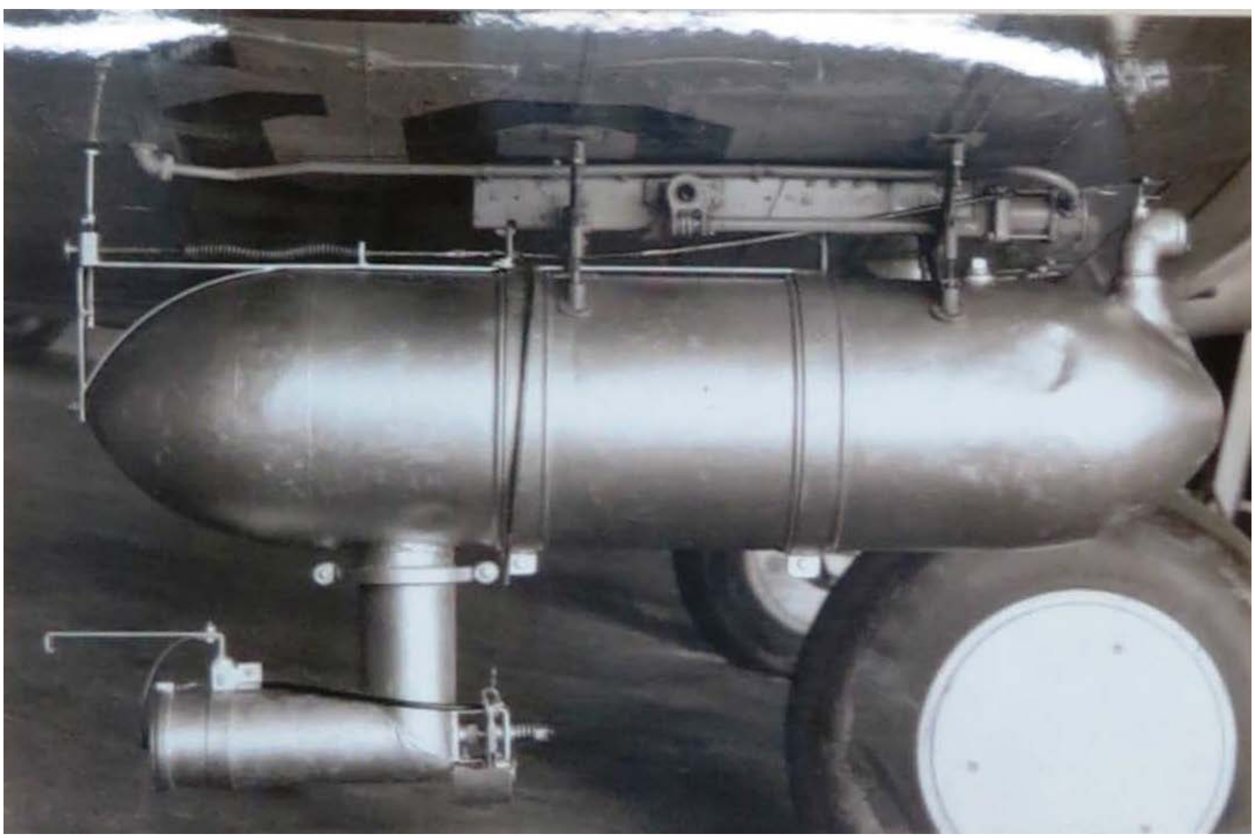

Figure 104: Tank, 23-gallon, Spraying Apparatus, E6R9 - Photograph - Right Side View - Airplane Chemical Spray Tank E6R9 Storage Type

Tank, 23-gallon, Spraying Apparatus, E6R9

Specifications

Tank, 23-gallon, Spraying Apparatus, E6R9 - Specifications and Other Data		Citation
Historical Name	Spraying Apparatus, E6R9 chemical tank	1
Type	Miscellaneous	2 (p. 1)
Size	23-gallon	1
Conflict	WWII	1
Service	Army, Army Air Corps	2 (p. 1)
Diameter	12.5-inches (91.75 cm)	3
Body Construction Material	Steel, 20-gauge	3

General Use and Description

The E6R9 was used for dispersing chemical agents from airplanes. It was designed to provide an airplane dispersing apparatus with a tank that could be filled at a depot, securely closed, stored for an indefinite period, and prepared for use by the addition of the necessary apparatus (1).

The last spraying apparatus standard for use by the Air Corps was the E6R9 chemical tank, a wing tank installation for use on single engine attack airplanes. The apparatus consisted of a tank, which had a total capacity of 23 gallons with uniform ogival front and rear, assembled with continuous discharge mechanism, and poppet-type vent with air scoop.

The apparatus consists of a streamlined tank, a discharge valve and discharge line, an air vent, and the necessary connections. When the valve is opened, the agent flows down through the discharge line and into the air. Here it is subjected to the natural shearing effect of the air blast and is broken up into very fine particles which drift with the wind.

The container used is a cylindrical tank with uniform ogival ends, and has a total capacity of approximately 23 gallons.

The discharge mechanism consisted of a detachable closure plate and a rotating shaft for releasing the plate. Operation was by a spring mechanism actuated by a solenoid attached to the plane (1), (3 p. 142-145).

Explosive Train

Operation was by electro-mechanical means, and the discharge of the contents was accomplished by release of a closure plate from the end of the discharge line (1).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Tank, 23-gallon, Spraying Apparatus, E6R9

Fills

Tank, 23-gallon, Spraying Apparatus, E6R9 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CNB	N/A	N/A	N/A	N/A	-	1
CNS	N/A	N/A	N/A	N/A	-	1
FM	N/A	N/A	N/A	N/A	-	1
FS	N/A	N/A	N/A	N/A	-	1, 2 (p. 11)
H	N/A	N/A	N/A	N/A	-	1
HL	N/A	N/A	N/A	N/A	-	1
L	N/A	N/A	N/A	N/A	-	1
MR	N/A	N/A	N/A	N/A	-	2 (p. 2)
PS	N/A	N/A	N/A	N/A	-	1

Shipping/Packing

Available references did not provide this information.

Key Dates

Tank, 23-gallon, Spraying Apparatus, E6R9 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Classified	1938	CCTC 1938-07	4

Sources

1. War Department. 1941. Technical Manual, TM 1-409, Aircraft Armament and Pyrotechnics. War Department.
2. Weaver, F.R. 1938. Technical Division Memorandum Report, TDMR 127, Report of Comparative Tests of Airplane Chemical Spray Tank E6R9 and Air Corps A-17 Chemical Tank with Airplane YIA-18. Chemical Warfare Service.
3. Gual, A. and Finklestein, Leo. 1952. 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). Volume 18, Part V, Incendiaries. Project 4-72-05-005. AD0224098. Army Chemical Center. Army Chemical Center.
4. Chemical Corps Technical Committee. 1938. CCTC Item # 1938-07, Airplane Chemical Spray Tank E6R9 – Classification of. Department of the Army.

12.9 Tank, 30-gallon, Airplane, M10 (E12)

Figures

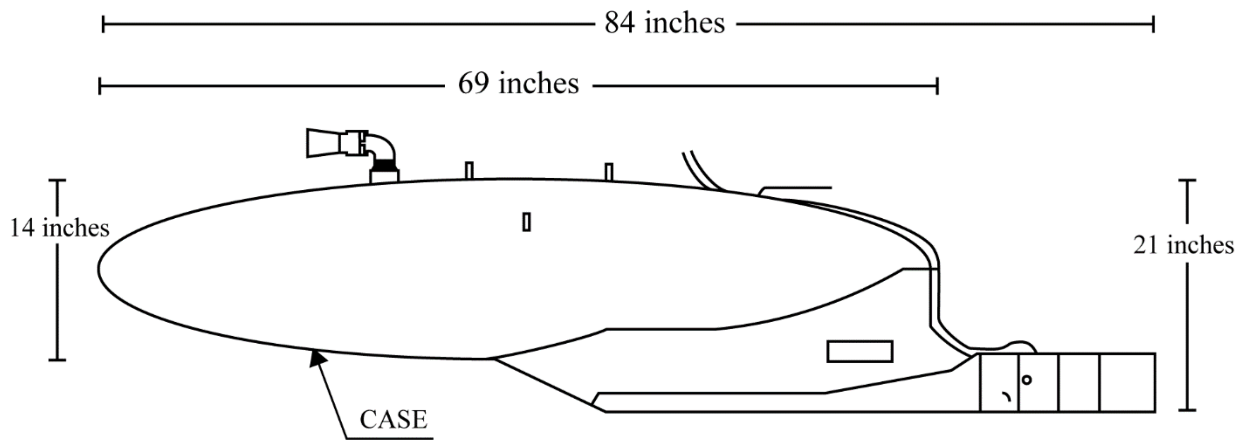

Figure 105: Tank, 30-gallon, Airplane, M10 (E12) - Line Drawing

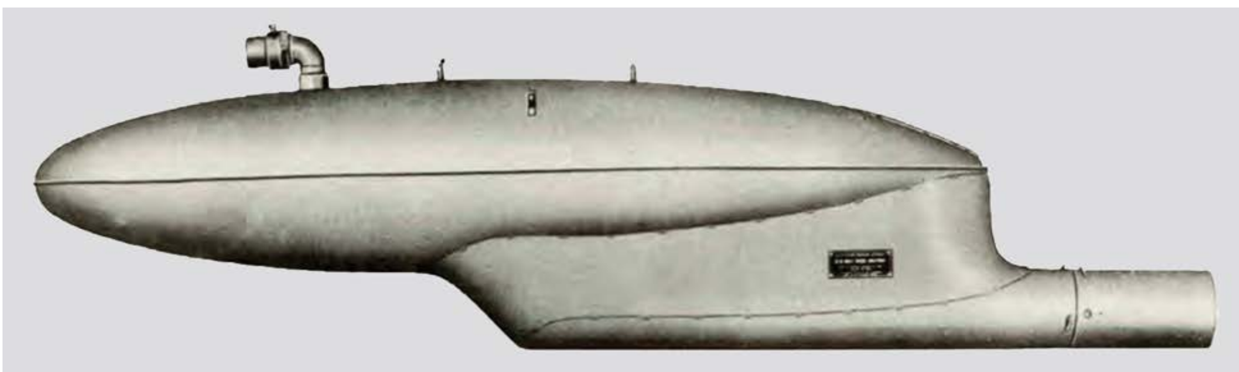

Figure 106: Tank, 30-gallon, Airplane, M10 (E12) - Photograph

Specifications

Tank, 30-gallon, Airplane, M10 (E12) - Specifications and Other Data		**Citation**
Historical Name	Airplane Smoke Tank M10 (E12)	1 (p. 236-240)
Type	Miscellaneous	2 (p. 9), 3 (p. 3)
Size	30-gallon	2 (p. 9), 3 (p. 3), 4 (p. 4)
Conflict	WWII	4
Service	Air Force, Army, Navy	1 (p. 247), 2 (p. 9), 3 (p. 3), 5 (p. 1)
Diameter	14 inches (35.5 cm)	1 (p. 239), 2 (p. 9), 6 (p. 42.7)
Length	69-84 inches (175.26 - 213.36 cm)	1 (p. 239), 2 (p. 9), 4 (p. 6), 6 (p. 42.7)
Height	21 inches (53.3 cm)	1 (p. 239), 2 (p. 9), 4, 6 (p. 42.7)
Other Engineering Data	During development, the M10 smoke tank was designated E12. The tank weighed 68 pounds when empty, and had a capacity of 20 to 25 gallons.	1 (p. 236-237)
Body Construction Material	Copper-bearing steel	1 (p. 239)
Spec/PD No	MIL-S-13610	2 (p. 239), 5 (p. 1)
B/M Dwg	D28-4-348, C28-4-348, 57A9821	2 (p. 239), 3

Tank, 30-gallon, Airplane, M10 (E12)

General Use and Description

The M10 airplane smoke tank was used to lay smoke screens and to spray blister agents, riot control agents, and simulated liquid agents for mustard gas from airplanes (4 p. 1), (5 p. 1).

The M10 airplane smoke tank was a streamlined gravity discharge tank with ogival ends having a net capacity of 30 gallons. The empty tank weighed about 68 pounds and measured 84 by 20.5 by 14 inches. It consisted of three parts. A container assembly, an air inlet assembly, and a discharge line assembly. The blasting caps shattered the frangible seals in the air inlet and discharge line assemblies resulting in the gravitational release of the liquid contents of the tank from the discharge pipe. Air entering the air inlet assembly helped force the liquid out of the discharge pipe. The slipstream of the airplane would break up the liquid into a spray (2 p. 9), (4).

Explosive Train

The contents of the tank were released by explosion of electric blasting caps (detonators) that shattered frangible seals in the air inlet and discharge line assemblies (3 p. 3).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Tank, 30-gallon, Airplane, M10 (E12) - Fill Types and Weights

Chemical	Fill Weight		Gross Weight		Notes	Citation
	Pounds	Kilograms	Pounds	Kilograms		
AS	255	115	323	146	-	4 (p. 49)
CNB	285	129	353	160	-	4 (p. 49), 6 (p. 42.7)
CNC (chloroacetophenone solution)	326	148	394	179	-	6 (p. 42.7)
CNS	367	166	435	197	-	4 (p. 49)
FM	360	163	428	194	-	4 (p. 49)
FS	432-480	195-217	500-548	226-248	-	1 (p. 240), 4 (p. 49), 6 (p. 42.7)
GA	270	122	338	153	-	7 (p. 19)
H	339	153	407	184	-	4 (p. 49)
HD	321	145	389	176	-	4 (p. 49), 6 (p. 42.7)
HL	405	183	473	214	-	4 (p. 49)
HV	315	142	383	173	-	4 (p. 49)
L	432-471	195-213	500-539	226-244	-	4 (p. 49)
MR	264	119	332	150	-	4 (p. 49), 6 (p. 42.7)

Shipping/Packing

The tank is packed in a wooden case and is fastened to the top of the case by threaded hooks engaging the suspension lugs. The air-inlet assembly is packed in the case, in a box placed under the nose of the tank. The shipping weight is approximately 150 pounds, and the displacement is approximately 28 cubic feet (2 p. 239), (5 p. 1).

Tank, 30-gallon, Airplane, M10 (E12)

Miscellaneous Information

As of 1948, there were 52,934 M10 smoke tanks on hand (8 p. 2), (9).

Key Dates

Tank, 30-gallon, Airplane, M10 (E12) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1940	CWTC 216, 281	1 (p. 237), 5 (p. 1)
Standard Modernization	1958	CCTC 3408 (Standard-A)	10 (p. 116)
Obsoleted	1977	Materiel Status Record (MSR) 08776018	11 (p. 3)

Sources

1. Finklestein, Leo. 1964. History of Research and Development of the Chemical Warfare Service in World War II (1 July 1940 - 31 December 1945) Screening Smokes Part III. Chemical Research and Development Laboratories (CRDL).

2. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

3. Department of the Army. 1961. Technical Manual, TM 3-500, Chemical Corps Equipment Data Sheets. U.S. Government Printing Office.

4. War Department. 1944. Technical Bulletin, TB 3-255A-1, Airplane Smoke Tank M10. War Department.

5. Army Chemical Center. 1957. Reclassifications, obsoletions, and related actions which have occurred since publication of EP 79, Chemical Corps Equipment Data Sheets. U.S. Army Chemical Corps Engineering Command.

6. Department of the Army. 1967. Field Manual, FM 3-8, Chemical Reference Handbook. U.S. Government Printing Office.

7. Gibby, I., Layton, L., Stone, W., & Clay, J. 1953. Dugway Proving Ground Report, DPGR 129, Assessment of Hazard from Aerial Spray, DPG CW 3-53. Chemical Warfare Division.

8. Chemical Corps Technical Committee. 1958. CCTC Item # 3483, Subject: Use of Airplane Smoke Tank M10 on L19 and L20 Aircraft. U.S. Army Chemical Center and Chemical Corps Materiel Command.

9. Chemical Corps Technical Committee. 1948. CCTC Item # 1913, Subject: Obsoletion of Tanks, Airplane Smoke, M10, AN-M33A1, M40 and Accessory Equipment. Chemical Corps.

10. Chemical Corps Technical Committee. 1958. CCTC Item # 3408, Revised Type Classifications & Modernization Codes for Chemical Corps Items. Department of the Army.

11. Department of the Army. 1977. Materiel Status Record Submission, MSR 08776018, Reclassification of Smoke Tank, Airplane: M10 and Accessory Equipment as Obsolete. Headquarters, United States Army Armament Command.

12.10 Tank, 31-gallon, Airborne, Aero 15A

Figures

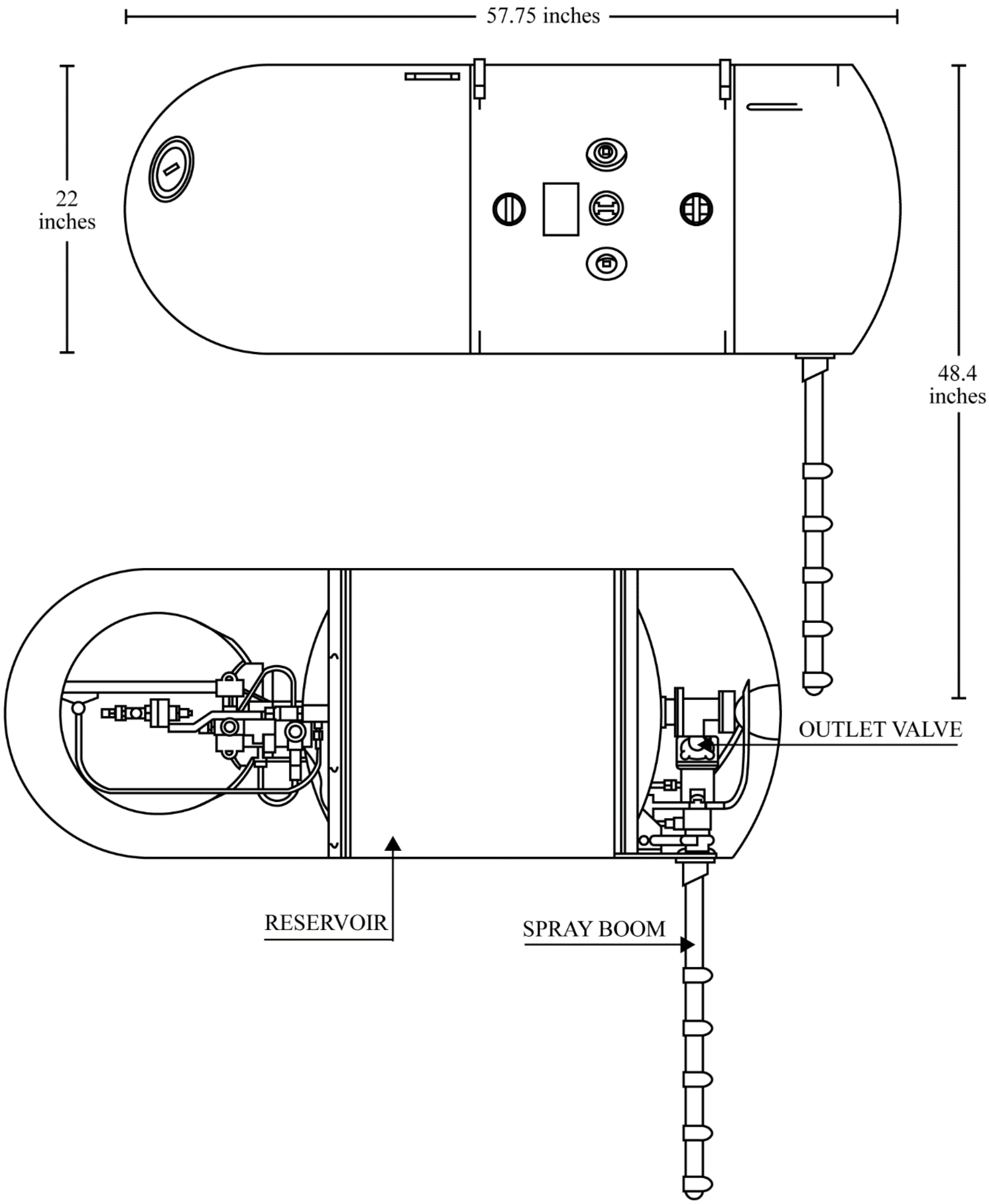

Figure 107: Tank, 31-gallon, Airborne, Aero 15A - Line Drawing

Tank, 31-gallon, Airborne, Aero 15A

Specifications

Tank, 31-gallon, Airborne, Aero 15A - Specifications and Other Data		Citation
Historical Name	Spray Tank, Airborne, Aero 15A	1 (p. 11-5)
Type	Miscellaneous	1 (p. 11-5)
Size	31-gallon	1
Diameter	22 inches (55.88 cm)	1 (p. 11-5), 2 (p. 7-4)
Length	57.75 inches (146.69 cm) Boom Length: 26.40 inches (67.06 cm)	1 (p. 11-5), 2 (p. 7-4)
Other	Suspension: 2 lugs, 14 inches apart	1 (p. 11-5), 2 (p. 7-4)
Other Engineering Data	Empty Weight: 111.0 pounds Filled Weight: 375 pounds Agent Weight: 260 pounds Agent Capacity: 31 Gallons Used with: Helicopter UH-34	1 (p. 11-5), 2 (p. 7-4)
Body Construction Material	Heavy aluminum	2 (p. 7-4)

General Use and Description

The Aero 15A Airborne Spray Tank was a system designed to disseminate insecticide and various liquid agents from a helicopter. With minor modifications, the system could be adapted to operate from ground vehicles or small agricultural aircraft (1 p. 11-5), (2 p. 7-4).

The Aero 15A Spray Tank was cylindrical and constructed of heavy aluminum. Rounded nose and tail fairings provided minimum resistance under low speed aerodynamic conditions. The tank had a capacity of 31 gallons with 5 gallons of space reserved as a void. Spray action power was provided by a spherical pressure bottle with filtered compressed air or compressed nitrogen. The high-pressure gas supply was controlled by a pressure regulator that maintained 50 psi on the agent storage reservoir.

A low-pressure gauge was mounted in a cutout in the nose fairing, and the pilot could view this gauge through the cockpit window to be sure the pressure required to disseminate the agent was present.

The heart of the Aero 15A tank was the pressure control system assembly. Its main components were the pressure bottle and holder assembly, bottle valve, safety head and regulator assembly, low pressure gauge, solenoid valve, and check valve. The system was mounted on the forward part of the agent reservoir, except for the solenoid valve, which was mounted on the read of the reservoir. The nose fairing protected the front end components.

The pressure bottle receives its gas charge through a filter assembly that contained a check valve, purifying filter, and high-pressure gauge.

A bottle valve distributed filtered, compressed air or nitrogen from the bottle to the pressure regulation system, and from the high-pressure line through a check valve to the outlet valve. This valve is of aluminum and is a 28/24-volt direct current electrically operated solenoid valve controlled by the pilots control box.

The outlet valve mounted on the rear of the agent reservoir and sheltered by the tail fairing controlled the discharge of agent from the reservoir.

The discharge nozzle assembly could be attached to the output of the outlet valve (1 p. 11-5), (2 p. 7-4, 7-5).

Tank, 31-gallon, Airborne, Aero 15A

Explosive Train

This item required no explosive train. To disseminate the agent from the tank, the pilot activated the spray tank control box switch (1 p. 11-5), (2 p. 7-5).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Available references did not include information regarding fills for this item.

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

2. U.S. Naval Ordnance Laboratory. 1968. NAVORD Ordnance Pamphlet, OP 2217, Miscellaneous Chemical Munitions, Description and Operation, First Revision, Change 1. Naval Ordnance Systems Command.

12.11 Tank, 70-gallon, Airplane, M33 and AN-M33A1

Figures

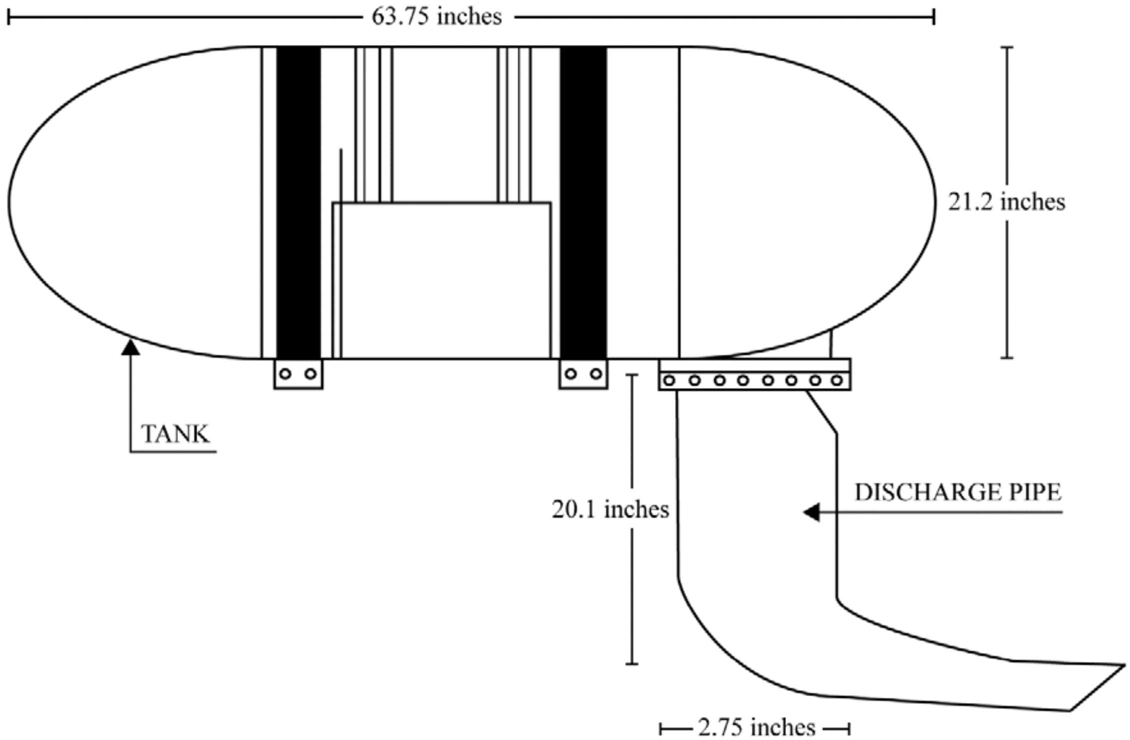

Figure 108: Tank, 70-gallon, Airplane, M33 and AN-M33A1 - Line Drawing

Figure 109: Tank, 70-gallon, Airplane, M33 and AN-M33A1 - Photograph - M33

Tank, 70-gallon, Airplane, M33 and AN-M33A1

Specifications

Tank, 70-gallon, Airplane, M33 and AN-M33A1 - Specifications and Other Data		Citation
Historical Name	Airplane Smoke Tanks AN-M33A1 And M33	1
Type	Miscellaneous	1
Size	70-gallon	1
Service	Army, Navy	2
Diameter	Outside: 21.375 inches (54.29 cm) Vent pipe: 2.75 inches (6.99 cm)	1, 3 (p. 257)
Length	Overall minus insulating cover: 63.75-64.75 inches (161.93 cm) Vent pipe: 20.125 inches (51 cm)	1, 3 (p. 257)
Other Engineering Data	Gross volume: 78 gallons (295.26 liters). Operating volume: 70 gallons (264.78 liters). During development, the M33 was known as the E16R1	1, 3 (p. 257)
Body Construction Material	The tank was constructed of 16-gage copper bearing steel	4 (p. 33, 38)

General Use and Description

The AN-M33A1 and M33 smoke tanks were used to lay smoke screens and to spray blister gases, tear gases, and training mustard simulants from airplanes. They were mounted either on the wings or inside the bomb bay of various airplanes. The M33 and M33A1 conformed to the dimensions of a 2,000-pound bomb (1), (4 p. 33-38).

The tanks were cylindrical with ogival ends, approximately 65 inches long and about 21-3/8 inches in diameter. It consisted of three parts. The blasting caps shattered the frangible seals in the air inlet and discharge line assemblies resulting in the gravitational release of the liquid contents of the tank from the discharge pipe. Air entering the air inlet assembly helped force the liquid out of the discharge pipe. The slipstream of the airplane would break up the liquid into a spray.

Both the AN-M33A1 and M33 airplane smoke tanks had the same components; the tank body assembly, closure plate assembly wired for electric control, and one of the various discharge pipe assemblies. They differed only in tank body assemblies. The AN-M33A1 had a tank carrier assembly that could be adjusted for either 14- or 30-inch suspension of the tank, depending on the airplane installation. Only 30-inch suspension could be used on the M33. Additional beading was provided on the AN-M33A1 tank body to hold the suspension straps in the 14-inch suspension position.

There were two flat steel straps that fit tightly around the tank for suspension. The tank body held the liquid, which was sprayed from the tank. There were two filling openings at the rear of the tank that were closed by square-head pipe plugs. Beading on the tank body held the suspension straps in place.

The vent and discharge assembly consisted of a flanged closure assembly with a discharge opening and a vent pipe. The vent pipe was welded at the bottom to the closure flange.

There were two types of discharge pipes and two types of discharge elbows. The M1 discharge pipe was a basic discharge line for bomb bay installations. The M2 discharge pipe was short and used for wing mounted smoke tanks (1), (3 p. 257-258).

Explosive Train

A wiring conduit was welded to the side of the tank. Detonator lead wires were run through this conduit. The CWS No. 4 detonator (electric blasting cap) fit into the vent pipe detonator retainer.

The discharge detonator retainer had a recess into which the CWS No. 6 detonator was inserted and a hole at one end of the recess through which the lead wires were threaded. The detonator retainer, with detonator, was inserted into the retaining screw.

The detonators shattered the frangible seals in the air inlet and discharge line assemblies resulting in the gravitational release of the liquid contents of the tank from the discharge pipe. Air entering the air inlet assembly helped force the liquid out of the discharge pipe. The slipstream of the airplane would break up the liquid into a spray (1), (4 p. 34).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Tank, 70-gallon, Airplane, M33 and AN-M33A1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
AS	595	269	736	333	-	3 (p. 102)
CNB	665	301	806	365	-	3 (p. 102)
CNS	858	389	999	453	-	3 (p. 102)
FM	1,015	460	1,156	524	-	3 (p. 102)
FS	1,120	508	1,261	572	-	3 (p. 102)
H	792	359	932	422	-	3 (p. 102)
HD	749	339	890	404	-	3 (p. 102)
HL	945	428	1,086	492	-	3 (p. 102)
L	1,099	498	1,240	562	-	3 (p. 102)
MR	616	279	757	343	-	3 (p. 102)

Shipping/Packing

The tank body was shipped in a single crate with a gross weight of 295 pounds. The discharge pipes, accessories set, and insulating cover were shipped separately (1 p. 64).

Miscellaneous Information

As of 1948, there were 7,831 AN-M33A1 smoke tanks on hand (2).

Key Dates

Tank, 70-gallon, Airplane, M33 and AN-M33A1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1943	711 (M33)	3 (p. 257)
Standardized	1944	CCTC 1092 (M33A1)	5
Obsoleted	1947	CCTC 1772 (M33), CCTC 1913	6 (p. K1), 7
Obsoleted	1949	CCTC 1946 (M33A1)	7
Obsoleted	1952	CCTC 2576 (AN-M33A1)	8

Sources

1. War Department. 1945. Technical Bulletin, TB 3-255B-1, Airplane Smoke Tanks AN-M33A1 and M33. War Department.

2. Chemical Corps Technical Committee. 1948. CCTC Item # 1913, Subject: Obsoletion of Tanks, Airplane Smoke, M10, AN-M33A1, M40 and Accessory Equipment. Chemical Corps.

3. Finklestein, Leo. 1964. History of Research and Development of the Chemical Warfare Service in World War II (1 July 1940 - 31 December 1945) Screening Smokes Part III. Chemical Research and Development Laboratories (CRDL).

4. Finklestein, Leo. 1964. CRDL Special Publication 1-42, History of Research and Development of the Chemical Warfare Service in World War II (1 July 1940 – 31 December 1945) Screening Smokes Part IV, CBRNIAC-CB-009967. Chemical Research and Development Laboratories (CRDL).

5. Chemical Corps Technical Committee. 1944. CCTC Item # 1092, Subject: Standardization of Tank, Airplane Smoke, M33A1. Department of the Army.

6. Chemical Corps Technical Committee. 1948. CCTC Item # 1881, Subject: Obsoletion of Tanks, Airplane Smoke, M10, AN-M33A1, M40 and Accessory Equipment. Chemical Corps.

7. Chemical Corps Technical Committee. 1949. CCTC Item # 1946, Subject: Obsoletion of Tanks, Airplane Smoke, M10, AN-M33A1, M40 and Accessory Equipment, Request Denied. Department of the Army.

8. Chemical Corps Technical Committee. 1952. CCTC Item # 2576, Obsoletion of Tank, Airplane Smoke, AN-M33A1, M40 and Related Accessories. Department of the Army.

12.12 Tank, 84-gallon, Aircraft, Aero 14B

Figures

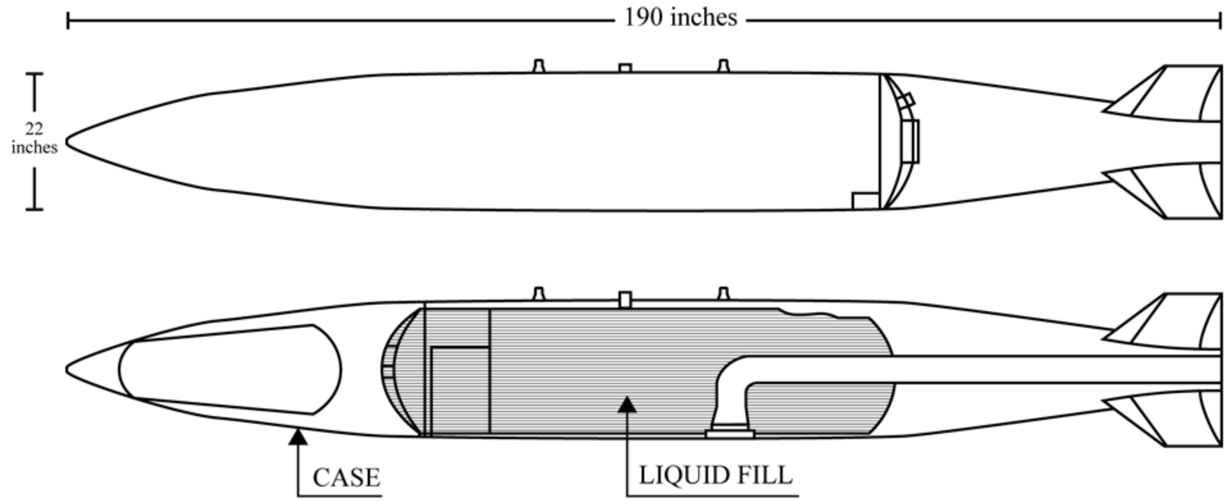

Figure 110: Tank, 84-gallon, Aircraft, Aero 14B - Line Drawing

Figure 111: Tank, 84-gallon, Aircraft, Aero 14B - Photograph - Top: Exterior, Bottom: Cutaway View with simulated agent

Tank, 84-gallon, Aircraft, Aero 14B

Specifications

Tank, 84-gallon, Aircraft, Aero 14B - Specifications and Other Data		Citation
Historical Name	Spray Tank, Liquid Aircraft, Aero 14B	1 (p. 4-93)
Type	Miscellaneous	1 (p. 4-93)
Size	84-gallon	1
Service	Marine Corps, Navy	1 (p. 4-93), 2 (p. 4-92)
Diameter	22 inches (55.88 cm)	1 (p. 4-94), 2 (p. 4-93), 3 (p. 11-2), 4 (p. 7-2)
Length	190 inches (482.6 cm)	1 (p. 4-94), 2 (p. 4-93), 3 (p. 11-2), 4 (p. 7-2)
Other	Suspension: 2 lugs 30 inches (76.2) apart	1 (p. 4-93), 3 (p. 11-2)
Other Engineering Data	It was expected that this unit would be replaced by the Aero X18A. Empty weight: 606 pounds.	2 (p. 4-93), 4 (p. 7-2)
B/M Dwg	54A50E1	3 (p. 11-2), 4 (p. 7-2)

General Use and Description

The Aero 14B Liquid Aircraft Spray Tank was designed to provide chemical offensive capability as a pressure spray, single fluid, air-to-surface system (1 p. 4-93), (2 p. 4-92), (3 p. 11-2), (4 p. 7-2).

This spray tank was a pressure controlled, combination storage and airborne dispersion system for various liquid chemical agents such as GB and VX nerve agents. The spray tank consisted of a nose assembly, center section, tail section, pressure control system, and discharge nozzle assembly. The nose assembly contained an 1,800 psi tank with regulator that could reduce the tank pressure to 100 psi for operation. The discharge nozzle was located at the rear of the tail section. Four removable fins were attached to the tail section. The center section contained the agent reservoir. A pneumatically operated valve controlled by the pilot released the agent through the discharge tube. Two integral lugs, spaced 30 inches apart, were provided for tank attachment to the underside of the aircraft. A minimum of two fins were required for gravity drop, although four are provided on the normal spray tank. The fins were adjustable in 45 degrees increments. No fins were required for ejector type racks (1 p. 4-93), (2 p. 4-92), (3 p. 11-2), (4 p. 7-2).

Explosive Train

This item required no explosive train. The pilot activated the tank by an electric switch coupled to the pneumatic valve through the electrical connector on top of the center section. The agent would then be forced out through the nozzle in the tail by the air released from the pressure tank in the nose section (1 p. 4-93), (2 p. 4-92), (3 p. 11-2), (4 p. 7-2).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Tank, 84-gallon, Aircraft, Aero 14B

Fills

Tank, 84-gallon, Aircraft, Aero 14B - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
FS	1,348	611	2,032	922	-	5 (p. 61)
GB	700-725	317-328	1,350-2,000	612-907	-	3 (p. 11-2)
HD	894	406	1,578	716	-	5 (p. 61)
VX	700-725	317-328	1,350-2,000	612-907	-	3 (p. 11-2)

Shipping/Packing

Shipping weights (pounds):

- center section empty - 909,
- center section filled - 1,810,
- Components container - 650

Shipping cubage: Center section 85 cubic feet, components container 66 cubic inches (4 p. 7-2).

Miscellaneous Information

Used with Aircraft A-1, A-4, and AF-1E and filling unit, chemical tank MK3 Mod0, MK 4 Mod 0 (1 p. 4-93), (2 p. 4-93), (3 p. 11-2), (4 p. 7-2).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
3. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.
4. U.S. Naval Ordnance Laboratory. 1968. NAVORD Ordnance Pamphlet, OP 2217, Miscellaneous Chemical Munitions, Description and Operation, First Revision, Change 1. Naval Ordnance Systems Command.
5. Booz-Allen Applied Research. 1962. A Study of Biological and Chemical Warfare Target Effects. Volume II. Characteristics of Biological and Chemical Agents in Munitions. AD0350553. Naval Ordnance Systems Command.

12.13 Tank, Aircraft, TMU-28/B

Figures

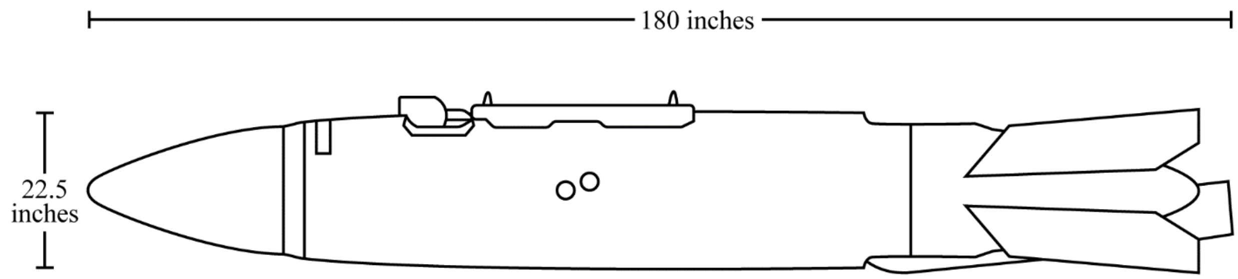

Figure 112: Tank, Aircraft, TMU-28/B - Line Drawing

Figure 113: Tank, Aircraft, TMU-28/B - Photograph

Specifications

Tank, Aircraft, TMU-28/B - Specifications and Other Data		**Citation**
Historical Name	Tank, Spray, Chemical, TMU-28/B	1 (p. 218)
Type	Miscellaneous	2
Service	Air Force	3 (p. 16)
Diameter	22.5 inches (57.15 cm)	1 (p. 218), 2 (p. 2-16)
Length	185 inches (471 cm)	1 (p. 218), 2 (p. 2-16)
Width	Fin: 35 inches (88.90 cm)	2 (p. 2-1)
NSN	1325-00-900-5542 (liquid agent) 1325-00-225-0901 (empty)	2 (p. 2-16)

General Use and Description

The TMU-28/B liquid agent spray tank was designed for airborne dissemination of toxic liquid agents by high performance aircraft (2 p. 2-1).

The TMU-28/B was a ram air spray tank that was filled with VX. It was fabricated of four major components, agent container, hardback assembly, tail cone section, and dissemination nozzle. The hardback assembly was attached to the top of the agent container. The tail cone section was removable and enclosed the electrical system components. Four each 30-inch suspension lugs were installed on hardback with threaded mountings for 14-inch suspension lugs and a metal, pressure sensitive identification nameplate.

The agent container was fabricated of stainless steel with a filler boss located on the top right side. The filler boss was welded shut after the container was filled with agent.

The tail cone was attached to the aft bulkhead by 34 screws. An access door located on left side of tail cone, gave access to the electrical system components, which were housed in tail cone section. Four removable tail cone fins were also attached to tail cone assembly.

The inlet cutter was installed on the forward top section of spray tank under the air scoop. The cutter contained an explosive charge of 13.8 grains of RDX, two PETN/lead azide detonators, one lead azide bridge wire, and two PETN boosters. The detonators were connected to the electrical cable.

The dissemination nozzle was maintained in a retracted position in tail cone during flight and was extended before dissemination of contents. After dissemination, the spray tank was released from the aircraft (1 p. 218), (2 p. 2-2, 2-3, 2-4, 6-5).

Explosive Train

When the explosive cutters were fired, front and rear caps were blown off, and ram air would force the agent out of the spray boom at a rate of 20 gallons a second (1 p. 218), (2 p. 2-1), (4 p. 3).

Fuzing

Tank, Aircraft, TMU-28/B - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Electrically fired explosive cutters	1 (p. 218), 2 (p. 2-2)

Booster, Adapter-Booster, or Burster

Tank, Aircraft, TMU-28/B - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	N/A	PETN	Two boosters required.	2 (p. 2-4)

Fills

Tank, Aircraft, TMU-28/B - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
VX	1,300-1,356	589-615	1,935-1,966	877-891	-	1 (p. 218), 2 (p. 2-16), 4 (p. 3), 5 (p. A-22)

Shipping/Packing

Shipped and stored in CNU-77/E23 shipping and storage container. The tank was supplied already filled with the chemical agent, and was not reusable (1 p. 238), (2 p. 2-16), (4 p. 3).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. School Munitions Department Redstone Arsenal. 1976. Chemical Munitions EOD/TE Study Guide. U.S. Army Missile and Munitions Center.

2. Secretary of the Air Force. 1982. Liquid agent spray tank, TMU-28/B and shipping and storage container, CNU-77/E23. Secretary of the Air Force.

3. Departments of the Army, Navy, and Air Force. 1966. Field Manual, FM 3-10, Employment of Chemical and Biological Agents. Department of the Army.

4. Andrulis Research. 1984. Chemical Munitions/Airframes Compatibility, Technical Report (CBRNIAC-CB-005440). Department of Defense.

5. Chu, S.C., Skinner, L.R., & Smith, W.H. 1987. Chemical Stockpile Disposal Program, Transportation of Chemical Agents and Munitions: A Concept Plan, Report No. SAPEO-CDE-IS-87003. PEO-PM Cml Demil.

12.14 Tank, Airplane, E28R2

Figures

No figures available.

Specifications

Tank, Airplane, E28R2 - Specifications and Other Data		Citation
Historical Name	Tank, Airplane, Spray, E28R2	1
Type	Miscellaneous	1 (p. 5), 2 (p. 2)
Service	Air Force	2 (p. 7)
Diameter	18.5 inches (46.99 cm)	1 (p. 16)
Length	135.5 inches (344.17 cm)	1 (p. 16)
Body Construction Material	Steel bulkhead	2 (p. 15)

General Use and Description

The E28R2 smoke tank was used to lay smoke and to spray liquid agents from airplanes.

The E28R2 spray tank weighed 98.5 pounds empty. The gross volume of the tank was 110 gallons. This tank had an orifice of eight inches and an approximate flow rate of 33 gallons per second at 480 miles per hour. Its performance was considered similar to that expected from a Russian spray tank with a reported 29 gallons per second discharge rate and a 7.9-inch orifice.

During development, the E28R2 was an E74R1 fire bomb converted to an airplane spray tank with the Kit, conversion, fire-bomb-to-spray-tank, E121R1 with an eight-inch nozzle (1), (2 p. 12).

Explosive Train

When the E28R1 functioned, the plastic nut was broken, which would release the tension on the spider, and the pressure of the fill would force the bulkhead and spider out of the rear orifice (2 p. 17).

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Tank, Airplane, E28R2 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GA	900	408	N/A	N/A	-	1 (p. 16)
GB	810	367	N/A	N/A	-	2 (p. 17)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Tank, Airplane, E28R2

Sources

1. Gibby, I., Layton, L., Stone, W., & Clay, J. 1953. Dugway Proving Ground Report, DPGR 129, Assessment of Hazard from Aerial Spray, DPG CW 3-53. Chemical Warfare Division.

2. Dugway Proving Ground. 1953. Dugway Proving Ground Report, DPGR 121, Airplane Spray Tank Development Test: development test of the tank, airplane spray, E261R1, E28R1, and E28R2, DPG CW 8-52. Chemical Corps.

12.15 Tank, Spray, E26R1

Figures

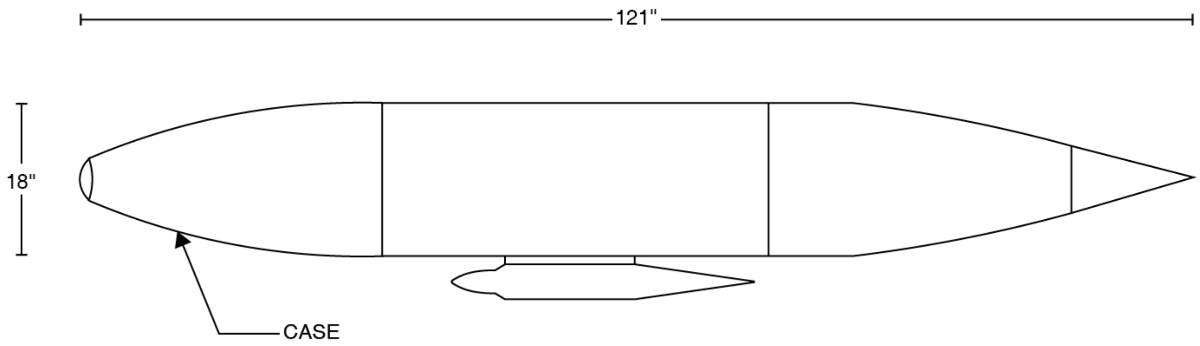

Figure 114: Tank, Spray, E26R1 - Line Drawing

Specifications

Tank, Spray, E26R1 - Specifications and Other Data		Citation
Historical Name	E26R1 Spray Tank	1
Type	Miscellaneous	1
Service	Air Force	1
Diameter	18 inches (45.75 cm)	1
Length	121 inches (320.04 cm)	1

General Use and Description

This tank was developed to provide the Air Force with an interim spray tank capability for disseminating smoke, nontoxic, and toxic agents from high speed aircraft.

The basic configuration for the tank was the E74 fire bomb, 750-pound capacity, which is converted to a spray tank by use of the E12R3 Spray Tank conversion kit. The kit introduced an intake and outlet manifold along the horizontal center line of the fire bomb to cutaway ports on the nose and tail section. The intake manifold curved upward from the nose port to direct ram air against the upper surface of the spray tank, thereby distributing the pressure over the surface of the agent in the tank. The outlet manifold had three branched openings, which were positioned approximately one-inch from the bottom of the tank. The branches blended together at the horizontal center line, thus forcing the liquid agent through the single discharge orifice at the tail of the tank.

Upon successful detonation and destruction of both the nose and tail closure plates the tank functioned as a spray dispenser, utilizing ram-air principle (1).

Explosive Train

To initiate a spray operation, the glass closure plates, located at the cutaway nose and discharge orifice, were removed simultaneously by the firing of blasting cap detonators. The firing of these caps also removed the tail cone fairings.

Fuzing

There was no fuze for this item.

Booster, Adapter-Booster, or Burster

There was no booster, adapter-booster, or burster for this item.

Fills

Available references did not include information regarding fills for this item.

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

Available references did not provide fill data for this munition.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Air Force Armament Center. 1954. Test of the E26R1 Spray Tank for Spraying Chemical Agents From F-84 and F-86 Type Aircraft Project "Work Horse". Air Research and Development Command.

13 Missile

A missile is a self-propelled precision-guided munition system. Missiles have four system components: targeting or missile guidance, flight system, engine, and warhead. Missiles come in types adapted for different purposes: surface-to-surface and air-to-surface missiles (ballistic, cruise, anti-ship, anti-tank, etc.), surface-to-air missiles (and anti-ballistic), air-to-air missiles, and anti-satellite weapons.

The first missiles were developed by the Germans at the end of World War II. U.S. forces studied the basic principles of agent dispersal by missile warhead following the war (Davis, 1968).

13.1 Missile, 787-mm, Warhead, M212 (E21), Sergeant

Figures

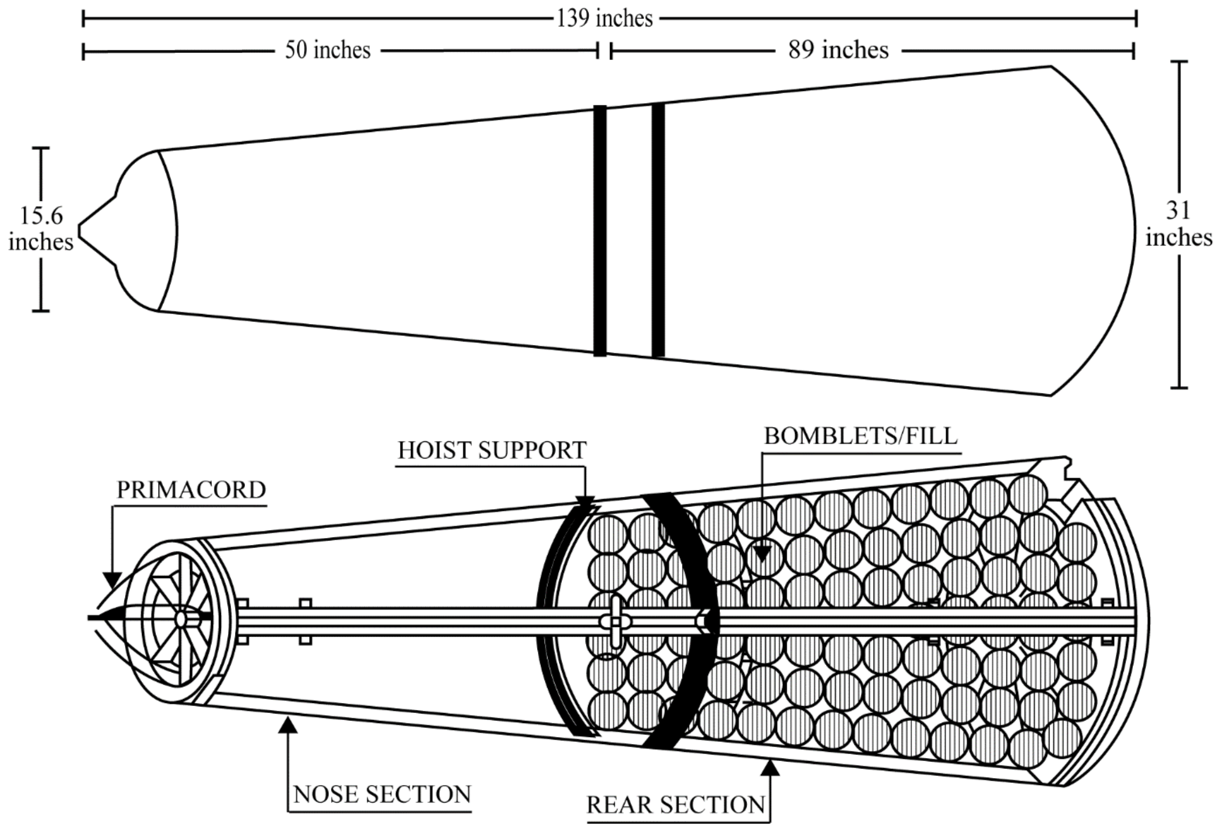

Figure 115: Missile, 787-mm, Warhead, M212 (E21), Sergeant - Line Drawing

Specifications

Missile, 787-mm, Warhead, M212 (E21), Sergeant - Specifications and Other Data		**Citation**
Historical Name	Warhead Section, Guided Missile, Gas, Nonpersistent GB, M212 (E21)	1 (p. 78)
Type	Missile	2 (p. 4-77), 3 (p. 4-76)
Size	787-mm	
Service	Army, Navy	1 (p. 78), 2 (p. 4-77), 4 (p. 16)
Diameter	31 inches (78.74 cm)	2 (p. 4-78), 3 (p. 4-77)
Length	Nose section: 50 inches (127 cm) Rear section: 89 inches (226.06 cm) Warhead Length: 139 inches (353.06 cm)	2 (p. 4-78), 3 (p. 4-77)
Other Engineering Data	Former type designation: E21	2 (p. 4-77), 3
Body Construction Material	Aluminum	1 (p. 78)
Propellant	Rocket Motor: XM-53	2 (p. 4-78), 3 (p. 4-77)
Spec/PD No	MIL-W-60081	1 (p. 78)
B/M Dwg	E123-1-41	1 (p. 78)
FSN	1336-764-5699	1 (p. 78)

Missile, 787-mm, Warhead, M212 (E21), Sergeant

General Use and Description

Supersonic, bomblet loaded, surface-to-surface missile designed to provide toxic offensive capability.

The M212 nonpersistent GB gas guided missile warhead section was designed to provide a GB weapon for the Sergeant artillery guided missile system (1 p. 78), (2 p. 4-77), (3 p. 4-76).

The M212 was a surface-to-surface munition powered by a solid propellant rocket motor that burned to completion on each flight. The warhead was cone shaped with an aluminum skin, and was loaded with 330 bomblets (i.e., M139 [E130R20]) for GB or 720 bomblets (i.e., E143) for VX. The fuze was in the nose section.

Since the warhead compartment was volume limited, the fore and aft dividers were eliminated. Four longitudinal non-load carrying detonating cord back up bars were held tightly against the inside skin surface by clips, and recessed into the forward and aft bulkheads. Detonating cord was also located circumferentially in these bulkheads (1 p. 78), (2 p. 4-77), (3 p. 4-76), (5 p. 4).

Explosive Train

Upon functioning the warhead skin was split by the detonating cord and was peeled off, which would release the munitions (1 p. 78), (2 p. 4-77), (3 p. 4-76).

Fuzing

Missile, 787-mm, Warhead, M212 (E21), Sergeant - Fuzing		
Fuze	**Note**	**Citation**
M17	Electric and barometric	1 (p. 78)
M71 (XM-71)	Electric and barometric	1 (p. 78), 2 (p. 4-78), 3 (p. 4-77), 5 (p. 5)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Missile, 787-mm, Warhead, M212 (E21), Sergeant - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	425-429	192-194	1,611	730	-	1 (p. 78), 2 (p. 4-78), 3 (p. 4-77)
VX	N/A	N/A	1,611	730	-	2 (p. 4-78), 6 (p. 16)

Shipping/Packing

The warhead was shipped in one M493 container, which weighed 3,061 pounds, and was 176.7 cubic feet (1 p. 78).

Miscellaneous Information

It was used with M139 (E130R2) or E134 bomblets (2 p. 4-77), (3 p. 4-77).

Missile, 787-mm, Warhead, M212 (E21), Sergeant

Key Dates

Missile, 787-mm, Warhead, M212 (E21), Sergeant - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1964	AMCTC 2874 (Standard-A)	5
Obsoleted	1985	MSR 07796014 (GB-fill)	7 (p. 54)

Sources

1. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.
2. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
3. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
4. Departments of the Army, Navy, and Air Force. 1966. Field Manual, FM 3-10, Employment of Chemical and Biological Agents. Department of the Army.
5. Chemical-Biological Subcommittee. 1964. AMCTC Item # 2874, Classification of Warhead Section, Guided Missile, Gas, Nonpersistent GB, M212 (E21) (SERGEANT) as a Standard-A Type. U.S. Army Materiel Command.
6. Secretary of the Army. 1962. Field Manual, FM 3-10, Chemical and Biological Weapons Employment. Department of the Army.
7. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.

13.2 Missile, 6.5-inch, Warhead, SS-11

Figures

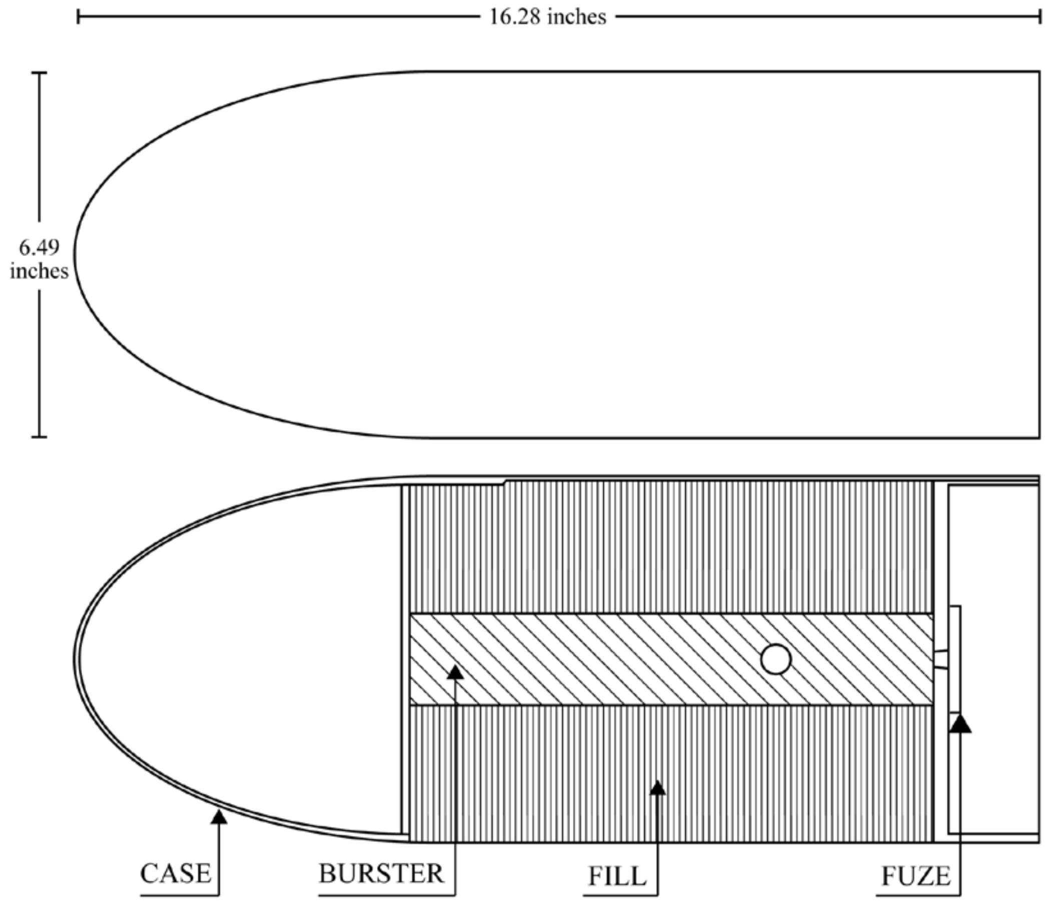

Figure 116: Missile, 6.5-inch, Warhead, SS-11 - Line Drawing

Figure 117: Missile, 6.5-inch, Warhead, SS-11 - Photograph - SS-11 Test Missile

Missile, 6.5-inch, Warhead, SS-11

Specifications

Missile, 6.5-inch, Warhead, SS-11 - Specifications and Other Data		Citation
Historical Name	Warhead, Missile, Chemical, (GB) SS-11	1 (p. 4-69)
Type	Missile	1 (p. 4-70)
Size	6.5-inch	2 (p. B-2)
Conflict	Cold War	-
Service	Army	-
Diameter	6.49 inches (16.49 cm)	1 (p. 4-70), 2 (p. 4-71)
Length	Missile: 42.5 inches (107.95 cm) Warhead: 16.28 inches (41.35 cm)	1 (p. 4-70), 2 (p. 4-71)
Width	Fin: 20 inches (50.8 mm)	1 (p. 4-7)
Other	Warhead skin thickness: 0.064 inch (0.16 cm)	1 (p. 4-7), 2 (p. 4-71)
Other Engineering Data	The missile had four fins.	2 (p. 4-70)
Maximum Range	3,510 meters	2 (p. 4-71)

General Use and Description

The SS-11 was antipersonnel and AT using chemical agents for use against small targets (1 p. 4-69), (2 p. 4-70).

The SS-11 was a light surface-to-surface missile propelled by two separate rocket motors; a booster for initial acceleration, and a sustainer for powered flight. Guidance commands were transmitted through two wires that unwound from the missile during flight. The missile was controlled and brought into alignment with the target during flight by means of a manual control stick located near the launch point. It was possible for one gunner to control a battery of six missiles. The missiles could be fired directly from their shipping containers. A small crew could set up the entire battery and ground station in about 15 minutes.

A cable allowed the gunner to select an observation point removed from the launch site. With the remote controlled equipment, the gunner acquired the missile and guided it to the target. The best accuracy was attained at a maximum range.

The liquid fill was contained in the volume of cylindrical ogive nose between the skin and the burster tube (1 p. 4-69), (2 p. 4-70).

Explosive Train

Upon initiation of the fuze and consequent detonation of the burster at missile-target impact, the fill was disseminated as a cloud of vapor, aerosol, and liquid splash (1 p. 4-69), (2 p. 4-70).

Fuzing

Available references did not include information regarding fuzes for this item.

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Missile, 6.5-inch, Warhead, SS-11

Fills

Missile, 6.5-inch, Warhead, SS-11 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	7.00	3.17	13.0	5.89	Weight is for the warhead.	1 (p. 4-70), 2 (p. 4-70)
VX	7.00	3.17	13.0-12.0	5.89	Weight is for the warhead.	1 (p. 4-69), 2 (p. 4-71)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

13.3 Missile, 250-pound, Warhead, Bullpup

Figures

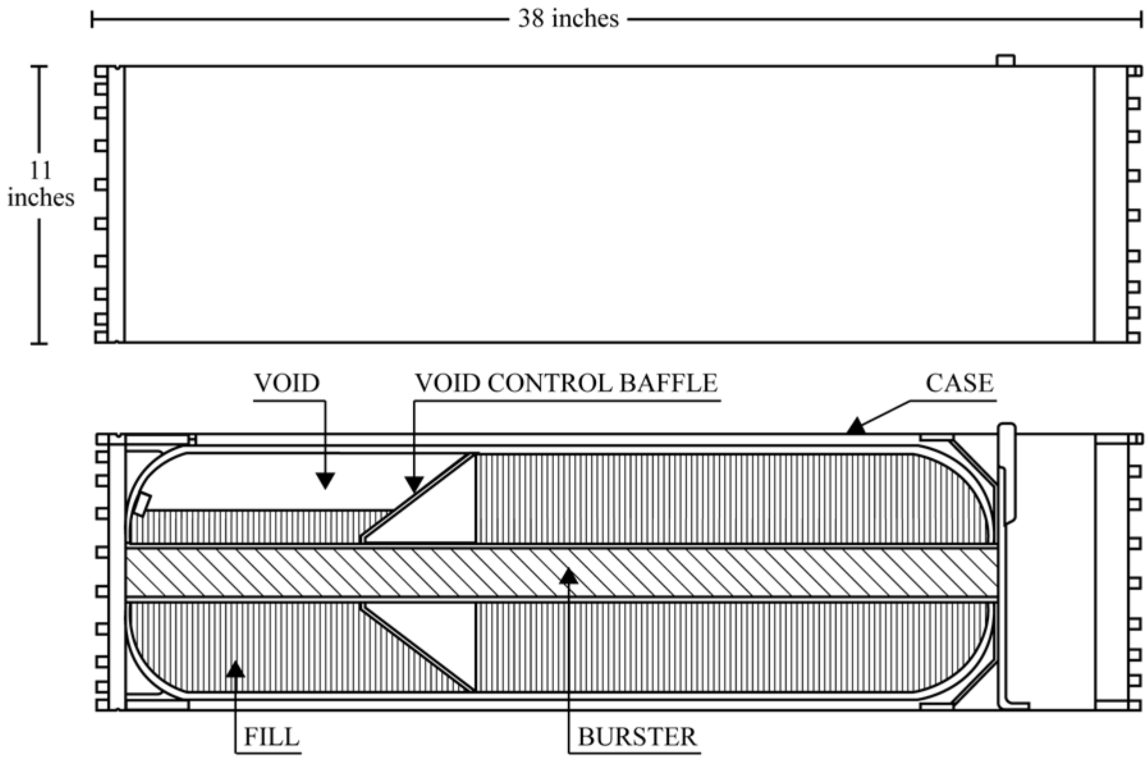

Figure 118: Missile, 250-pound, Warhead, Bullpup - Line Drawing

Figure 119: Missile, 250-pound, Warhead, Bullpup - Photograph - Bullpup Missiles Installed on Aircraft

Missile, 250-pound, Warhead, Bullpup

Specifications

Missile, 250-pound, Warhead, Bullpup - Specifications and Other Data		**Citation**
Historical Name	Warhead, Bullpup Missile, (GB) (250-Pound)	1 (p. 4-73)
Type	Missile	2 (p. 4-72)
Size	250-pound	1 (p. 4-74), 2 (p. 4-73), 3 (p. 10)
Conflict	Cold War	3 (p. 1)
Service	Navy	2 (p. 4-72)
Diameter	Warhead: 11 inches (27.6 cm)	1 (p. 4-74), 2 (p. 4-73), 3 (p. 8)
Length	Complete Missile: 126 inches (320.04 cm) Warhead: 38.42 inches (97.59 cm)	1 (p. 4-74), 2 (p. 4-73), 3 (p. 7)
Other	Wing Span: 37.9 inches (96.27 cm)	1 (p. 4-74), 2 (p. 4-73), 3 (p. 7)
Other Engineering Data	Fuel: 103.5 lbs. Missile Gross Weight: 570 pounds Burnout Weight: 467 pounds	2 (p. 4-73), 3 (p. 3, 7)
Body Construction Material	Mild steel Thickness: 0.188 inches	1 (p. 4-73), 3 (p. 8)

General Use and Description

The BULLPUP guided missile system was used with attack type aircraft in support of ground troops and for use against small tactical targets (1 p. 4-73), (2 p. 4-72), (3 p. 5).

The BULLPUP was a massive type warhead, air-to-surface, that was carried by a variety of Naval aircraft.

The warhead consisted of a cylindrical agent container with a central burster for explosive dissemination and was housed in the missile center section. It was interchangeable with other warheads that were used with the Bullpup Missile. A relatively thick casing of mild steel was used, which could withstand severe handling loads. Ballast was necessary to obtain the correct weight. The missile was radio controlled to the target and could be used against small crafts, tanks, vehicles, and buildings (1 p. 4-73), (2 p. 4-72), (3 p. 8).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Missile, 250-pound, Warhead, Bullpup - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Impact	1 (p. 4-74), 2 (p. 4-73)

Booster, Adapter-Booster, or Burster

Missile, 250-pound, Warhead, Bullpup - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	10.5 pounds	N/A	Central burster	3 (p. 10)

Missile, 250-pound, Warhead, Bullpup

Fills

Missile, 250-pound, Warhead, Bullpup - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	100-105	45.3-47.6	250	113	Weight is for the warhead.	1 (p. 4-74), 3 (p. 10)
VX	N/A	N/A	N/A	N/A	VX was considered for use with this missile.	1 (p. 4-74), 3 (p. 3)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The Bullpup can utilize any 250-pound bomb, without tail fins, as a warhead.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
3. Walton, Ralph & Kratzer, John. 1959. Chemical Warfare Laboratory, CWL Technical Memorandum 30-47, Preliminary Chemical Warhead Study for the Bullpup Missile (U). Army Chemical Warfare Laboratories.

13.4 Missile, Warhead, Pershing

Figures

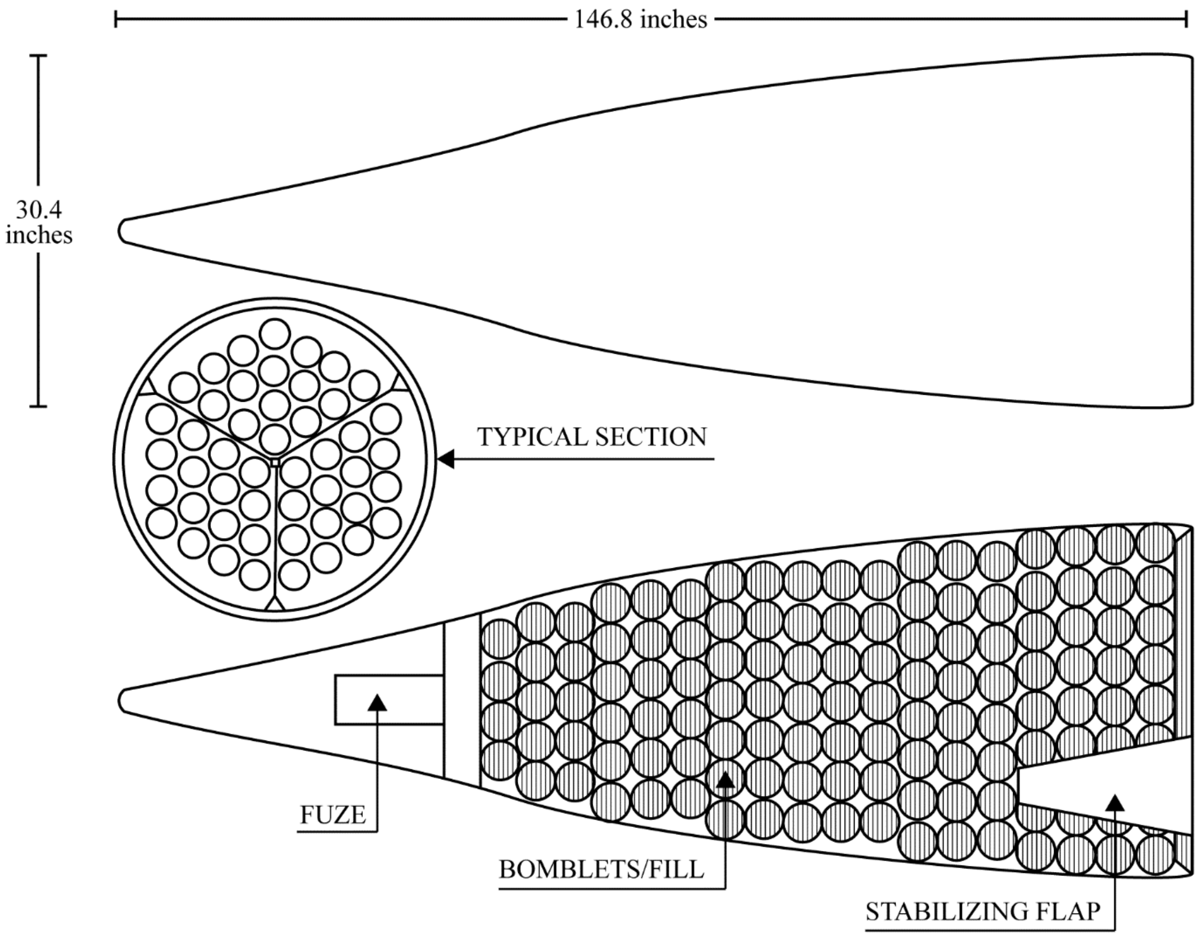

Figure 120: Missile, Warhead, Pershing - Line Drawing - Radar and Warhead Sections

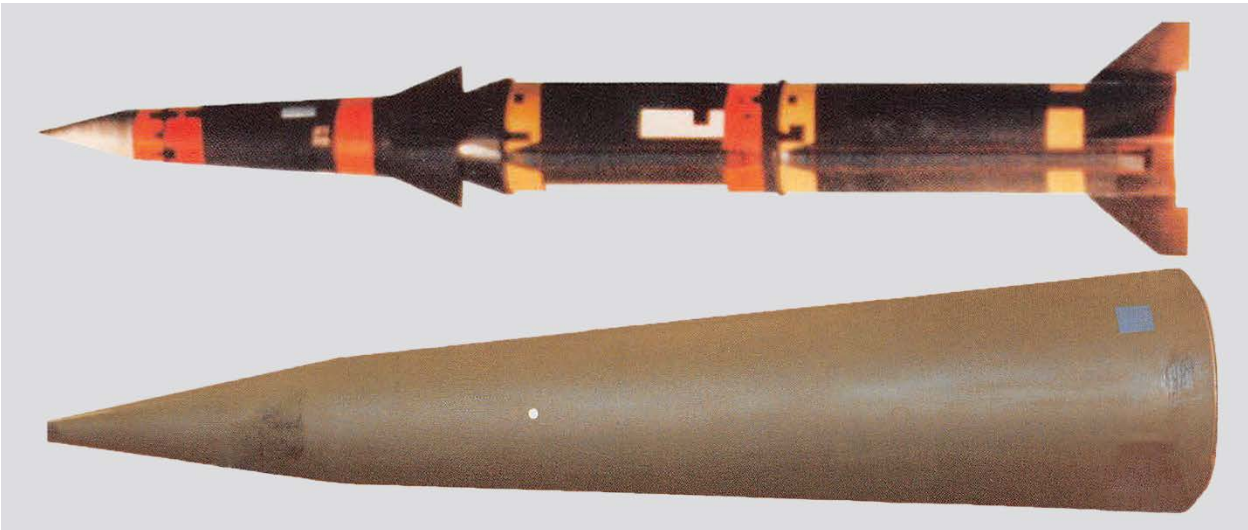

Figure 121: Missile, Warhead, Pershing - Photograph - Top: Missile System, Bottom: Warhead

Specifications

Missile, Warhead, Pershing - Specifications and Other Data		Citation
Historical Name	Warhead, Pershing Missile (GB-VX)	1 (p. 4-85)
Type	Missile	1 (p. 4-85)
Diameter	Warhead: 30.4 inches (77.22 cm)	1 (p. 4-85)
Length	Warhead: 146.8 inches (372.87 cm)	1 (p. 4-85)

General Use and Description

The Pershing missile was a surface-to-surface missile designed for dissemination of chemical agents (1 p. 4-86), (4 p. 4-86).

The chemical warhead for the Pershing missile was based on the utilization of self-dispersing munitions, or bomblets, clustered within the missile nose section. The clustering of the bomblets required a special warhead system design, which would release the bomblets into the airstream at a predetermined altitude upon receipt of a fuzing signal. The ground impact pattern could be increased in size by increasing the altitude of bomblet release, or vice versa.

The payload compartment was divided longitudinally into three equal sections. The proposed method of skin separation utilized three explosive longerons within which are housed a linear-shaped charge (1 p. 4-85), (4 p. 4-86).

Explosive Train

At a predetermined altitude the payload compartment would be opened by explosive means, which allowed the bomblets to release into the airstream allowing the bomblets to function as designed (1 p. 4-85), (4 p. 4-86).

Fuzing

Missile, Warhead, Pershing - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Barometric	1 (p. 4-86), 4 (p. 4-87)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Missile, Warhead, Pershing - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	698	316	1,900	861	1.3 pounds (0.59 kilograms) agent per E130R2	1 (p. 4-6), 4 (p. 4-86)
VX	698	316	1,900	861	1.3 pounds (0.58 kilograms) agent per E130R2	1 (p. 4-6, 4-85)

Shipping/Packing

Available references did not provide this information.

Missile, Warhead, Pershing

Miscellaneous Information

The warhead was used with E130R2 bomblets. Approximately 537 bomblets (2.4 pounds each with 1.3 pounds of agent) were used in the warhead (1 p. 4-85), (4 p. 4-86).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

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14 Mortar

A mortar is an indirect fire weapon that launches a low velocity shell in a high arc over shorter ranges than howitzers or cannons. During WWI, mortars were used for the projection of shells with any of the four classes of chemical agents (General Headquarters, American Expeditionary Forces, France, 1919b, p. 7). The primary role of the mortars is to provide immediately available, indirect fire that supports the maneuver of the company and that reinforces direct fire during close combat. Chemical agent mortar shells are discussed in the sections below.

14.1 Mortar, 81-mm, M57

Figures

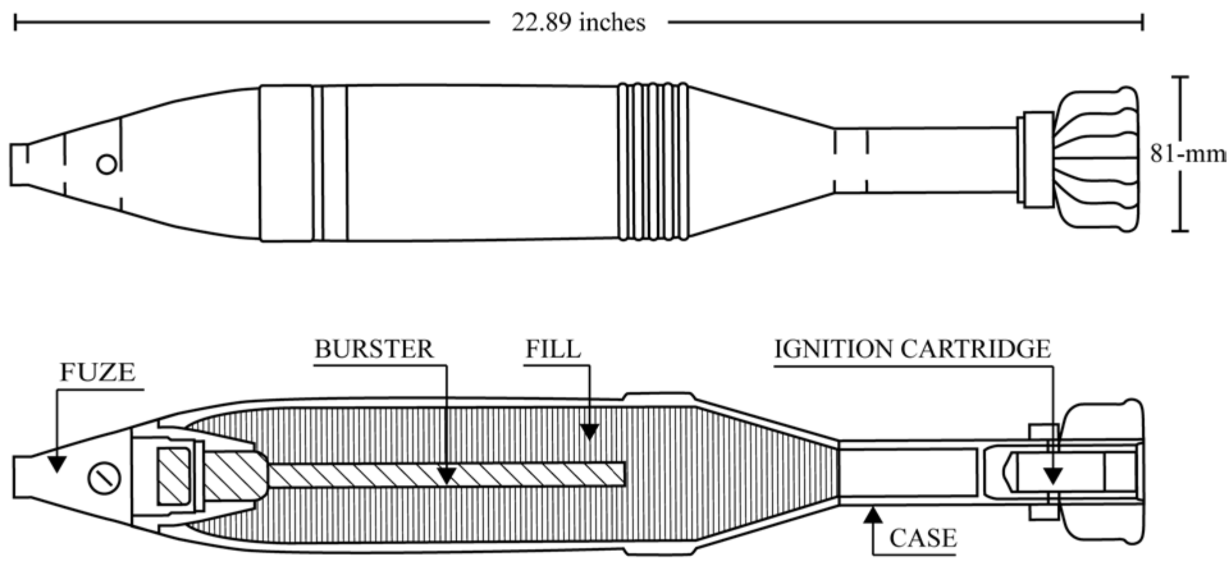

Figure 122: Mortar, 81-mm, M57 - Line Drawing

Figure 123: Mortar, 81-mm, M57 - Photograph - Inert, Top: Exterior, Bottom: Cutaway View

Specifications

Mortar, 81-mm, M57 - Specifications and Other Data		**Citation**
Historical Name	Shell, Smoke, Phosphorus, WP, M57, w/Fuze, P.D. [point detonating], M52, 81-mm Mortar, Complete Round	1 (p. 155)
Type	Mortar	2 (p. 287)
Size	81-mm	2 (p. 287)
Diameter	81 mm (3.19 inch)	2 (p. 287)
Length	22.89 inches (58.14 cm)	2 (p. 287)
Other Engineering Data	Forged, steel tube	3 (p. 12)
Propellant	820 grams (4 inch- M2)	2 (p. 287)
Maximum Range	2,466 yards	4 (p. 100)
B/M Dwg	75-2-284	-

General Use and Description

This projectile was used for the placing of smoke screens and gas clouds with a secondary incendiary effect when WP was used as its chemical filler (2 p. 287).

In general construction, this mortar shell body had the same outer characteristics as the HE Shell M56. It was a smooth-bore, muzzle-loading weapon for high angle fire. The nose of the projectile was threaded to receive the type of adapter peculiar to chemical shell. The adapter was threaded internally to receive the point detonating Fuze M52, which had a superquick action.

All chemical shells, in order to produce efficient dispersion of filler, needed to burst above ground. A superquick action fuze was therefore used to produce such action. The fin assembly, ignition cartridge, propellant increments, and percussion primer were identical to those used with the HE Shell M56 (1 p. 287), (2 p. 287).

Explosive Train

The explosive charge ran through the entire length of the shell and split the shell from nose to tail upon function of the fuze, which allowed for the dispersion of all the chemical filler in the shell (2 p. 287).

Fuzing

Mortar, 81-mm, M57 - Fuzing		
Fuze	**Note**	**Citation**
M52	Point detonating, superquick	1 (p. 287), 2 (p. 287)
M52A1	Point detonating	3 (p. 12)
M77	Time, superquick	3 (p. 12), 5 (p. 147)

Booster, Adapter-Booster, or Burster

Mortar, 81-mm, M57 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
MI	N/A	Tetryl pellets or tetrytol	The Burster Charge Ml consisted of tetryl pellets or tetrytol in an aluminum or cardboard cylinder.	2 (p. 287)

Mortar, 81-mm, M57

Fills

Mortar, 81-mm, M57 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	N/A	N/A	N/A	N/A	Experimental	6
FS	4.59	2.08-4.59	11.9-13.1	5.39-5.94	Gross weight varied depending on fuze used.	2 (p. 287), 3 (p. 12), 7 (p. 11)
H	3.15	1.42	10.5	4.76-476	-	2 (p. 287)
WP	4.04-4.09	1.83-1.86	11.3-12.5	5.12-5.67	Gross weight varied depending on fuze used.	2 (p. 287), 3 (p. 12), 4 (p. 100), 7 (p. 11)

Shipping/Packing

The rounds were packed completely assembled and ready to fire. There was one round per fiber container, three fiber containers per bundle, and one bundle per wooden crate (2 p. 288).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. War Department. 1944. Technical Manual, TM 9-1901, Artillery Ammunition, 29 June 1944. War Department.
2. War Department. 1944. Technical Manual, TM 9-1904, Ammunition Inspection Guide. U.S. Government Printing Office.
3. Chief of Ordnance. 1950. No. 5981, Complete Round Charts, Sheet No. 18. ORDIM.
4. War Department. 1946. Field Manual, FM 3-5, Characteristics and Employment of Ground Chemical Munitions. War Department.
5. Department of the Army. 1950. Technical Manual, TM 9-1901, Artillery Ammunition. U.S. Government Printing Office.
6. McCullough, G. 1941. TDMR 311, Test of 81mm Mortar M1 Firing Shell M57, Phosgene Filled. CBRNIAC-CB-003529. U.S. Government Printing Office.
7. Anonymous. 1941. Complete Round Charts, issued and revised various dates (RMA barcode GE104415 GE028220-1). U.S. Government Printing Office.

14.2 Mortar, 4-inch, MI, Stokes

Figures

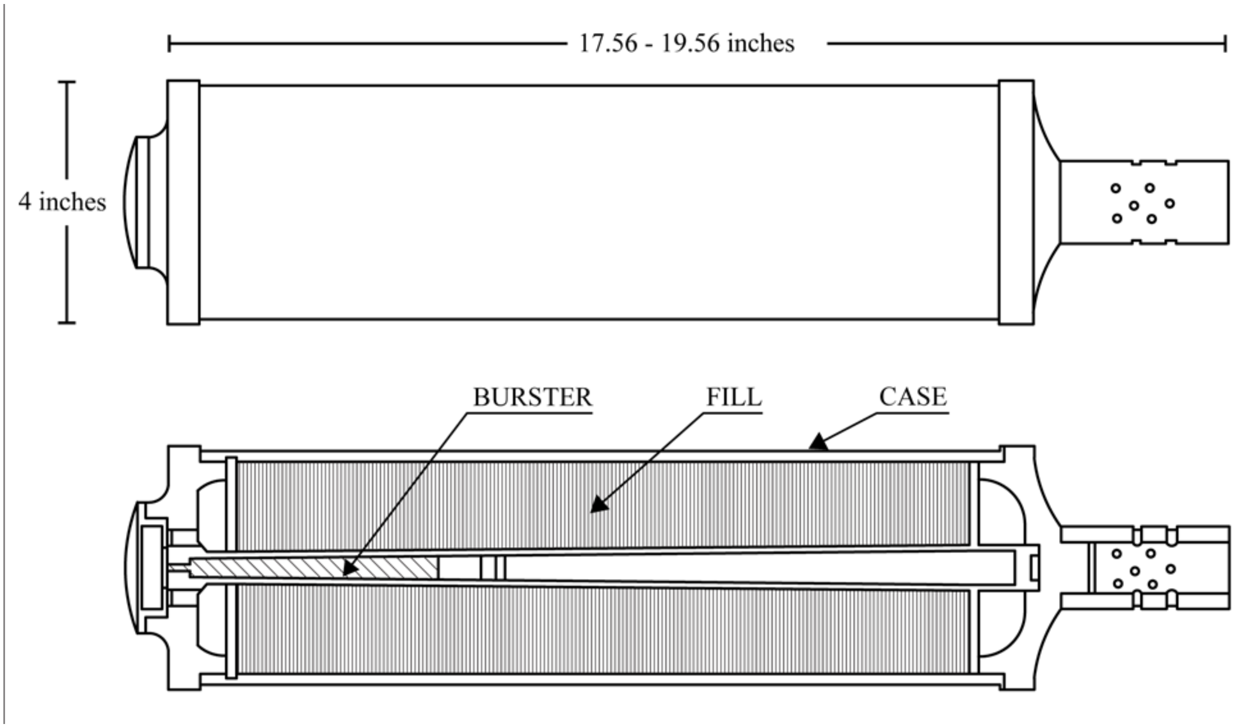

Figure 124: Mortar, 4-inch, MI, Stokes - Line Drawing

Figure 125: Mortar, 4-inch, MI, Stokes - Photograph - Inert, Top: Cutaway View, Bottom: Exterior

Mortar, 4-inch, MI, Stokes

Specifications

Mortar, 4-inch, MI, Stokes - Specifications and Other Data		Citation
Historical Name	4-Inch Stokes Mortar Shell	1 (p. 1)
Type	Mortar	2 (p. 30)
Size	4-inch	1 (p. 1), 2 (p. 30)
Conflict	WWI	1 (p. 1), 2 (p. 29-32)
Service	Army	3, 4
Diameter	Body: 4-inch (10.16 cm) Guide disks: 4.178 inches (10.61 cm)	2 (p. 31), 5 (p. 7)
Length	Overall: 17.56 - 19.56 inches (44.6-49.68 cm) Body length: 15 inches (38.1 cm)	2 (p. 30-31), 3
Body Construction Material	Steel	1 (p. 1), 2 (p. 30-32)
Propellant	E.C. 3 Powder, Cordite, or Ballistite (400 grains).	2 (p. 33, 42), 5 (p. 9)
Maximum Range	1,050-1,100 yards	5 (p. 7), 6
B/M Dwg	B8-13-43	-

General Use and Description

The Stokes mortar was used in active offensive where its mobility permitted it to be pushed far forward and brought into operation on short notice. Within its range, it was a particularly suitable weapon for projecting gas. It was also known as the Shell, 4-inch Chemical Mortar (2 p. 88), (3 p. 75).

The 4-inch Stokes mortar was a smooth-bore muzzle loading weapon with a high angle of fire. The 4-inch Stokes mortar was reclassified as the 4-inch chemical mortar, MI. The complete 4-inch Stokes mortar projectile consisted of the shell body, burster, fuze, and propellant charge. The projectile body was a cylindrical tube, 4 inches in diameter and 15 inches long, 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.

The burster consisted of a gaine tube detonator and a felt washer. The gaine tube was a brass tube 0.5 inch in diameter, and was recessed at the open end to take the detonator and felt washer.

The total length of the body assembly varied, depending on the type of filling that was required (2 p. 29-38), (3 p. 75), (6).

Explosive Train

Upon fuze functioning a No. 8 detonator containing fulminate of mercury was exploded, which initiated the tetryl burster (3).

Fuzing

Mortar, 4-inch, MI, Stokes - Fuzing		
Fuze	**Note**	**Citation**
31-D	-	2 (p. 36)
E1	All-ways acting, 1.4 pounds fully assembled	1 (p. 2)
Mark XI	All-ways acting	2 (p. 39)
MK V	Essentially a copy of British No.79, Mark II. For use when air bursts were desired.	2 (p. 37, 39)

Booster, Adapter-Booster, or Burster

Mortar, 4-inch, MI, Stokes - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	42 grams	Tetryl	The brass tube had a 0.5 inch diameter.	1 (p. 3), 2 (p. 31)

Fills

Mortar, 4-inch, MI, Stokes - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CA	7.22	3.27	N/A	N/A	-	7
CG	6.69	3.03	N/A	N/A	-	1, 4, 7, 8 (p. 7)
CN	N/A	N/A	N/A	N/A	-	1, 8 (p. 7)
CNB	N/A	N/A	N/A	N/A	-	9
CNS	N/A	N/A	N/A	N/A	-	8 (p. 7), 9
CS	N/A	N/A	N/A	N/A	-	9
FM	N/A	N/A	N/A	N/A	-	1 (p. 2), 5, 8 (p. 7), 9
FS	N/A	N/A	N/A	N/A	-	9
H	N/A	N/A	N/A	N/A	-	5, 8 (p. 7), 9
KJ	N/A	N/A	N/A	N/A	-	3
L	N/A	N/A	N/A	N/A	-	8, 9
NC (PS and KJ)	7.56	3.42	N/A	N/A	-	3, 7
PG	6.75	3.06	N/A	N/A	-	3, 7
PS	N/A	N/A	N/A	N/A	-	3, 9
TH3 (thermite)	7.75	3.51	25.0	11.3	-	2 (p. 30), 7
UNKNOWN	N/A	N/A	N/A	N/A	There was a practice round and a ranging round identified in reference publications.	3
WP	9.00	4.08	N/A	N/A	-	1 (p. 2), 3, 5 (p. 12), 8 (p. 7), 9

Shipping/Packing

Available references did not provide this information.

Mortar, 4-inch, MI, Stokes

Key Dates

Mortar, 4-inch, MI, Stokes - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1924	CWS Letter 400.114/280	-
Standardized	1933	CCTC 1933-02 (HS, CG, WP, FM and CN-solution fills)	10
Obsoleted	1944	CWTC item 1033	-

Sources

1. Chemical Warfare Board. 1931. 4" Stokes Mortar Shell and Fuze - CWB Project No. 126. Chemical Warfare Service.

2. American Expeditionary Forces. 1919. Gas Manual Part III, Use of Gas by Gas Troops, A.E.F. No. 1475-3. War Department.

3. Prentiss, Augustin M. 1937. Chemicals in War: A Treatise on Chemical Warfare. McGraw-Hill Book Company, Inc.

4. Chemical Warfare Technical Committee. 1937. Obsoletion of 4-Inch Chemical Mortar Equipment. McGraw-Hill Book Company, Inc.

5. Rouiller, C.A. 1934. 4-In. Chemical Mortar MI, Complete With Ammunition, Accessories and Transportation Equipment. War Department.

6. Chemical Corps Technical Committee. 1944. CCTC Item # 938, Obsoletion of 4-inch Chemical Mortar Equipment. Department of the Army.

7. Edgewood Arsenal. 1921. Weight of Chemical Fillings (NARA II. RG 175. E 1 (P1-8). Box 520.). Mechanical Division.

8. Bouder, N.M., & Powell, H.C. 1931. Approximate Average Weights of Fillings in Chemical Munitions. Information Division.

9. War Department. 1928. 4-Inch Chemical Mortar Shell Painting and Marking Diagram and Bill of Material. Chemical Warfare Service.

10. Chemical Corps Technical Committee. 1933. CCTC Item # 1933-02, Chemical Fillings for Munitions. Department of the Army.

14.3 Mortar, 4.2-inch, M1A1, M2, M2A1

Figures

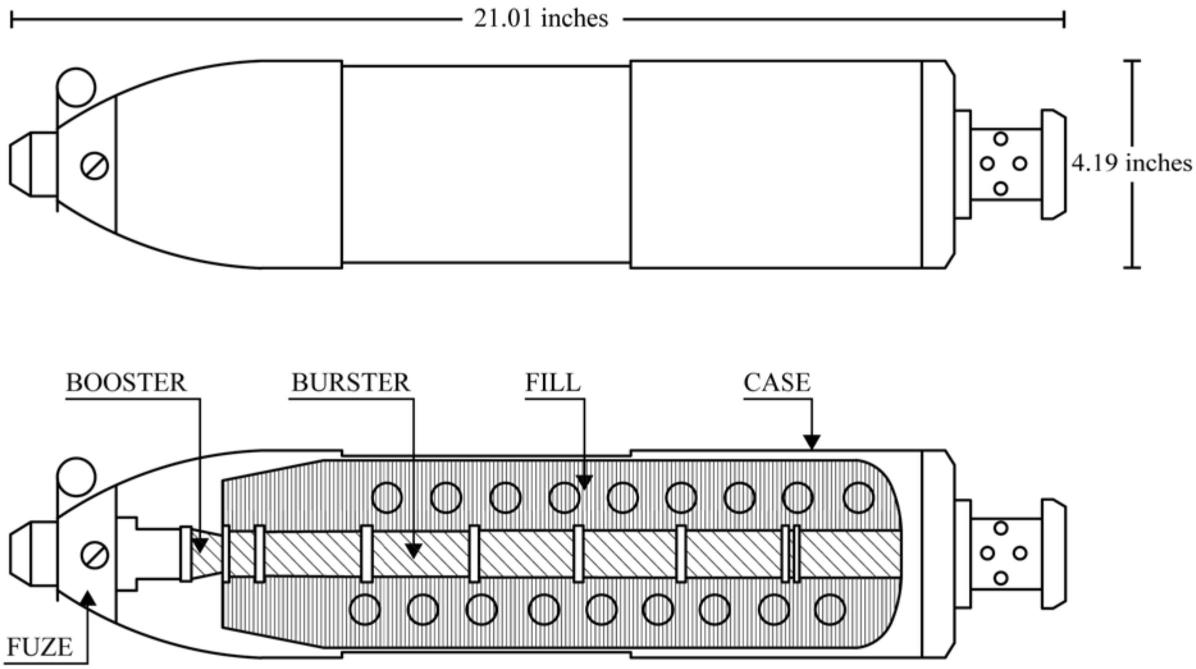

Figure 126: Mortar, 4.2-inch, M1A1, M2, M2A1 - Line Drawing

Figure 127: Mortar, 4.2-inch, M1A1, M2, M2A1 - Photograph - Model, Top: Exterior, Bottom: Cutaway View

Mortar, 4.2-inch, M1A1, M2, M2A1

Specifications

Mortar, 4.2-inch, M1A1, M2, M2A1 - Specifications and Other Data		Citation
Historical Name	Mortar, Chemical, 4.2-Inch, M2A1, M2, and M1A1	1 (p. 63)
Type	Mortar	2 (p. 4-83), 3 (p. 4-125), 4 (p. 4-127)
Size	4.2-inch	1 (p. 75), 4 (p. 4-126), 5 (p. 5-6)
Conflict	Cold War, WWII	1 (p. 63), 2 (p. 4-83), 6 (p. 16), 7 (p. 1)
Service	Army, Marine Corps	3 (p. 4-125), 4 (p. 4-126), 5 (p. 5-6), 6 (p. 16)
Diameter	4.2 inches (10.64 cm)	1 (p. 63), 3 (p. 4-126), 5 (p. 5-6), 8 (p. 2-25)
Length	With fuze: 21.01 inches (53.37 cm)	2 (p. 4-84), 3 (p. 4-126), 5 (p. 5-6), 8 (p. 2-25)
Other	Wall thickness: 0.188 inch (4.78 mm) to 0.443 inch (11.25 mm)	1 (p. 63), 3 (p. 4-126), 5 (p. 5-6), 8 (p. 2-25)
Body Construction Material	Cartridge: seamless steel tubing Fuze assembly: aluminum or steel	1 (p. 63)
Propellant	M6, 0.43 pounds; M28A2, 0.4 pounds	2 (p. 4-84), 9 (p. A-18, A19)
Maximum Range	3,940 meters, 4,879 yards	2 (p. 4-86), 3 (p. 4-126), 4 (p. 4-127), 5 (p. 5-6), 6 (p. 16)
B/M Dwg	75-1-284, Assembly Drawing: B8-10-13; B8-10-17	3 (p. 4-126), 4 (p. 4-127), 5 (p. 5-6), 10
NSN	1325-00-028-5023 (M2 H-filled) 1325-00-028-5018 (M2 HD-filled) 1325-00-028-5027 (M2A1 HD-filled) 1315-00-028-5024 (M2 HT-filled)	11 (p. 31)
FSN	1315 028 5021	-

General Use and Description

The mortar shell was used for casualty effect and could be filled with either nonpersistent gases or persistent gases (2 p. 4-83), (4 p. 4-126), (5 p. 5-6).

The complete round consisted of a projectile body, a point detonating fuze with an integral burster, and a tail assembly. The body contained a perforated vane assembly welded to the inside of the body and is designed to accommodate the burster tube that extended from the fuze. The tail assembly consisted of a pressure plate and rotating disc, a propelling charge, a cartridge container, and ignition cartridge, and a striker nut assembly. The M2 differed slightly from the M2Al cartridge in that the design of the obturating mechanism was different (2 p. 4-83).

Explosive Train

When the shell was released, it slid down the mortar tube until the percussion primer struck the firing pin. The flash from the primer ignited the ignition cartridge, which in turn, ignited the propelling charge. The spin imparted to the projectile as it left the weapon stabilized it in flight. The perforated vane caused the liquid filler to rotate with the projectile to reduce the possibility of erratic flight. The fuze functioned on impact, detonating the burster charge, which ruptured the projectile and dispersed the gas filler (2 p. 4-83), (3 p. 4-125).

Fuzing

Mortar, 4.2-inch, M1A1, M2, M2A1 - Fuzing		
Fuze	**Note**	**Citation**
E15R8	-	7
E2R8 (Model M20)	Earlier rounds, circa 1927, used this point detonating fuze	2 (p. 4-84)
M2 ignition cartridge	Total weight: 635.6 grams, Overall length: 16.13 inches (40.99 centimeters) - with burster tube	2 (p. 4-84), 3 (p. 4-126), 5 (p. 5-6)
M51A5	HT-filled M2 or M2A1	9 (p. A-19)
M8	Point detonating Total Weight: 1.9 pound (0.86 kg) Overall Length: 16.25 inches	2 (p. 4-84), 3 (p. 4-126), 6 (p. 16), 9 (p. A-17, A-18), 12 (p. 1-11)

Booster, Adapter-Booster, or Burster

Mortar, 4.2-inch, M1A1, M2, M2A1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M14 Burster Charge	0.73 pounds	Tetryl	The charge extended the length of the body cavity.	3 (p. 4-126), 4 (p. 4-127), 5 (p. 5-6), 9 (p. 1-7)

Fills

Mortar, 4.2-inch, M1A1, M2, M2A1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	5.75-8.00	2.61-3.63	23.8-24.7	10.8-11.2	-	2 (p. 4-83), 3 (p. 4-126), 10, 13 (p. 92), 14
CK	5.00-8.00	2.27-3.63	22.6-24.7	10.3-11.2	-	2 (p. 4-83, 4-84), 3 (p. 4-126), 13 (p. 92)
CN	5.22	2.73	23.5	10.7	-	15 (p. 11)
CNB	5.45-8.00	2.47-3.63	21.6-24.7	9.70-11.2	-	2 (p. 4-83), 3 (p. 4-126), 14, 16
CNS	5.75-8.00	2.60-3.63	23.1-25.0	10.4-11.3	-	2 (p. 4-83), 3 (p. 4-126), 14, 16
FM	7.50-7.56	3.40-3.43	25.1-25.7	11.3-11.6	-	3 (p. 4-126), 10, 14 (p. 207), 16 (p. 21)
FS	7.50-7.56	3.40-3.43	25.1-25.7	11.3-11.6	-	1, 3 (p. 4-126), 10, 14
H	5.75-11.6	3.60-3.62	23.7-24.7	10.7-11.2	-	2 (p. 4-83), 3 (p. 4-126), 13 (p. 92), 14, 16 (p. 21)
HD	5.75-8.00	2.60-3.62	23.5-25.5	10.6-11.5	-	1 (p. 75), 2 (p. 4-83), 3 (p. 4-126), 4, 5 (p. 5-6), 6 (p. 16), 13 (p. 92), 14
HT	5.75-8.00	2.60-3.62	23.3-24.7	10.5-11.2	-	2 (p. 4-83), 3 (p. 4-126), 13 (p. 92), 14
L	7.50-7.56	3.40-3.42	25.5-25.7	11.6-11.6	Filled as M-1	16 (p. 21), 17 (p. 2)
PWP	6.25	2.83	23.8-24.9	10.7-11.3	-	2 (p. 4-85), 3 (p. 4-126), 14 (p. 207)
WP	7.50-7.56	3.40-3.43	24.9-25.7	11.2-11.6	-	2 (p. 4-85), 3 (p. 4-126), 10, 14 (p. 207)

Shipping/Packing

Each complete round was enclosed in a cylindrical, waterproof, fiber container. Two containers were packed in a wooden box that was approximately 25 inches long, 11 inches wide, and 7 inches high, and weighed 75 pounds (1 p. 74), (2 p. 4-84).

Mortar, 4.2-inch, M1A1, M2, M2A1

Miscellaneous Information

The M2A1 was used with the 4.2-inch M30 Mortar. In the period between 1940 and 1945, the Chemical Warfare Service produced 175 L-filled M2 shells (3 p. 4-126), (4 p. 4-127), (5 p. 5-6), (18 p. 28).

Key Dates

Mortar, 4.2-inch, M1A1, M2, M2A1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1933	CCTC 1933-02 (MI w/ HS, CG, WP, FM and CN-solution fill)	19
Standardized	1939	CCTC 54 (MII)	20
Classified	1940	CCTC 272	-
Standardized	1942	CCTC 505 (L-fill)	-
Obsoleted	1943	CCTC 885 (M1 and M1A1)	21, 22 (p. 3)
Standardized	1944	CCTC 1049 (HD-fill Standard, H-fill substitute Standard)	23 (p. 25)
Obsoleted	1945	CCTC 1342 (L-filled) CCTC 1527 (Cl-filled)	21, 22 (p. 3)
Standardized	1945	CCTC 1420 (CK-fill Standard) CCTC 1269 (HT-fill Substitute Standard)	22 (p. 3), 24
Standardized	1958	OCM 36841 (M2A1 Standard A)	11 (p. 31)
Standardized	1960	OCM 37119 (M2)	-

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14.4 Mortar, 4.2-inch, T172 (Modified)

Figures

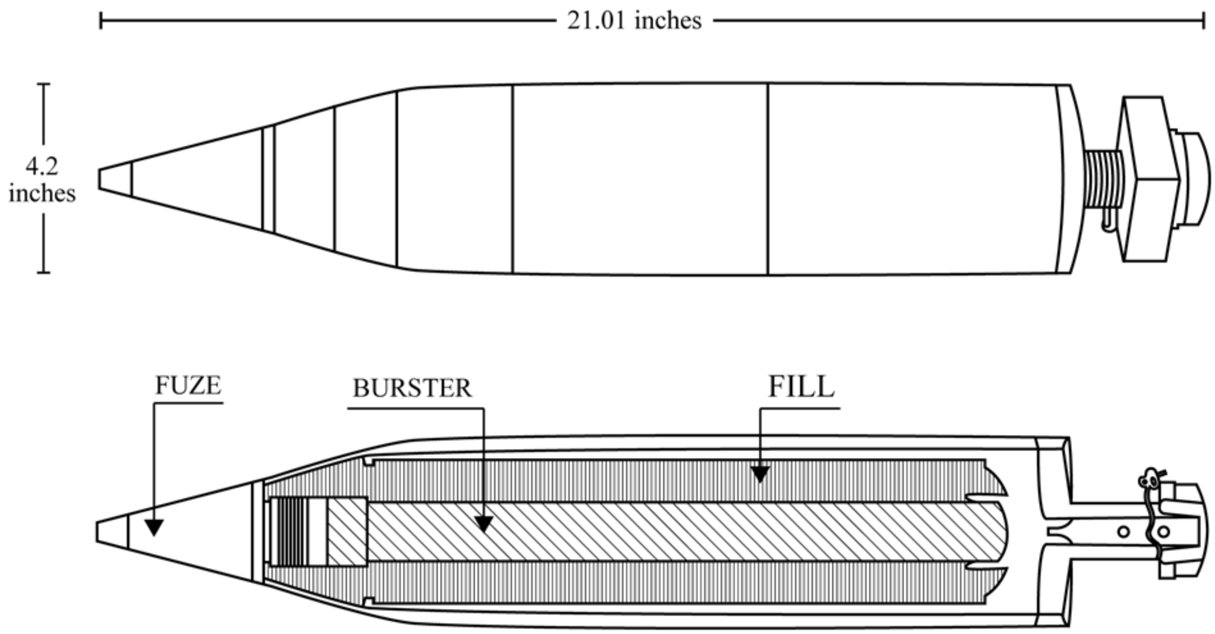

Figure 128: Mortar, 4.2-inch, T172 (Modified) - Line Drawing

Figure 129: Mortar, 4.2-inch, T172 (Modified) - Photograph - T172 (Modified)

Specifications

Mortar, 4.2-inch, T172 (Modified) - Specifications and Other Data		Citation
Historical Name	Shell, Gas, Nonpersistent, 4.2-inch Mortar, T172	1 (p. 92)
Type	Mortar	1 (p. 92), 2 (p. 1)
Size	4.2-inch	2 (p. 1), 3 (p. 2-25), 4 (p. 2)
Diameter	4.2 inches (10.69 cm)	2 (p. 1), 3 (p. 2-25), 4 (p. 2)
Length	Fuzed: 21.01 inches (53.37)	2 (p. 1), 3 (p. 2-25), 4 (p. 2)

General Use and Description

Available references did not provide information on specific use.

This projectile was designed for use in either the M2 or the M30 4.2-inch mortar. The projectile accommodated standard point detonating or variable time fuzes. The ratio of filling to explosive was approximately two to one. The T172 (modified) was designed to replace the T172 completed in 1951, which was ballistically unstable. The latter projectile was modified to make it stable at ranges from 600 to 4,000 yards for the M2 mortar and from 600 to 6,000 yards for the M30 mortar (5 p. H8).

Explosive Train

When the cartridge was released, it slid down the mortar tube until the percussion primer struck the firing pin. The flash from the primer would ignite the ignition cartridge, which in turn, ignited the propelling charge. The spin imparted to the projectile as it left the weapon stabilized it in flight. The fuze functioned on impact or at selected VT setting, detonating the burster charge, which ruptured the projectile and dispersed the chemical filler.

Fuzing

Mortar, 4.2-inch, T172 (Modified) - Fuzing		
Fuze	**Note**	**Citation**
M48 series	-	-
M51	Superquick	2 (p. 2)
M51A4	Point detonating, superquick for T172	4 (p. 2, Appendix A), 6 (p. Appendix A)
Not Designated	Variable rime	-

Booster, Adapter-Booster, or Burster

Mortar, 4.2-inch, T172 (Modified) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M21A4	1.65 pounds	Tetrytol	-	2 (p. 1)

Fills

Mortar, 4.2-inch, T172 (Modified) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	3.20	1.45	N/A	N/A	-	1 (p. 92)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

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14.5 Mortar, 8-inch, Livens Projector, MI, MII, MIIA1

Figures

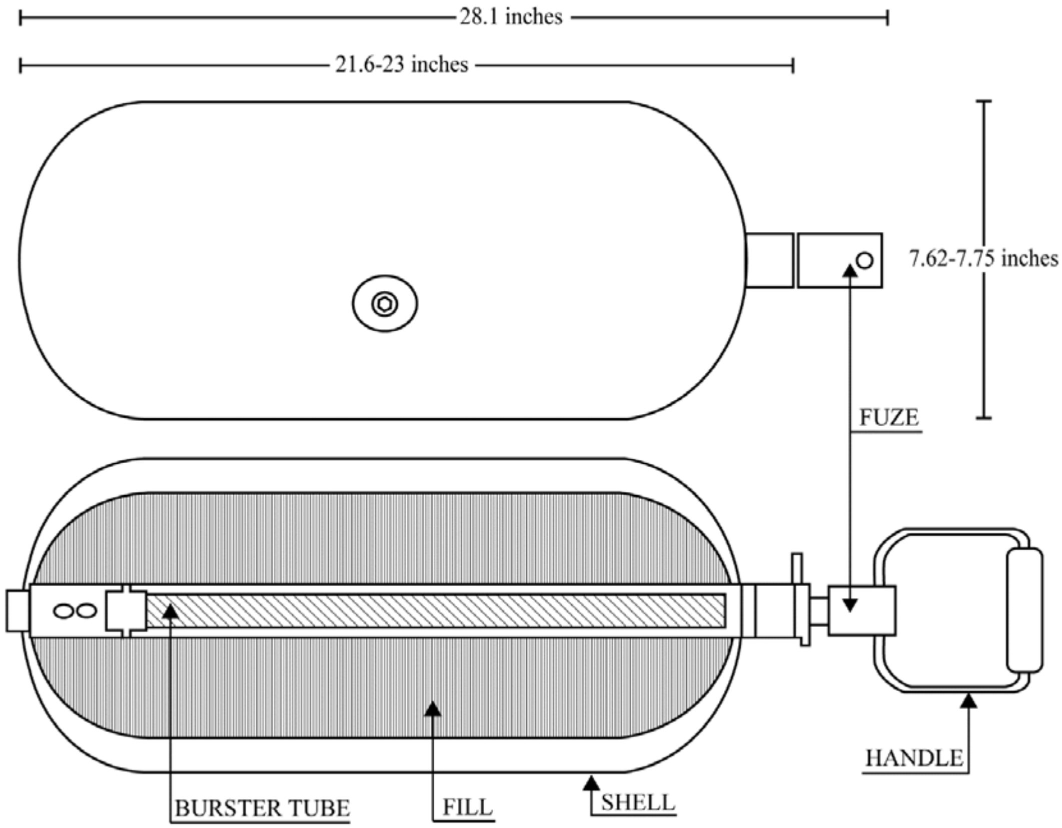

Figure 130: Mortar, 8-inch, Livens Projector, MI, MII, MIIA1 - Line Drawing

Figure 131: Mortar, 8-inch, Livens Projector, MI, MII, MIIA1 - Photograph - Top: Inert, Bottom: Cutaway

Mortar, 8-inch, Livens Projector, MI, MII, MIIA1

Specifications

Mortar, 8-inch, Livens Projector, MI, MII, MIIA1 - Specifications and Other Data		Citation
Historical Name	Livens Projector MI, Shells MII and MIIA1	1 (p. 1-35)
Type	Mortar	1 (p. 1-35)
Size	8-inch	1 (p. 6), 2 (p. 50)
Conflict	WWI, WWII	1, 3
Diameter	7.62-7.75 inches (19.3-19.69 cm)	1 (p. 6), 4 (p. 234)
Length	Unfuzed: 21.6-23 inches (54.8-58.42 cm) Fuzed: 28.1 inches (71.4 cm)	1 (p. 6), 4 (p. 234), 5
Propellant	The propelling charge MIII assembly consisted of a charge container, a base charge, and a number of auxiliary smokeless powder charges.	1 (p. 12)

General Use and Description

The Livens Projector was a crude form of mortar that was designed to throw large quantities of chemical agents on distant targets. The high chemical content of the projectiles permitted a more rapid delivery of agent upon the target, and in higher concentration, thereby obtaining greater surprise than with other ground weapons (1 p. 2), (6 p. 12).

The complete round consisted of a filled "shell" (i.e., projectile), a loaded burster tube assembly, a fuze assembly, and a propelling assembly. In the 1920s, there was a 24-pound, 40-pound, and 60-pound “drum” that could be used in the Livens Projector. In the 1940s, two types of projectile bodies were used in the Livens Projector, the MII and the MIIA1.

The projectile body, MII, was made of seamless drawn steel tubing 3/16-inch thick with forge-welded ends. It can be identified by the projections at each end, which were 1.69 inches in diameter and approximately 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 projectile. There were also two vent holes. After filling, the shell was sealed by screwing a tapered plug into the filling hole.

The MIIA1 differed in construction in that it had rounded ends closed by fusion welding, with no projections on either end. The other details of its construction were the same as for the MII (1 p. 5-6), (7).

Explosive Train

A fuze assembly that consisted of a primer, a 12-inch section of Type III safety fuze, and a No. 8 detonator was used in the burster-tube assembly to set off the burster charge (1 p. 5).

Fuzing

Mortar, 8-inch, Livens Projector, MI, MII, MIIA1 - Fuzing		
Fuze	**Note**	**Citation**
MI Assembly	12-inch type II safety fuze	1 (p. 6-8)

Booster, Adapter-Booster, or Burster

Mortar, 8-inch, Livens Projector, MI, MII, MIIA1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
MI Burster tube assembly	N/A	65 grams of crystalline TNT	Consisted of a burster tube with adapter, body, cap, and handle. Available references did not provide weight information.	1 (p. 10)

Fills

Mortar, 8-inch, Livens Projector, MI, MII, MIIA1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	6.00-30.0	2.72-13.6	60.0-61.5	27.2-27.6	There were three sizes of Livens in 1921. The Mark I was produced in 24, 40 and 60-pound sizes.	1 (p. 6), 3 (p. 12), 5, 8, 9 (p. 102)
Cl	28.0	12.7	61.0	27.6	Limited standard fill.	1 (p. 6), 5, 10 (p. 46)
FM	6.00-30.0	2.72-13.6	61.0	27.6	Limited standard fill. There were three sizes of Livens in 1921. The Mark I was produced in 24, 40, and 60-pound sizes.	1 (p. 6), 4 (p. 234), 10 (p. 6)
FS	28.0	12.7	61.0	27.6	MII and MIIA1	1 (p. 6), 4 (p. 234), 10 (p. 6)
H	6.00-14.0	2.72-6.35	61.0	27.6	There were three sizes of Livens in 1921. The Mark I was produced in 24, 40, and 60-pound sizes.	5
NC	6.00-30.0	2.72-13.6	N/A	N/A	There were three sizes of Livens in 1921. The 25 and 40-pound Mark I was HS filled.	5, 7
PG	6.00-30.0	2.72-13.6	N/A	N/A	There were three sizes of Livens in 1921. The Mark I was produced in 24, 40, and 60-pound sizes.	7
PS	6.00-30.0	2.72-13.6	N/A	N/A	There were three sizes of Livens in 1921. The Mark I was produced in 24, 40, and 60-pound sizes.	5, 7
TH3	6.00-30.0	2.72-13.6	N/A	N/A	There were three sizes of Livens in 1921. The Mark I was produced in 24, 40, and 60-pound sizes.	5, 7

Shipping/Packing

Ammunition for the Livens projector (i.e., MII and MIIA) were packed one in a single wooden box for shipment. The box was approximately 27 inches long, 9.5 inches wide, and 9.5 inches high. The packed box weighed 83 pounds.

The Livens projector was packaged in a Livens chest, which weighed approximately 24 pounds when complete and 11 pounds when empty. The chest dimensions were 15.5 inches by 7 2/5 inches, by 8 inches (1 p. 15-16).

Mortar, 8-inch, Livens Projector, MI, MII, MIIA1

Key Dates

Mortar, 8-inch, Livens Projector, MI, MII, MIIA1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1933	CCTC 1933-02 (CG & FM-fill)	11
Obsoleted	1944	CCTC 1145	12

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15 Projectile

A projectile is propelled by something else, usually the compression or expansion of gases. Projectiles, such as artillery rounds, deliver an explosive charge, chemical agent, or other fill from a ranged weapon.

There are several types of artillery ammunition designed for ease in handling and loading. Chemical and smoke rounds typically fall into three categories: fixed, semifixed, and separate loading. Fixed artillery projectiles are used in gun cannons and recoilless rifles; semifixed, in howitzers and mortars; and separate-loading, in large caliber guns and howitzers.

Fixed ammunition consists of a complete round issued with the cartridge case (containing a nonadjustable propelling charge and a primer) permanently crimped or otherwise attached to the projectile. The complete round is loaded into the weapon as a unit.

In semifixed howitzer ammunition, the cartridge case is loose-fitted over the base of the projectile. The propelling charge, bagged inside the cartridge case, can be adjusted to obtain the desired range. The complete round, like that of fixed ammunition, is loaded into the weapon as a unit.

In separate-loading ammunition, the major components-projectile, propelling charge and primer-are issued unassembled and are loaded into the weapon separately. The propelling charge, loaded in cloth bags, is adjustable. It is loaded into the weapon immediately to the rear of the projectile. After the breechblock has been closed and locked behind the charge, with igniter, the primer is inserted into the firing mechanism of the breechblock (Department of the Army 1969, 4-1 to 4-3).

15.1 Projectile, 75-mm, MK II

Figures

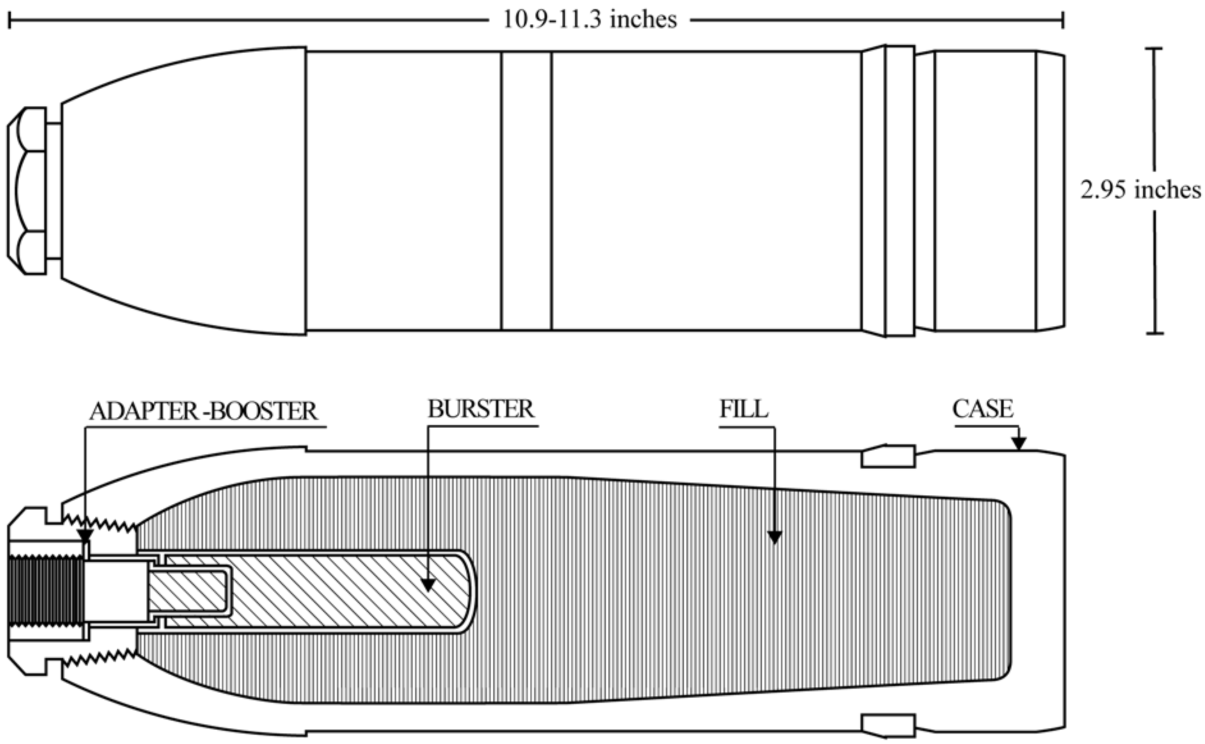

Figure 132: Projectile, 75-mm, MK II - Line Drawing

Figure 133: Projectile, 75-mm, MK II - Photograph - Top: Exterior, Bottom: Cutaway View

Projectile, 75-mm, MK II

Specifications

Projectile, 75-mm, MK II - Specifications and Other Data		**Citation**
Historical Name	American 75 MM. Common Steel Shell Mark II	1 (p. 42)
Type	Projectile	1 (p. 42)
Size	75-mm	2 (p. 419)
Conflict	WWI, WWII	1 (p. 42), 3 (p. 110)
Diameter	2.95 inches (75-mm)	1 (p. 42-43), 2 (p. 110)
Length	10.9-11.3 inches (27.8-28.7 cm)	1 (p. 43), 2 (p. 110)
Other	Rotating band: 0.49 inches (1.25 cm)	2 (p. 110)
Other Engineering Data	The shell weighed 10.27 pounds (4.65 kilograms) when empty.	1 (p. 24), 2 (p. 110)
Body Construction Material	Steel	4 (p. 7)
Propellant	Flashless nonhygroscopic (FNH) propelling powder (1.35 pound)	2 (p. 109), 3 (p. 419)
Maximum Range	8,600 yards	2 (p. 110)
B/M Dwg	75-2-171	4 (p. 7)

General Use and Description

Available references did not provide information on specific use.

The Mark II shell design was an adaptation of the French M 1900, and represented the older type of shell in use before the streamlined shape was developed. It had a copper rotating band, two grooves behind the rotating band for stab crimping of the cartridge case to the projectile, and a square base. The nose did not take the fuzes directly, but required an adapter that the booster was fitted to. The Mark II projectile varied from the HE Projectile MK I only in that it was pipe-threaded in the nose and had no base plate. (Absence of the base plate was common to chemical shells of all sizes.) The pipe threads in the nose of the shell insured a gastight seal in the joint between adapter-booster and the nose of the projectile (3 p. 419-421).

Explosive Train

The adapter-booster in this projectile performed the function of bursting the shell. It was not entirely efficient; sometimes fragmenting only the upper half of the shell and leaving the lower half in the form of a cup which would carry a portion of the chemical agent fill into the ground undispersed (3 p. 421).

Fuzing

Projectile, 75-mm, MK II - Fuzing		
Fuze	**Note**	**Citation**
French I.A. Model 1915	Point detonating, superquick	1 (p. 34, 42)
French I.A.L. Model 1916	Point detonating, superquick	1 (p. 34, 42)
French R.Y	Point detonating, superquick	1 (p. 38, 42)
French Schneider, Model 1916	Point detonating; only to be used if other fuzes were unavailable	1 (p. 40, 42)
M46	Superquick, adapted for point detonating	2 (p. 109), 3 (p. 419), 4 (p. 7)
Modified British No. 106	Superquick	1 (p. 42)
U.S. Mark III	Superquick	1 (p. 34, 42)

Projectile, 75-mm, MK II

Booster, Adapter-Booster, or Burster

Projectile, 75-mm, MK II - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
MK IV Adapter-booster	N/A	N/A	-	1 (p. 43)
MK IVB Adapter-booster	N/A	N/A	-	3 (p. 419)
MK IVM1 Adapter-booster	N/A	N/A	-	3 (p. 421)

Fills

Projectile, 75-mm, MK II - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BA (Bromoacetone)	1.97	0.89	10.6-12.3	4.80-5.57	-	1 (p. 24, 42), 4 (p. 7), 5
CA	1.45-1.55	0.65-0.70	10.6-12.3	4.80-5.57	-	1 (p. 24, 42), 5
CG	1.32-1.36	0.59-0.61	10.6-12.3	4.80-5.57	-	1 (p. 24, 42), 5
CN	0.95-1.05	0.43-0.47	N/A	N/A	-	6 (p. 4)
CNS	1.24	0.56	N/A	N/A	-	6 (p. 4)
FM	1.68-1.71	0.76-0.77	12.7	5.76	Gross weight is “as fired”.	1 (p. 24, 42), 2 (p. 110), 3 (p. 421), 5
FS	1.68-1.90	0.76-0.86	12.9	5.85	Gross weight is “as fired”.	2 (p. 110), 3 (p. 421), 5
H	1.25-1.36	0.56-0.61	12.3	5.59	Gross weight is “as fired.”	1 (p. 24, 42), 3 (p. 421), 5
NC	1.74	0.78	10.6-12.0	4.85-5.58	-	1 (p. 24), 2 (p. 356), 3 (p. 421), 5
WP	1.81-1.91	0.82-0.86	12.8	5.82	Gross weight is “as fired”.	2 (p. 110), 3 (p. 421), 5

Shipping/Packing

For domestic shipment, three individual fiber containers (3 rounds per) bundle with a shipping weight of 58.9 pounds and a volume of one cubic foot. For overseas shipment, one bundle (3 rounds) per crate. Shipping weight was 72 pounds and the volume was 1.7 cubic feet.

Miscellaneous Information

The MK II was the only standard chemical shell for the 75-mm gun in 1944 (3 p. 419).

Key Dates

Projectile, 75-mm, MK II - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1933	CCTC 1933-02 (HS, WP, FM, CN solution fill)	7 (p. Item No. 2)
Standardized	1943	CCTC 881 (H and WP-fill Standard, FS and L-fill Substitute Standard, FM-fill Limited Standard)	8

Sources

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2. War Department. 1944. Technical Manual, TM 9-1901, Artillery Ammunition, 29 June 1944. War Department.

3. War Department. 1944. Technical Manual, TM 9-1904, Ammunition Inspection Guide. U.S. Government Printing Office.

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15.2 Projectile, 75-mm, M64

Figures

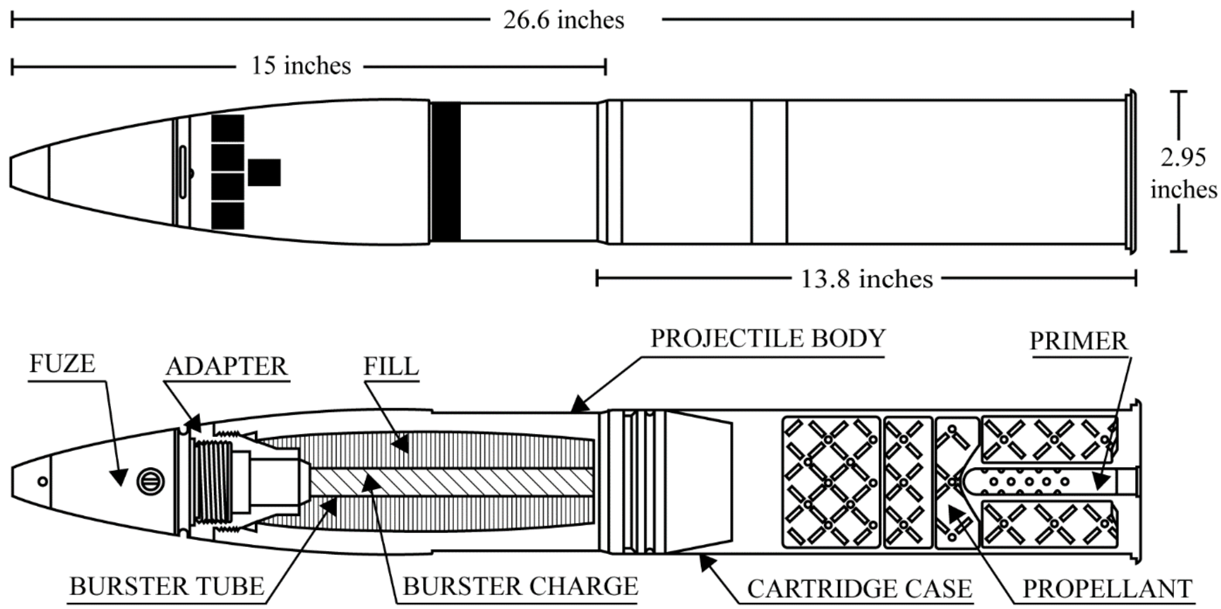

Figure 134: Projectile, 75-mm, M64 - Line Drawing

Specifications

Projectile, 75-mm, M64 - Specifications and Other Data		**Citation**
Historical Name	75-mm Chemical Shell, M64	1 (p. 108-109, 111, 335, 356-358)
Type	Projectile	1 (p. 108)
Size	75-mm	1 (p. 108)
Service	Army	2 (p. 4-100)
Diameter	75mm (2.95 inches)	1 (p. 108)
Length	Complete Round: 26.6 inches (67.6 cm) Fuzed: 15.0 inches (38 cm) Cartridge case: 13.82 inches (35.1 cm)	1 (p. 109)
Other Engineering Data	The M64 was a modification of the M48 HE shell. Primer M31A2 or M1B1A2. Cartridge casing: M5A1 and M5A1B1	1 (p. 108), 3 (p. 432)
Body Construction Material	Steel	2 (p. 4-100), 4
Propellant	Propelling charge: FNH (2 pounds) FNH, M1 (1.04 pounds)	1 (p. 108)
Maximum Range	9,630 yards	4, 5 (p. 104)
B/M Dwg	75-2-294	6 (p. 7)

General Use and Description

The M64 projectile was used for screening and incendiary purposes. It was also effective against personnel (1 p. 108).

Projectile, 75-mm, M64

The shell body was a relatively thin-walled forged-steel cylinder. A streamlined effect was obtained by boat-tailing the base. The projectile was a modification of the M48 HE shell, the nose being cut and threaded to hold an adapter which screwed into the body. The adapter served three purposes: to provide a tight seal for the chemical contents of the projectile; to hold the fuze; and to provide a seat for the forward end of the burster (1 p. 108-109).

Explosive Train

The M57 fuze was a superquick point detonating fuze. The burster contained a detonator relay chain and a burster charge (Charge, burster, M8) of HE to rupture shell and disperse the chemical agent (1 p. 108).

Fuzing

Projectile, 75-mm, M64 - Fuzing		
Fuze	**Note**	**Citation**
M57	Point detonating, superquick	1 (p. 109, 356), 3 (p. 431)

Booster, Adapter-Booster, or Burster

Projectile, 75-mm, M64 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M6 Burster casing	N/A	N/A	-	3 (p. 431), 7 (p. 109, 335, 356)
M8 Burster	1 ounce	Tetryl	Used in the M6 burster casing in conjunction with a detonator assembly to rupture the casing and disperse the chemical filler of the M64 chemical shell for 75-mm howitzers. It was 7.9 inches long with a 0.5-inch diameter.	1 (p. 109, 335, 356), 3 (p. 431)

Fills

Projectile, 75-mm, M64 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CNS	1.10	0.49	15.0	6.80	-	1 (p. 356), 2 (p. 4-101)
FS	1.51	0.68	15.4	6.98	-	1 (p. 358), 8 (p. IV-5)
H	1.04	0.47	12.8-14.9	5.80-6.75	-	1 (p. 358), 9 (p. 13, 102)
HD	0.96	0.44	14.9	6.74	-	5 (p. 103)
L	N/A	N/A	N/A	N/A	-	8 (p. IV-5)
WP	1.34	0.60	15.2	6.89	-	1 (p. 357), 6 (p. 7)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The M64 was used with the 75-mm guns M1897, M2, and M3 and 75-mm howitzers (1 p. 108).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

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15.3 Projectile, 105-mm, Howitzer, M360 (T173)

Figures

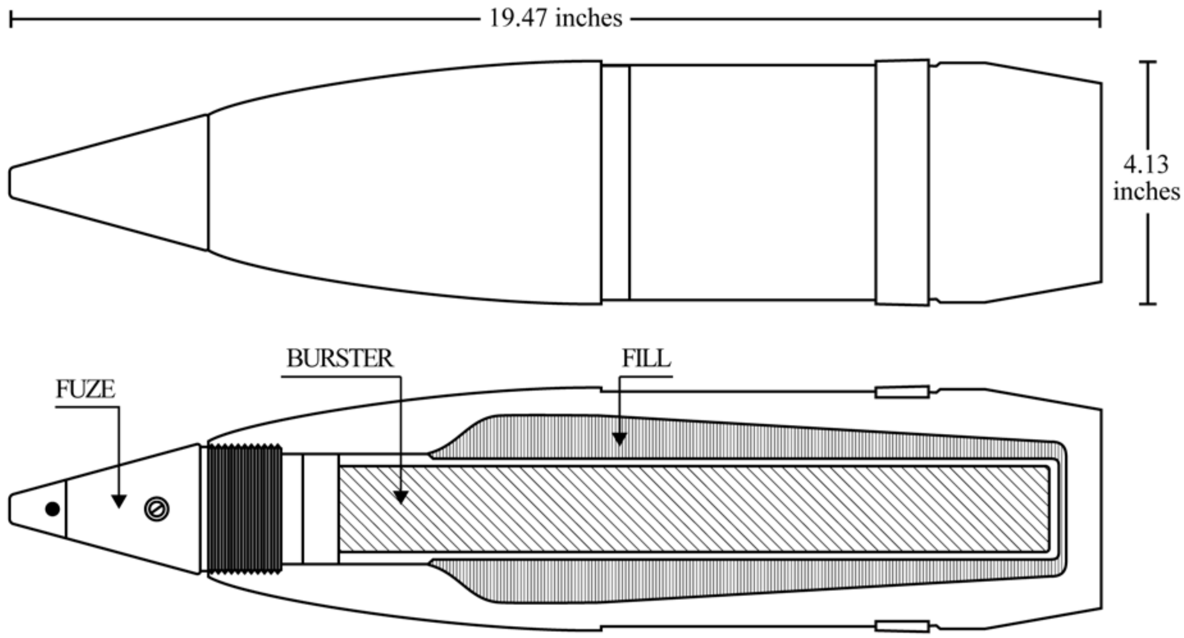

Figure 135: Projectile, 105-mm, Howitzer, M360 (T173) - Line Drawing

Figure 136: Projectile, 105-mm, Howitzer, M360 (T173) - Photograph - Top: Exterior (fuzed), Bottom: Cutaway View (unfuzed)

Projectile, 105-mm, Howitzer, M360 (T173)

Specifications

Projectile, 105-mm, Howitzer, M360 (T173) - Specifications and Other Data		Citation
Historical Name	Cartridge, 105mm: Gas, Nonpersistent, GB, M360 (T173)	1 (p. 36a)
Type	Projectile	2 (p. 1-7, A-14)
Size	105-mm	1 (p. 36a), 3 (p. 4-123), 4 (p. 3-43), 5 (p. 5-4)
Conflict	Cold War	1 (p. 36a)
Service	Army, Marine Corps	3 (p. 4-123), 4 (p. cover), 5 (p. 5-4), 6 (p. iv)
Diameter	4.13 inches (105 mm)	2 (p. A-14), 3 (p. 4-124), 4 (p. 4-34), 5 (p. 5-4), 6 (p. 4-123)
Length	Fuzed: 19.47 inches (49.45 cm) Unfuzed: 16.0 inches (40.6 cm) Complete round: 31.18 inches (79.20 cm)	2 (p. A-14), 3 (p. 4-124), 4 (p. 3-44), 5 (p. 5-4), 6 (p. 4-123)
Other Engineering Data	Projectile weight: 35.6 pounds The M360 was designated T173 during development.	1, 3 (p. 4-124)
Body Construction Material	Steel, forged or bar	4 (p. 3-44)
Propellant	M1: 2.75 pounds	5 (p. 5-4), 6 (p. 4-123), 7
Maximum Range	11,140-11,500 meters	4 (p. 3-44), 8 (p. 12)
B/M Dwg	75-1-363	3 (p. 4-124), 5 (p. 5-4)
NSN	1315-203-8985, 1315-640-8857, 1315-00-926-3952	9 (p. 32)

General Use and Description

The M360 Howitzer cartridge was designed to provide toxic chemical offensive capability using GB (3 p. 4-123), (5 p. 5-4), (6 p. 4-122), (7).

The cartridge was a semifixed, central burst GB gas round used for antipersonnel effects. The M360, which resembled the high explosive cartridge in external appearance, was boat-tailed, and the nose was ogival and threaded for an adapter. The adapter provided a tight seal for the chemical contents, held the fuze, and provided a seat for the forward end of the burster tube. The burster casing was thin-walled steel tubing extending from the adapter to the rear of the round cavity. A burster charge ruptured the casing to disperse the contents. The cartridge was used with a point detonating fuze to provide superquick or delay action (3 p. 4-123), (4 p. 3-43), (5 p. 5-4), (6 p. 4-122).

Explosive Train

Upon impact, the fuze would provide superquick or delayed action to initiate the burster charge. The burster charge would rupture the casing to disperse the contents (3 p. 4-123), (5 p. 5-4), (6 p. 4-122).

Fuzing

Projectile, 105-mm, Howitzer, M360 (T173) - Fuzing		
Fuze	**Note**	**Citation**
M508	Point detonating	2 (p. A-14), 3 (p. 4-124), 5 (p. 5-3, 5-5), 6 (p. 4-123)
M51A4	Point detonating	3 (p. 4-124)
M51A5	-	3 (p. 4-124)
M557	-	10 (p. 19)
M57	-	3 (p. 4-124)
M739	-	10 (p. 19)

Projectile, 105-mm, Howitzer, M360 (T173)

Booster, Adapter-Booster, or Burster

Projectile, 105-mm, Howitzer, M360 (T173) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M16 burster casing	N/A	N/A	-	3 (p. 4-124)
M40	N/A	Tetrytol	Weight range of 1.12-1.9 pounds	2 (p. A-14), 3 (p. 4-124)
M40A1 Burster	1.12 pounds	Composition B	-	2 (p. A-14)

Fills

Projectile, 105-mm, Howitzer, M360 (T173) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	1.63-1.80	0.73-0.81	32.0-44.6	14.5-20.2	44.6 lb./20.2 kilograms (Complete)	3 (p. 4-123), 5 (p. 5-4), 6 (p. 4-124), 7 (p. 8-6), 8 (p. 16)

Shipping/Packing

The M360 were packed one cartridge in a fiber container and two containers in a wooden box. The box weighed 117 pounds, was 37.25 inches by 11.1 inches by 7.59 inches and was 2 cubic feet (4 p. 3-44).

Miscellaneous Information

The M360 was used with the M2A1, M2A2, M4, M4A1, and M49 Howitzer (3 p. 1-124).

Key Dates

Projectile, 105-mm, Howitzer, M360 (T173) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1954	CCTC 2932 (GB fill Standard-A)	11

Sources

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10. Army Materiel Command. 1985. Army Materiel Command Pamphlet, AMC-P 700-3-3, Logistics, Complete Round Charts, Artillery Ammunition. U.S. Army.

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15.4 Projectile, 105-mm, Howitzer, M60 (T4E1)

Figures

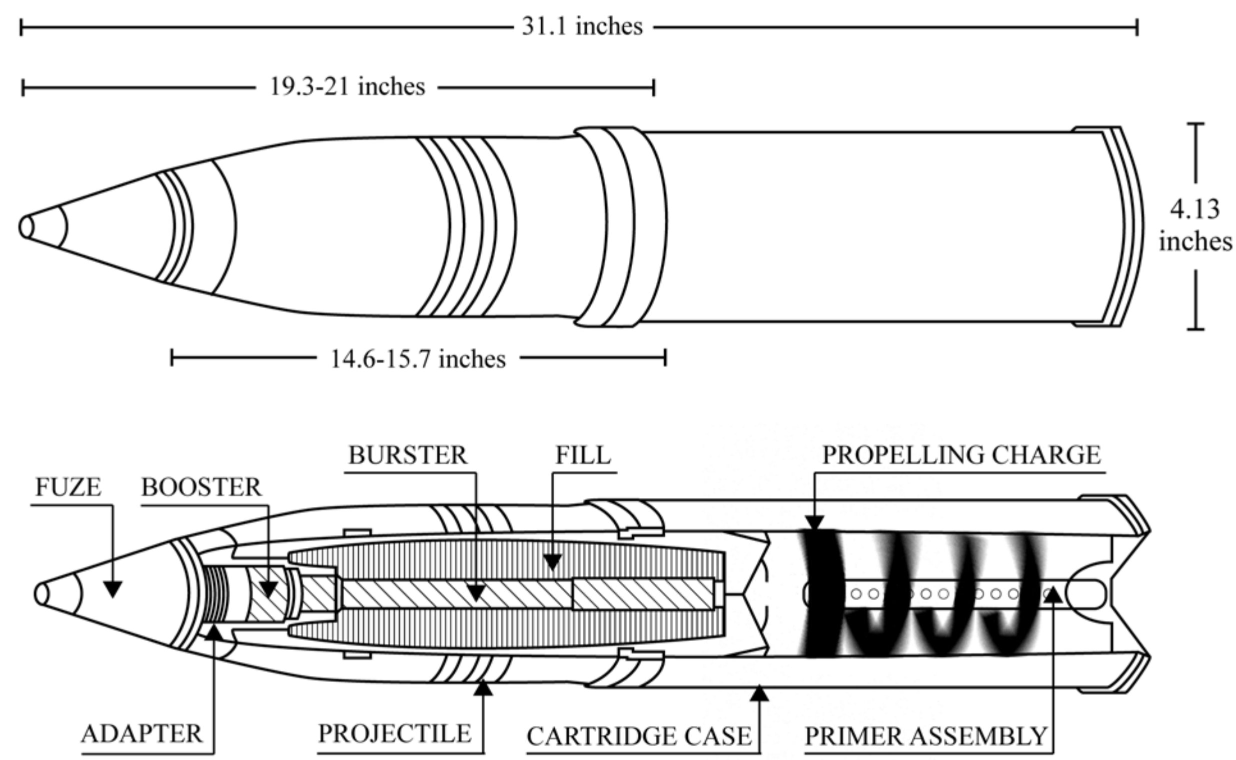

Figure 137: Projectile, 105-mm, Howitzer, M60 (T4E1) - Line Drawing

Figure 138: Projectile, 105-mm, Howitzer, M60 (T4E1) - Photograph - M60

Projectile, 105-mm, Howitzer, M60 (T4E1)

Specifications

Projectile, 105-mm, Howitzer, M60 (T4E1) - Specifications and Other Data		**Citation**
Historical Name	Shell, Semifixed, Gas, Persistent, H, M60, W/ Fuze, P.D. [point detonating], M57, 105-mm	1 (p. 174)
Type	Projectile	2 (p. 36a), 3 (p. 5-2), 4 (p. 4-119)
Size	105-mm	4 (p. 4-119), 5 (p. 12), 6 (p. 3-15), 7 (p. 9), 8 (p. 8-3)
Service	Army, Marine Corps	3 (p. 5-2), 4 (p. 4-119), 9 (p. 4-118)
Diameter	105 mm (4.13 inches)	1 (p. 173), 3 (p. 5-2), 4 (p. 4-120), 6 (p. 3-16), 8 (p. 8-4), 9 (p. 4-119)
Length	Complete: 31.1 inches (78.94 cm) Fuzed: 19.3-21 inches (49-53.3 cm) Cartridge case: 14.6-15.7 inches (37.2-39.9 cm)	1 (p. 173-174), 3 (p. 5-2), 4 (p. 4-120), 6 (p. 3-16), 8 (p. 8-4), 9 (p. 4-119), 10 (p. 475-476), 11 (p. A-15)
Other Engineering Data	Primer: M28A2 or M28B2 During development the M60 was designated T4E1.	3 (p. 5-2), 4 (p. 4-120), 8 (p. 8-4), 9 (p. 4-119), 12
Body Construction Material	M60: forged steel M60A1, M60A2: high strength aluminum	1 (p. 173), 3 (p. 5-2), 4 (p. 4-120), 6 (p. 3-16), 10 (p. 475)
Propellant	Propelling charge: M1- 2.75 pounds, M6- 2.8 pounds	3 (p. 5-2), 8 (p. 8-4), 9 (p. 4-120), 11 (p. 1-7)
Maximum Range	12,150 yards	1 (p. 173), 5 (p. 12), 8 (p. 8-4), 13 (p. 5-2)
B/M Dwg	75-1-109	3 (p. 5-2), 4 (p. 4-120), 8 (p. 8-3)
NSN	1315-00-028-4795 1315-00-028-4796 1315-00-028-4829 1315-00-060-0884 1315-00-222-6365	7 (p. 32)

General Use and Description

The M60 was used with M2A1, M2A2, M4, M4A1, and M49 howitzers to disperse a casualty-producing agent for use against enemy personnel (3 p. 5-2), (6 p. 211), (8 p. 8-3).

This round was assembled with the M60 smoke shell which resembled the HE shell in outward appearance. The body was one inch shorter than the HE projectile, but the adapter that was necessary to hold the burster brings the length to the same as the HE. The projectile was boat-tailed and the nose was ogival and threaded to take an adapter. The adapter served three purposes: it provided a tight seal for chemical agent contents of the projectile; it held the fuze and booster; and it provided a seat for the forward end of the burster, which was a thin walled steel tube that extended from the adapter to the rear of the shell cavity. The projectile had no base plate (1 p. 173), (3 p. 5-2), (4 p. 4-119), (9 p. 4-119), (10 p. 475).

Explosive Train

Upon impact with the target, the point detonating fuze would detonate the burster charge rupturing the projectile and dispersing the chemical agent fill (1 p. 174), (3 p. 5-2, 5-3), (4 p. 4-119), (6 p. 211), (9 p. 4-118), (10 p. 475).

Projectile, 105-mm, Howitzer, M60 (T4E1)

Fuzing

Projectile, 105-mm, Howitzer, M60 (T4E1) - Fuzing		
Fuze	**Note**	**Citation**
M51A4	Point detonating	3 (p. 5-3)
M51A5	Point detonating	3 (p. 5-2), 4 (p. 4-120), 9 (p. 4-119), 11 (p. A-15)
M557	Point detonating (M60, M60A1, M60A2))	8 (p. 8-4)
M564	Mechanical time, superquick (M60A1, M60A2)	6 (p. 3-16)
M57	Point detonating, used with M22 booster	1 (p. 173-174), 3 (p. 5-2, 5-3), 4 (p. 4-120), 9 (p. 4-119), 10 (p. 475), 11 (p. A-15)
M582	Mechanical time, superquick (M60A1, M60A2)	6 (p. 3-16)
M767	(M60A1, M60A2)	6 (p. 3-16)

Booster, Adapter-Booster, or Burster

Projectile, 105-mm, Howitzer, M60 (T4E1) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M22 Booster	N/A	Lead azide and tetryl	Used with M5 Burster.	1 (p. 173), 10 (p. 475)
M5 Burster	0.51 pounds	Tetrytol	Used in the M60 with a M557 fuze.	3 (p. 5-2), 4 (p. 4-120), 6 (p. 3-16), 8 (p. 8-4), 9 (p. 4-119), 10 (p. 475), 11 (p. A-15)
M53 Burster	N/A	Composition B	Used in the M60A1 with a M557, M564, M582, or M767 fuze.	6 (p. 3-16)
M53A1 Burster	N/A	Composition B	Used in the M60A2 with a M557, M564, M582, or M767 fuze.	6 (p. 3-16)

Fills

Projectile, 105-mm, Howitzer, M60 (T4E1) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CNS	N/A	N/A	N/A	N/A	-	14 (p. IV-5)
FS	4.60-4.61	2.09-2.09	34.8-35.2	15.8-16.0	Gross weight is as fired.	1 (p. 174), 10 (p. 475)
H	2.86-3.17	1.30-1.44	33.4-37.7	15.1-17.1	Gross weight is as fired	1 (p. 174), 4 (p. 4-119), 7 (p. 32), 8 (p. 8-3), 10 (p. 475)
HD	2.69-3.10	1.22-1.40	32.0-43.3	14.5-19.6	-	4 (p. 4-119), 5 (p. 12), 6 (p. 212), 7 (p. 32), 8 (p. 8-4), 9 (p. 4-118), 11 (p. 1-7)
L	N/A	N/A	N/A	N/A	-	14 (p. IV-5)
WP	4.06-4.10	1.84-1.86	34.3-34.7	15.6-15.7	Gross weight is as fired	1 (p. 173), 6 (p. 3-16), 10 (p. 475)

Shipping/Packing

This cartridge is packed one per fiber container with two containers per wooden box. The filled box weighs approximately 120 pounds (8 p. 8-3).

Projectile, 105-mm, Howitzer, M60 (T4E1)

Miscellaneous Information

The M60 series of projectiles were used in the following Howitzers:

- M2
- M2A1
- M2A2
- M4
- M4A1
- M49 (M52, M52A1)
- M2A1
- M2A2 (101)
- M101A1, M103 (M108)
- M137 (M102) (4 p. 4-119), (6 p. 3-16), (9 p. 4-119), (13 p. 5-2)

Key Dates

Projectile, 105-mm, Howitzer, M60 (T4E1) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1940	OCM 16063	12
Standardized	1958	OCTM 36841 (H/HD-fill Standard-A)	7 (p. 32)

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15.5 Projectile, 155-mm, Artillery, E15, E15R1, E15R2, E15R3

Figures

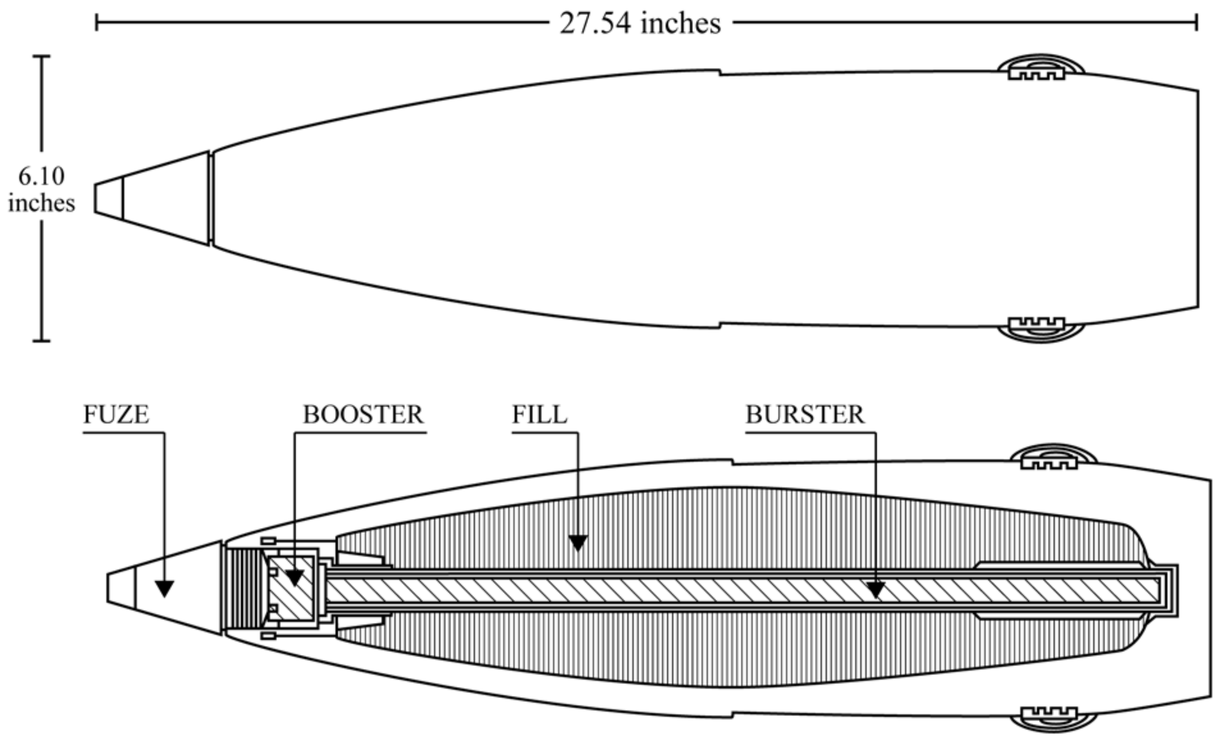

Figure 139: Projectile, 155-mm, Artillery, E15, E15R1, E15R2, E15R3 - Line Drawing

Specifications

Projectile, 155-mm, Artillery, E15, E15R1, E15R2, E15R3 - Specifications and Other Data		**Citation**
Historical Name	Artillery Shell, E15, E15R1, E15R2, E15R3, E15R3	1
Type	Projectile	1
Size	155-mm	1 (p. 1)
Service	Army	1 (p. 1)
Diameter	155mm (6.10 inches)	1 (p. 1)
Length	26.78 inches (68 cm)	2 (p. 3-86)
Body Construction Material	Steel	2 (p. 3-85)

General Use and Description

These projectiles were used for field tests of artillery shells for dispersing GB. These projectiles provided preliminary information on the size of cloud and magnitude of dosages produced by different burster to agent (i.e., GB) ratios (1 p. 6, 7).

The E15 series projectiles were modified M110 155mm artillery shells. These projectiles were used to test dispersion rates of different agent to burster ratios (1 p. 6).

Explosive Train

The burster was initiated by electric means to measure dissemination rates among the four projectiles (1 p. 6).

Fuzing

Projectile, 155-mm, Artillery, E15, E15R1, E15R2, E15R3 - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Munitions were fired electronically	1 (p. 6)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, Artillery, E15, E15R1, E15R2, E15R3 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	3.15 pounds	N/A	E15	1 (p. 1)

Fills

Projectile, 155-mm, Artillery, E15, E15R1, E15R2, E15R3 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	6.30-7.80	2.85-3.53	N/A	N/A	-	1 (p. 1)

Shipping/Packing

Available references did not provide this information.

Key Dates

Projectile, 155-mm, Artillery, E15, E15R1, E15R2, E15R3 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Field Testing	1950	Project- 4-04-15-12	1

Sources

1. Milly, George H., & Cave, Clearburn B. 1950. Technical Command Informal Report, TCIR 570, Report of Field Test 299 Static Test of Modified 155mm Artillery Shell, E15, E15R1, E15R3, E15R3, Filled GB (CBRNIAC-CB-110590). U.S. Army Chemical Corps Research and Development Command.

2. Department of the Army. 1980. Technical Manual, TM 43-0001-28, Army Ammunition Data Sheets for Artillery Ammunition: Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers and Artillery Fuzes. U.S. Government Printing Office.

15.6 Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1

Figures

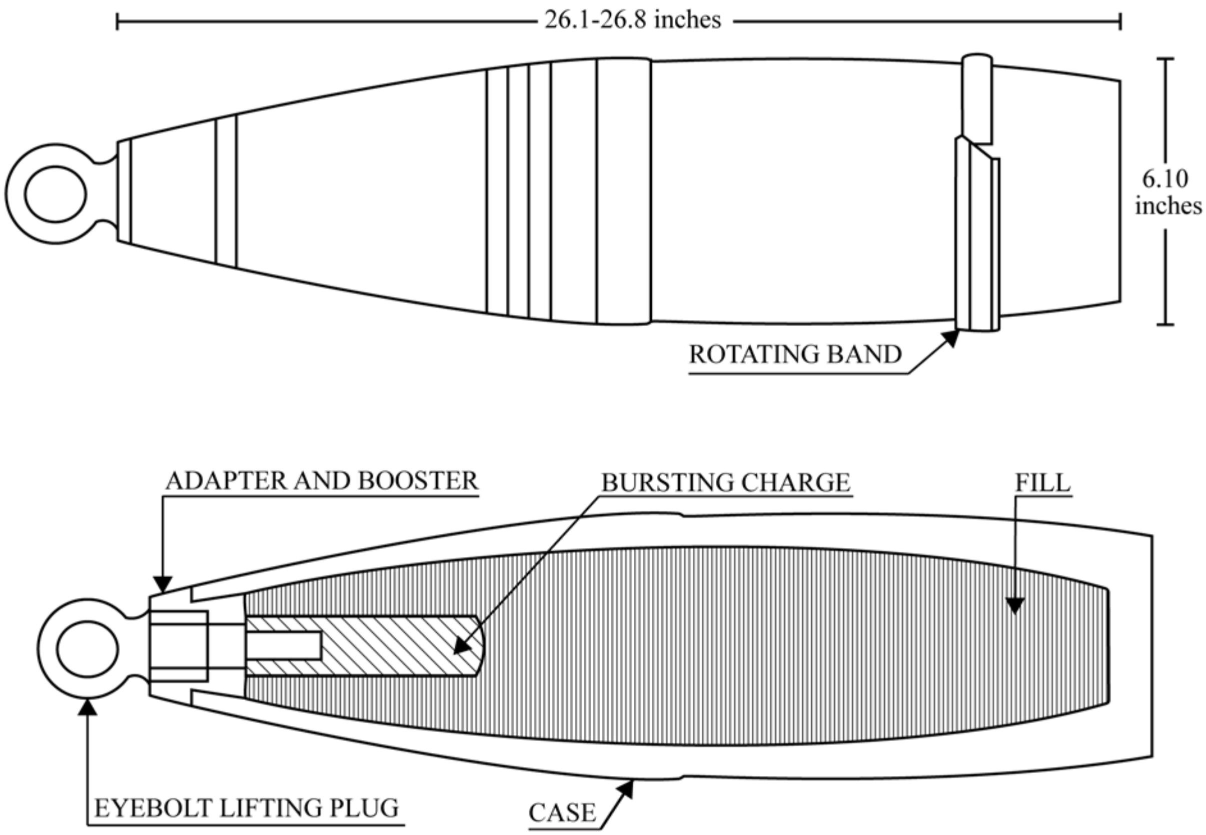

Figure 140: Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1 - Line Drawing (Note: no fuze installed)

Specifications

Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1 - Specifications and Other Data		Citation
Historical Name	Shell, Gas Persistent, H, Mk. IIA1 and Mk. IIA1-Mod. 1 155-mm How.	1 (p. 194)
Type	Projectile	1 (p. 194)
Size	155-mm	1 (p. 195), 2
Conflict	Other, WWII	1 (p. 194), 3
Service	Army	1
Diameter	155-mm (6.10 inches)	1 (p. 194), 2
Length	MK II: 26.1 inches (66.3 cm) MK IIA1: 26.8 inches (68.1 cm)	1 (p. 194-195), 2
Width	Rotating band: 0.60 inch (1.52 cm)	1 (p. 194-195)
Body Construction Material	Steel	4 (p. 17)
Propellant	M1A1, M2A1	1 (p. 370)
Maximum Range	12,400 yards	5 (p. 116)
B/M Dwg	75-4-85	4 (p. 17)

Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1

General Use and Description

A military requirement for a 155-mm chemical shell was established in 1922. The MK II (howitzer) and MK VII (gun) shell with MK VIB adapter and booster we adopted as standard in 1923. HS was adopted as the persistent chemical fill for these shells in 1928 (3 p. 1).

The, MK II, gas and smoke projectile, was adapted for the point detonating M46 fuze. It had tapered or pipe threads and did not contain a base cover. The adapter-booster was tightly screwed into place, which formed a gastight seal for the filler. The MK IIA1 was a limited standard chemical projectile and was a modification of the MK II projectile; it had a burster extending from the nose to the base of the shell and used the point detonating M51 fuze and modifications. The MK IIA1 Mod. 1 was a modification of the MK VII Projectile for the 155-mm Guns M1917-17Al-18MI. The modification consisted of machining down the forward rotating band to the diameter of the shell body. Dimensions and data were the same as for the MK IIA1 Shell (1 p. 194-195).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1 - Fuzing		
Fuze	**Note**	**Citation**
French I.A. Model 1915	Superquick	6 (p. 34, 53)
French I.A.L. Model 1916	Superquick	6 (p. 34, 53)
French R.Y. Model 1917	Superquick; only to be used if other fuzes were unavailable	6 (p. 38, 53)
M46	Point detonating, superquick	1 (p. 195), 5 (p. 115)
M51 and modifications	Point detonating, superquick	1 (p. 370-371)
Modified British No. 106	Superquick	6 (p. 42, 53)
U.S. Mark III	Superquick	6 (p. 34, 53)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M6	0.36 pounds	Tetryl	The M6 burster was 20.67 inches long.	1 (p. 336, 370)
MK VIB	N/A	N/A	-	1 (p. 370), 5 (p. 115)

Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1

Fills

Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BA	16.4	7.43	97.2	44.1	Fill weights are approximate.	6 (p. 24, 53)
CA	12.1	5.48	93.0	42.1	-	6 (p. 24, 53)
CG	11.0-11.3	4.98-5.12	91.8-92.1	41.6-41.8	-	6 (p. 24, 53), 7
CNS	13.9	6.30	N/A	N/A	MK IIA1 Mod 1	1 (p. 371), 5 (p. 117)
FM	14.3-14.4	6.48-6.53	95.1-96.1	43.1-43.6	-	1 (p. 370), 6 (p. 24, 53)
FS	16.2	7.34	99.1-100	44.9-45.3	-	1 (p. 194, 370), 4 (p. 17)
H	10.4-11.8	4.71-5.35	92.6-97.1	42.0-44.0	-	1 (p. 194, 370), 6 (p. 24, 53)
L	N/A	N/A	N/A	N/A	-	8 (p. IV-5)
NC	14.5	6.57	95.3	43.2	-	6 (p. 24, 53)
PS	13.6	6.16	94.5	42.8	-	6 (p. 24, 53)
WP	14.8-15.8	6.71-7.16	96.0-98.8	43.5-44.8	-	1 (p. 194, 371), 6 (p. 24, 53)

Shipping/Packing

Available references did not provide this information.

Key Dates

Projectile, 155-mm, MK II, MK IIA1, MK IIA1-Mod 1 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1933	CCTC 1933-02 (howitzer HS, CG, WP, and FM-fill and Gun HS-fill)	9
Standardized	1941	MK IIA1 (howitzer HS-fill)	3

Sources

1. War Department. 1944. Technical Manual, TM 9-1901, Artillery Ammunition, 29 June 1944. War Department.
2. Woodberry, D.L. 1940. Technical Division Memorandum Report, TDMR 241, Chemical Filling for Artillery Shell Static Test of 155-mm. (How.) Chemical Shell MK.II A1, Filled with WP, FS, and HS. Chemical Warfare Service.
3. Rouiller, C.A. 1942. Edgewood Arsenal Technical Report, EATR 297, 155-MM Chemical Shell MK. IIA1 and MK. VIIA1, HS-Filled. Final Report on Projects A 1.1-1b and A 1.1-1c. War Department.
4. Anonymous. 1941. Complete Round Charts, issued and revised various dates (RMA barcode GE104415 GE028220-1). War Department.
5. War Department. 1946. Field Manual, FM 3-5, Characteristics and Employment of Ground Chemical Munitions. War Department.
6. American Expeditionary Forces. 1919. Gas Manual Part II, Use of Gas by the Artillery, A.E.F. No. 1475-2 G-5. War Department.
7. Edgewood Arsenal. 1921. Weight of Chemical Fillings (NARA II. RG 175. E 1 (P1-8). Box 520.). Mechanical Division.
8. Office of the Chief Chemical Corps. 1948. Disposition of Chemical Corps Items, Department of the Army. Mechanical Division.
9. Chemical Corps Technical Committee. 1933. CCTC Item # 1933-02, Chemical Fillings for Munitions. Department of the Army.

15.7 Projectile, 155-mm, Howitzer and Gun, MK VII, MK VIIA1

Figures

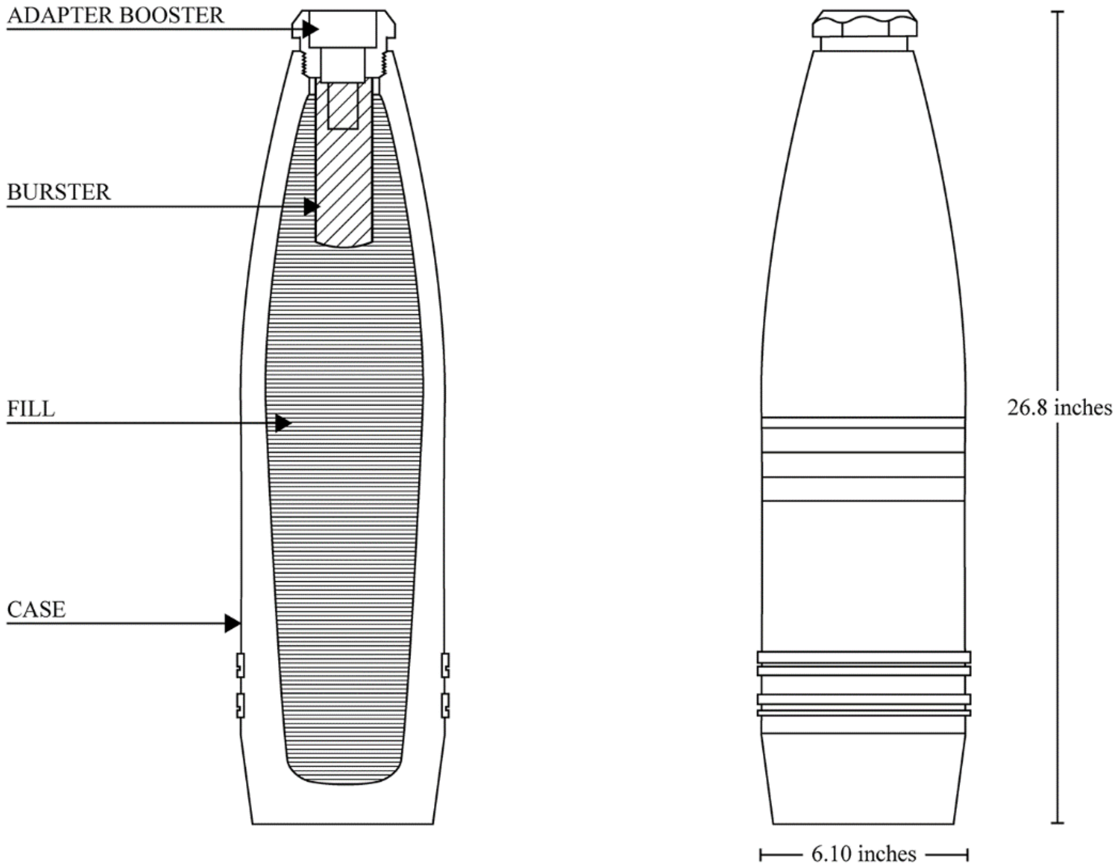

Figure 141: Projectile, 155-mm, Howitzer and Gun, MK VII, MK VIIA1 - Line Drawing

Specifications

Projectile, 155-mm, Howitzer and Gun, MK VII, MK VIIA1 - Specifications and Other Data		**Citation**
Historical Name	Shell, MK VII, MK VIIA1, Gas and Smoke	1 (p. 200-201)
Type	Projectile	1 (p. 200-201)
Size	155-mm	1 (p. 201)
Conflict	WWII	1
Diameter	155-mm (6.10 inches)	1 (p. 201)
Length	26.8 inches (68.1 cm)	1 (p. 201)
Width	Rotating band: MK VII: 2 inches Rotating band: MK VII A1- 2 each 0.59 inch	1 (p. 201)
Body Construction Material	Steel	2 (p. 57)
Propellant	M1917-18, M1, M1A1	1 (p. 201)
Maximum Range	20,247 yards	3 (p. 112)

General Use and Description

Available references did not provide information on specific use.

Projectile, 155-mm, Howitzer and Gun, MK VII, MK VIIA1

The MK VII had tapered or pipe threads, and did not have a base cover. The adapter-booster was tightly screwed into place forming a gastight seal for the chemical agent fill. The MK VII A1 were modifications of the MK VII shell, the adapter was changed to take the point detonating M51 fuze and modifications (1 p. 200-201).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Projectile, 155-mm, Howitzer and Gun, MK VII, MK VIIA1 - Fuzing		
Fuze	**Note**	**Citation**
French I.A. Model 1915	Point detonating, superquick	2 (p. 34, 57)
French I.A.L. Model 1916	Point detonating, superquick	2 (p. 34, 57)
French R.Y. Model 1917	Point detonating; only to be used if other fuzes were unavailable.	2 (p. 57)
M46	Superquick, adapted for point detonating	1 (p. 201, 374)
M51 and modifications	Point detonating	1 (p. 200, 374)
Modified British No. 106	Point detonating, superquick	2 (p. 38, 57)
U.S. MK III	Point detonating, superquick	2 (p. 42, 57)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, Howitzer and Gun, MK VII, MK VIIA1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M6	0.36 pounds	Tetryl or tetryl and TNT mixture	MK VII	1 (p. 201, 336, 374)
MK VIB Adapter-booster	N/A	Tetryl	MK VIIA1	1 (p. 200, 339, 384)

Fills

Projectile, 155-mm, Howitzer and Gun, MK VII, MK VIIA1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BA	16.4	7.43	95.9	43.5	Fill weights are approximate.	2 (p. 24, 57)
CA	12.1	5.48	91.6	41.5	Fill weights are approximate.	2 (p. 24, 57)
CG	11.0	4.98	90.5	41.0	Approximate fill weight	2 (p. 24, 57)
FM	14.3	6.48	93.8	42.6	-	2 (p. 24, 57)
FS	16.2	7.34	99.7	45.2	MK VIIA1.	1 (p. 200, 374), 2 (p. 24, 57)
H	11.3-11.5	5.12-5.18	90.8-94.9	41.1-43.0	MK VII and MK VIIA1.	1 (p. 200, 374), 2 (p. 24, 57), 4 (p. 13, 102)
NC	14.5	6.57	94.0	42.6	Approximate fill weight	2 (p. 57)
PS	13.6	6.16	93.1-3.10	42.2	Approximate fill weight	2 (p. 24, 57)
WP	14.8-15.8	6.71-7.16	97.6-98.3	44.2-44.6	MK VII and MK VIIA1.	1 (p. 200, 201, 374), 2 (p. 24, 57)

Shipping/Packing

Available references did not provide this information.

Projectile, 155-mm, Howitzer and Gun, MK VII, MK VIIA1

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. War Department. 1944. Technical Manual, TM 9-1901, Artillery Ammunition, 29 June 1944. War Department.
2. American Expeditionary Forces. 1919. Gas Manual Part II, Use of Gas by the Artillery, A.E.F. No. 1475-2 G-5. War Department.
3. War Department. 1946. Field Manual, FM 3-5, Characteristics and Employment of Ground Chemical Munitions. War Department.
4. War Department. 1942. Field Manual, FM 3-5, Chemical Warfare Service Field Manual: Tactics of Chemical Warfare. War Department.

15.8 Projectile, 155-mm, M104

Figures

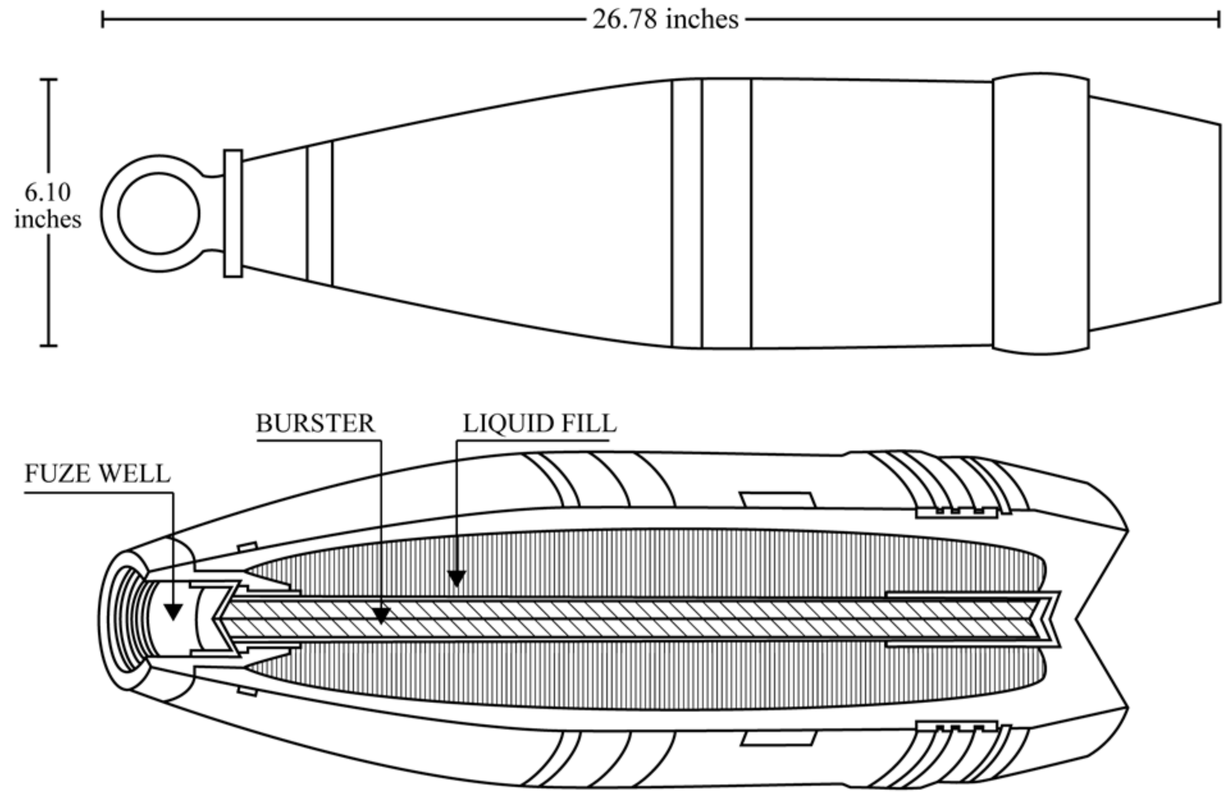

Figure 142: Projectile, 155-mm, M104 - Line Drawing (Note: unfuzed)

Specifications

Projectile, 155-mm, M104 - Specifications and Other Data		**Citation**
Historical Name	Shell, M104, Gas and Smoke	1 (p. 200)
Type	Projectile	2 (p. 8-22), 3 (p. A-13), 4 (p. 36a)
Size	155-mm	1 (p. 200), 3 (p. A-13), 4 (p. 36a)
Conflict	WWII	5
Service	Marine Corps	6 (p. 16)
Diameter	6.1 inches (155 mm)	2
Length	Unfuzed (with lifting plug): 26.78-26.8 inches (68.02-68.07 cm) Fuzed: 27.54 inches (69.95 cm)	1 (p. 200), 2 (p. 8-23), 3 (p. A-13), 5 (p. 545)
Other Engineering Data	Primer- Mk. IIA4, 17 grains; M82, Mk 15, Mk 34	1 (p. 373), 2 (p. 8-23), 5 (p. 545)
Body Construction Material	Forged steel	2 (p. 8-22)
Propellant	M1917-18, M1 and M1A1: 26.17 pounds, M1 and M1A1: 32.23 pounds, or M19	1 (p. 200), 2 (p. 8-23)
Maximum Range	25,940 yards	1 (p. 200)
B/M Dwg	75-14-296	2
NSN	1320-00-529-7350	2

Projectile, 155-mm, M104

General Use and Description

The M104 projectile was used to produce a toxic effect on personnel and to contaminate habitable areas (2).

The M104 gas and smoke projectile consisted of a forged steel body that contained a filler and a M6 burster. The burster was housed in the M1 burster casing, which extended the full length of the projectile. The burster casing was assembled after the projectile cavity was filled. A threaded adapter was press fitted to the forward end of the burster casing, which sealed the nose end of the projectile. The projectile was issued unfuzed, with an eyebolt lifting plug threaded in the fuze adapter. A point detonating fuze was normally used with this projectile. A rotating band encircled the projectile body near the base and was protected by a grommet which was removed before loading the projectile in the weapon (1 p. 200), (2 p. 8-22).

Explosive Train

The point detonating fuze functioned on impact to explode the burster. The burster would rupture the projectile case and disperse the chemical agent fill (1 p. 200), (2 p. 8-22).

Fuzing

Projectile, 155-mm, M104 - Fuzing		
Fuze	**Note**	**Citation**
M51	Point detonating	1 (p. 200)
M51A1	Point detonating	7 (p. 16)
M51A3	Point detonating	5 (p. 545)
M51A4	Point detonating	1 (p. 373)
M51A5	Point detonating	6 (p. 16)
M520	Mechanical time, superquick	2 (p. 8-23)
M557	Point detonating (modification)	2 (p. 8-23)
M564	Mechanical time, superquick (modification)	2 (p. 8-23)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, M104 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M22 Booster	N/A	N/A	-	5 (p. 545)
M6 Burster	0.83 pounds	Tetrytol	Thin steel or aluminum tube.	1 (p. 373), 2 (p. 8-23), 3 (p. A-13), 5 (p. 545)

Fills

Projectile, 155-mm, M104 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
FS	16.2-16.9	7.34-7.66	99.7	45.2	-	1 (p. 373), 5 (p. 545)
H	11.4-11.7	5.17-5.30	94.4-94.8	42.8-43.0	-	1 (p. 373), 5 (p. 545)
HD	9.70-11.7	4.39-5.31	94.6	42.9	-	2 (p. 8-22), 4 (p. 36a), 6 (p. 16)
WP	14.8-15.6	6.71-7.07	98.2-98.4	44.5-44.6	-	1 (p. 373), 5 (p. 545)

Shipping/Packing

The projectiles were packed eight per pallet, and the pallet weighed approximately 797 pounds (2).

Projectile, 155-mm, M104

Key Dates

Projectile, 155-mm, M104 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1958	OCTM 36841 (HD-fill Standard-B)	4 (p. 36a)

Sources

1. War Department. 1944. Technical Manual, TM 9-1901, Artillery Ammunition, 29 June 1944. War Department.

2. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

3. Chu, S.C., Skinner, L.R., & Smith, W.H. 1987. Chemical Stockpile Disposal Program, Transportation of Chemical Agents and Munitions: A Concept Plan, Report No. SAPEO-CDE-IS-87003. PEO-PM Cml Demil.

4. Chemical Corps Technical Committee. 1969. Chemical Corps Book of Standards, 2nd Abridged Edition, Revision No. 29. Department of the Army.

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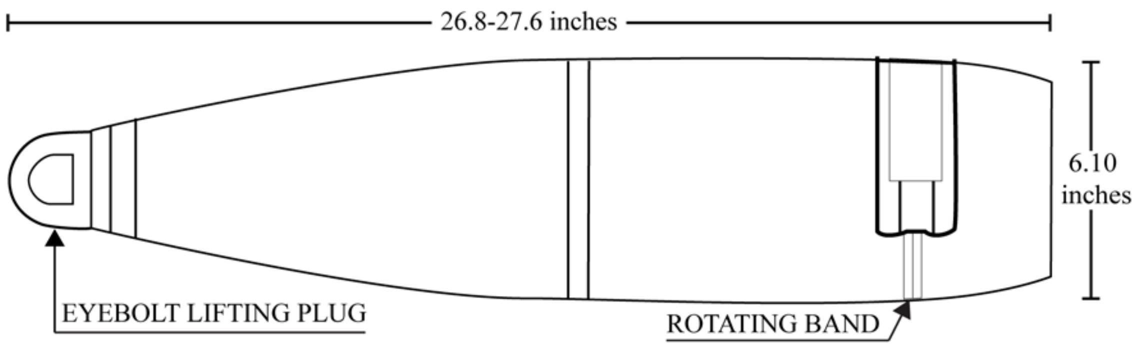
6. Secretary of the Army. 1962. Field Manual, FM 3-10, Chemical and Biological Weapons Employment. Department of the Army.

7. Anonymous. 1941. Complete Round Charts, issued and revised various dates (RMA barcode GE104415 GE028220-1). Department of the Army.

15.9 Projectile, 155-mm, M105, M105B1

Figures



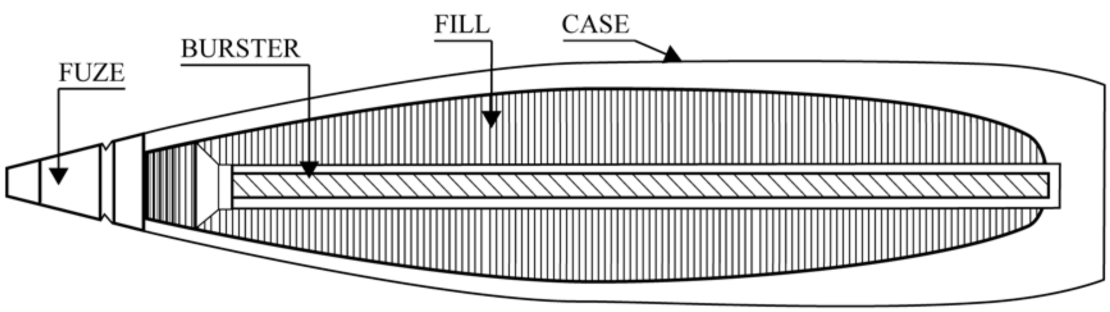


Figure 143: Projectile, 155-mm, M105, M105B1 - Line Drawing (Note: top drawing is unfuzed)

Specifications

Projectile, 155-mm, M105, M105B1 - Specifications and Other Data		**Citation**
Historical Name	Shell, M105, M105B1, Gas and Smoke	1 (p. 193)
Type	Projectile	-
Size	155-mm	1 (p. 193)
Diameter	155 mm (6.10 inches)	2 (p. 193)
Length	26.78-27.56 inches (68.02-70.0 cm) (with eyebolt lifting plug)	1 (p. 222), 2 (p. 193), 3
Width	0.6 inches (1.52 cm) (rotating band)	2 (p. 193)
Other	Rotating band located 3.5 inches from base of projectile.	2 (p. 193)
Body Construction Material	Steel	1 (p. 193)
Propellant	M1A1- 4.22 pounds M2A1- 8.64 pounds	2 (p. 371)
Maximum Range	12,775 yards	4 (p. 113)
B/M Dwg	75-4-27 (MKII) 75-4-85 (MKII A1)	-

General Use and Description

Available references did not provide information on specific use.

Projectile, 155-mm, M105, M105B1

The 155-mm M105 was similar to the M110 chemical round and superseded the MK IIA1. The body was a relatively thin walled, steel shell with a nose formed to a long ogive and threaded to hold a point detonating fuze. The projectile had a single rotating band (2 p. 193).

Explosive Train

The explosive charge of the burster, which was contained in a cardboard or thin aluminum casing, was held in place in the casing by the fuze well cup. One end of the burster casing was fastened to an adapter in the nose cavity. The projectile was adapted for the point detonating M51 Fuze, and modifications (3).

Fuzing

Projectile, 155-mm, M105, M105B1 - Fuzing		
Fuze	**Note**	**Citation**
M51 series	Used with booster M20 or M21	2 (p. 189, 371)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, M105, M105B1 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M6	N/A	Tetryl	The M6 was 20.67 inches long.	2 (p. 336, 371), 3

Fills

Projectile, 155-mm, M105, M105B1 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
FS	16.9	7.66	99.2-100	44.9-45.4	-	2 (p. 193), 5 (p. 17)
H	11.7	5.30	94.0-95.0	42.6-43.1	-	2 (p. 371), 5 (p. 17)
HD	11.1	5.04	95.1	43.1	-	4 (p. 113)
L	N/A	N/A	N/A	N/A	-	6 (p. IV-5)
WP	15.6	7.07	98.9	44.9	-	2 (p. 371), 5 (p. 17)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Department of the Army. 1950. Technical Manual, TM 9-1901, Artillery Ammunition. U.S. Government Printing Office.

2. War Department. 1944. Technical Manual, TM 9-1901, Artillery Ammunition, 29 June 1944. War Department.

3. Technical Division. 1944. Catalogue of Standard Ordnance Items, Second Edition 1944, Volume III. Office Chief of Ordnance.

4. War Department. 1946. Field Manual, FM 3-5, Characteristics and Employment of Ground Chemical Munitions. War Department.

5. Anonymous. 1941. Complete Round Charts, issued and revised various dates (RMA barcode GE104415 GE028220-1). War Department.

6. Office of the Chief Chemical Corps. 1948. Disposition of Chemical Corps Items, Department of the Army. War Department.

15.10 Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3)

Figures

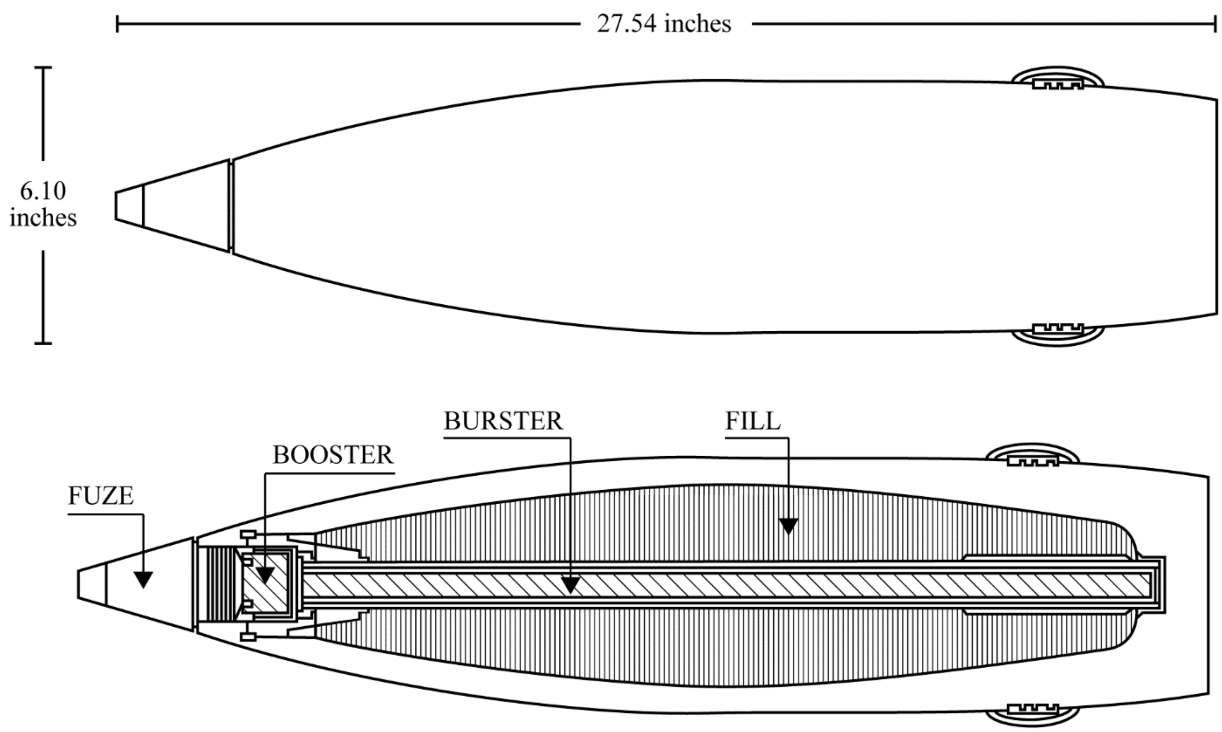


Figure 144: Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3) - Line Drawing

Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3)

Specifications

Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3) - Specifications and Other Data		Citation
Historical Name	Persistent Gas Howitzer Projectile, HD, 155mm M110	1 (p. 5-12)
Type	Projectile	2 (p. 5-12), 3 (p. 4-150)
Size	155-mm	2 (p. 5-12), 4 (p. 16)
Service	Army, Marine Corps	2 (p. 5-12), 3 (p. 4-152), 4 (p. 16), 5 (p. 4-149)
Diameter	6.1 inches (155 mm)	2 (p. 5-12), 3 (p. 4-152), 5 (p. 4-149), 6 (p. 8-25), 7 (p. 3-85)
Length	27.54 inches (69.95 cm) with fuze	2 (p. 5-12), 3 (p. 4-152), 5 (p. 4-149), 7 (p. 3-85)
Other Engineering Data	MK IIA4 Primer	8 (p. 371)
Body Construction Material	Thin-walled steel	2 (p. 5-12)
Propellant	M1A1 (4.022 pounds), M2A1 (8.64 pounds), M3 (5.5-5.94 pounds), or M4A1 (13.19 pounds)	2 (p. 5-12), 3 (p. 4-152), 5 (p. 4-149), 6 (p. 8-25), 8 (p. 371)
Maximum Range	16,404 yards (15,000 meters)	3 (p. 4-151)
B/M Dwg	75-14-317, 73-1-179, 73-1-264, 75-14-293	5 (p. 4-150-151), 6 (p. 8-25), 7 (p. 3-82), 9 (p. 32)
NSN	13200-00-529-7352, 1320-00-096-3067	6 (p. 8-25), 10 (p. 34)

General Use and Description

The M110 series was designed to provide toxic chemical offensive capability, or incendiary, spotting, and screening effects (2 p. 5-12), (3 p. 4-152), (5 p. 4-149), (6 p. 8-25), (7 p. 3-81, 3-85, 3-89).

The projectile was a separate loaded, central burst gas shell used for antipersonnel effects. It was similar to the standard HE round except for the HD filling burster tube, and burster charge. The burster charge, contained in a thin tube, was held in place in the burster casing by a fuze well cup. The forward end of the burster casing was assembled to the adapter in the nose of the round and extended the full length of the projectile. The adapter was threaded to receive a point detonating fuze. The body was of thin-walled steel with a nose formed to a long ogive. A single rotating band was located about 3.5 inches in front of the base (2 p. 5-12), (3 p. 4-152), (5 p. 4-149), (6 p. 8-25), (7 p. 3-85), (8 p. 190).

Explosive Train

The point detonating fuze functioned on impact to explode the burster. The burster ruptured the projectile case and dispersed the chemical agent fill (6 p. 8-25), (7 p. 3-85), (8 p. 191).

Fuzing

Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3) - Fuzing		
Fuze	**Note**	**Citation**
M51A3	Point detonating	11 (p. 549)
M51A4	Point detonating	3 (p. 4-152), 5 (p. 4-150, 4-152), 8 (p. 371)
M51A5	Point detonating	2 (p. 5-12), 3 (p. 4-152), 5 (p. 4-149, 4-150), 6 (p. 8-25)
M55	Time, superquick	5 (p. 4-159)
M557	Point detonating	5 (p. 4-159), 7 (p. 3-86, 3-90)
M564	Mechanical time, superquick	5 (p. 4-149), 7 (p. 3-86, 3-90)
M582	Mechanical time, superquick	5 (p. 4-149), 7 (p. 3-86, 3-90)
M67	Time, superquick	3 (p. 4-152)
M739	Point detonating	5 (p. 4-149), 7 (p. 3-86, 3-90)
M767	Electronic Time	5 (p. 4-149), 7 (p. 3-86, 3-90, B-4)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M20 or M21 series Booster	N/A	Tetryl	Used with M51 series fuzes.	8 (p. 189, 328-331), 11 (p. 549)
M54A1 Burster	N/A	Composition B	Used with M110A1 (M110E2) and M110A2 (M110E3).	7 (p. 3-89)
M6	N/A	Tetrytol or tetrytol and TNT mixture	Used with M1 burster casing and M21A2 booster. Weight range: 0.36-0.83 pounds	2 (p. 5-12), 7 (p. 3-85), 8 (p. 336, 371), 11 (p. 549)

Fills

Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CNS	13.8	6.25	N/A	N/A	-	8 (p. 371), 9 (p. 32)
FS	14.2-16.9	6.44-7.66	99.4	45.0	-	8 (p. 371), 12 (p. 6)
H	10.3-11.7	4.67-5.30	93.1-95.2	42.2-43.2	-	5 (p. 4-151), 7 (p. 3-81, 3-82), 8 (p. 371)
HD	9.70-11.7	4.39-5.31	92.5-94.5	41.9-42.8	-	3 (p. 4-152), 5 (p. 4-151), 6 (p. 8-25), 7 (p. 3-82)
WP	15.6	7.07	97.5-98.4	44.2-44.6	-	3 (p. 4-152), 5 (p. 4-150), 7 (p. 3-86, 3-90), 8 (p. 371)

Shipping/Packing

Eight projectiles were packed on a pallet that weighed 797 pounds and was approximately 27 by 14 inches (7 p. 3-86, 3-90).

Miscellaneous Information

The M110 was used with M1, M1A1, and M45 Howitzers 155-mm or M2, M2A1 and M46 Gun 155-mm (5 p. 4-150).

Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3)

Key Dates

Projectile, 155-mm, Gun or Howitzer, M110, (M110E1), M110A1 (M110E2), M110A2 (M110E3) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1944	OCM 23555, OCM 23318 (WP 155-mm M110 for howitzer M1)	13 (p. 93)
Standardized	1958	OCM 36841 (HD-fill Standard-A)	14 (p. 36a)

Sources

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10. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.
11. Technical Division. 1944. Catalogue of Standard Ordnance Items, Second Edition 1944, Volume III. Office Chief of Ordnance.
12. Department of Defense. 1957. Military Specification, MIL-P-11807C; Projectiles, 155-MM. Gun And Howitzer, 104 AND M110; WP, FS, HD, and H Filling Assemblies. U.S. Government Printing Office.
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15.11 Projectile, 155-mm, Howitzer, M121, M121A1 (T77)

Figures

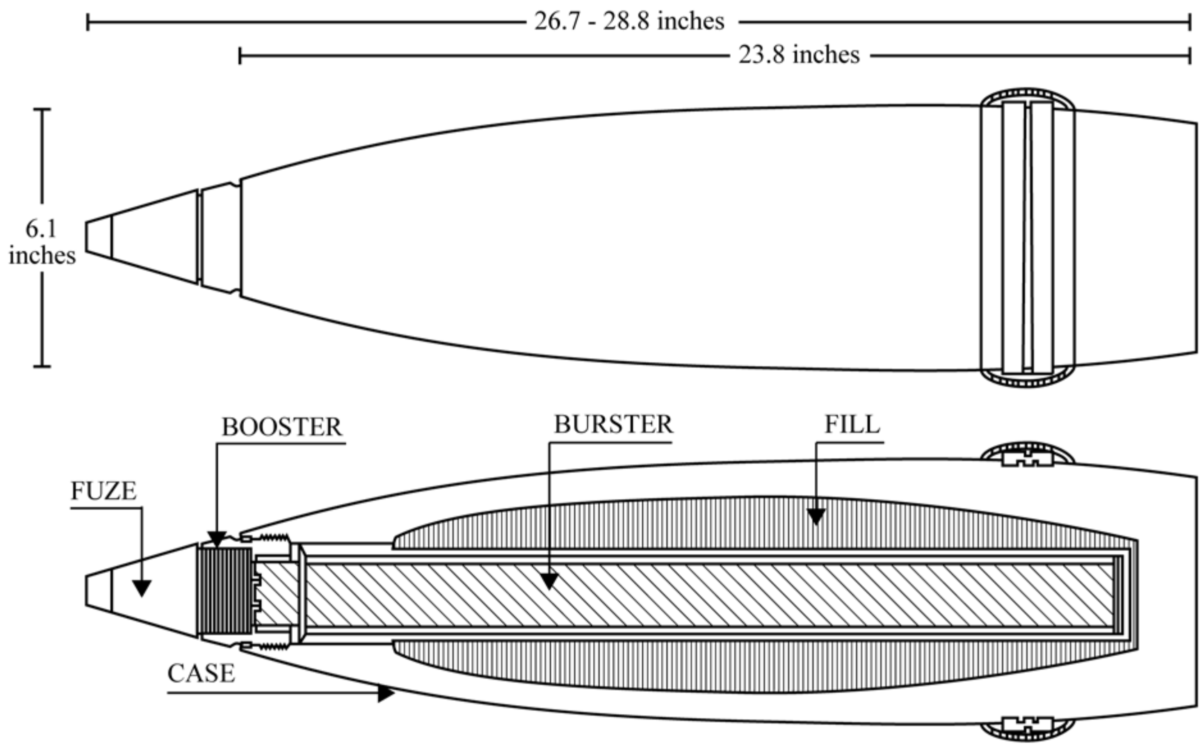

Figure 145: Projectile, 155-mm, Howitzer, M121, M121A1 (T77) - Line Drawing

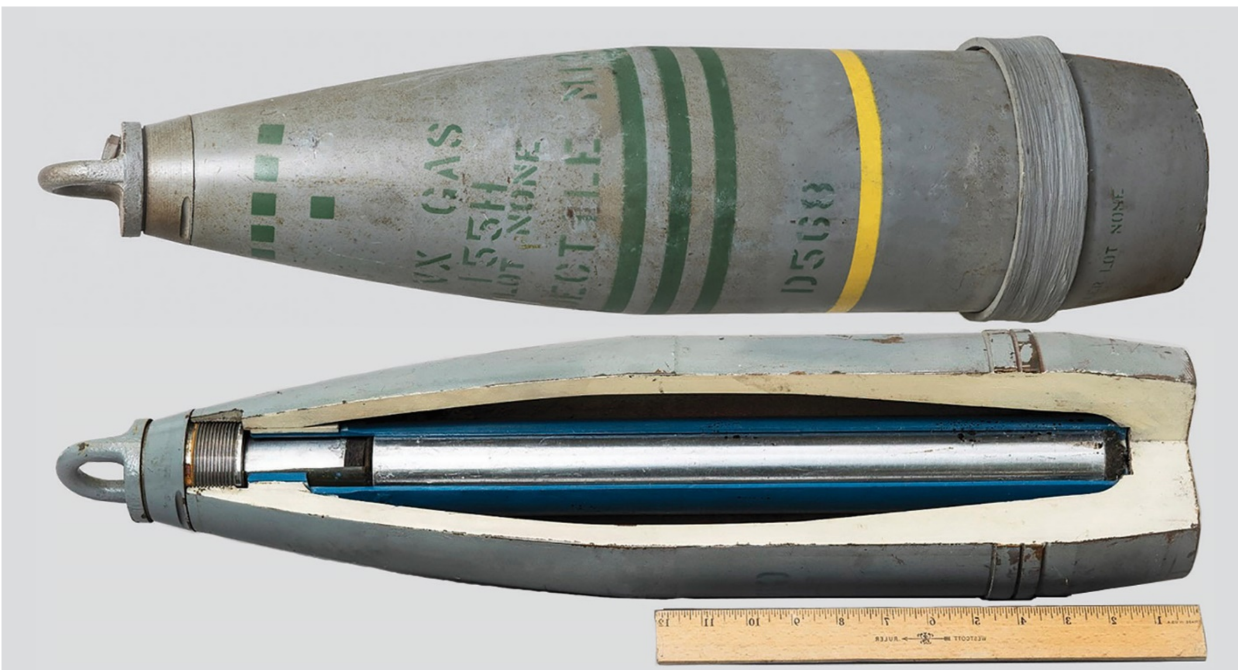

Figure 146: Projectile, 155-mm, Howitzer, M121, M121A1 (T77) - Photograph - Left: Inert (Note: lug inserted), Right: Cutaway

Projectile, 155-mm, Howitzer, M121, M121A1 (T77)

Specifications

Projectile, 155-mm, Howitzer, M121, M121A1 (T77) - Specifications and Other Data		**Citation**
Historical Name	Projectile, 155mm: VX (Persistent) or GB (Non-persistent): M121A1 (T77)	1 (p. 3-105)
Type	Projectile	1 (p. 3-105), 2 (p. 5-8), 3 (p. 32)
Size	155-mm	1 (p. 3-105), 3 (p. 32), 4 (p. 4-145)
Service	Army, Marine Corps	2 (p. 5-8), 4 (p. 146), 5 (p. 4-146), 6 (p. 16)
Diameter	155mm (6.1 inches)	1 (p. 3-106), 2 (p. 5-8), 4 (p. 146), 5 (p. 4-147), 7 (p. 3-105), 8 (p. A-9, A-11)
Length	Fuzed: 26.7 - 28.8 inches (67.8 - 73.15cm) Unfuzed: 23.8 inches (60.45 cm)	1 (p. 3-106), 2 (p. 5-8), 4 (p. 146), 5 (p. 4-149), 7 (p. 3-105), 8 (p. A-9, A-11)
Other Engineering Data	Primer: MK 2A4 The M121 was designated T77 during development.	5 (p. 4-149), 9 (p. 1)
Body Construction Material	Forged, thin walled steel	5 (p. 4-148), 10 (p. 29)
Propellant	M3 (5.5 pounds), or M4A1 (13.19 pounds)	2 (p. 5-8), 4 (p. 146), 5 (p. 4-149)
Maximum Range	14,920 meters (with M4A1 propelling charge)	5 (p. 4-149)
B/M Dwg	75-14-656, 73-1-264, 881031, 8861029	1 (p. 3-106), 2 (p. 5-10), 5 (p. 4-147), 7 (p. 3-105)
NSN	1320-00-892-4186, 1320-059-3536, 1320-143-7009, 1320-028-4890, 1320-529-7346, 1320-567-7909, 1320-00-756-2888, 1320-059-3535, 1320-756-2888	7 (p. 3-106)
FSN	1320-00-756-2888 (VX) 1320-00-143-7009 (GB)	-

General Use and Description

The M121, and M121A1, were designed to provide toxic chemical offensive capability (1 p. 3-106), (2 p. 5-8), (4 p. 146), (5 p. 4-148), (7 p. 3-105).

The projectile was a separate loaded, central burst VX- or GB-filled projectile, which could be used for antipersonnel effects. It was similar to the HE round except for the filling and the burster. The burster casing was one piece, extending the full length of the projectile cavity and was a press-fit into the body. The burster charge contained in a thin tube, and was held in the burster casing by the fuze well cup.

The adapter on the forward end was screwed into the body and was threaded to receive the point detonating fuze. The body was thin-walled steel with a nose formed to a long ogive.

The M121A1 differed from the M121 in that the M121A1 fill was VX and the M121 fill was GB (1 p. 3-106), (2 p. 5-8), (4 p. 145), (5 p. 4-148), (7 p. 3-105).

Explosive Train

When the point detonating fuze was used, the fuze detonated the supplementary charge on impact. The supplementary charge detonated the burster which ruptured the projectile case and heated the agent so that dispersal was in the gaseous state. When a proximity fuze was employed, detonation of the burster tube resulted directly from the action of the fuze booster and occurred on approach to the target (1 p. 3-106), (7 p. 3-105).

Fuzing

Projectile, 155-mm, Howitzer, M121, M121A1 (T77) - Fuzing		
Fuze	**Note**	**Citation**
M508	Point detonating	1 (p. 3-106), 2 (p. 5-8), 4 (p. 146), 5 (p. 4-147), 7 (p. 3-105)
M514	Proximity	2 (p. 5-10)
M514A1	Variable time (VX fill)	2 (p. 5-10), 5 (p. 4-149)
M557	Point detonating	1 (p. 3-106)
M728	Proximity	1 (p. 3-106)
M732	Proximity	1 (p. 3-106)
M739	Point detonating	1 (p. 3-106)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, Howitzer, M121, M121A1 (T77) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M15 casing	2.72 pounds	Composition B	-	2 (p. 5-10)
M37	N/A	Composition B	Used with M15 casing. Weight range 2.0-2.72 pounds.	2 (p. 5-10), 5 (p. 4-149)
M71	2.45 pounds	Composition B	Supplemental charge: 0.3-pound Tetrytol.	1 (p. 3-105), 8 (p. A-9), 10 (p. 29)

Fills

Projectile, 155-mm, Howitzer, M121, M121A1 (T77) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	6.50	2.94	98.9-101	44.8-45.8	Weight shown is for M121.	1 (p. 3-106), 2 (p. 5-8), 3 (p. 32), 4 (p. 146), 5 (p. 4-147), 7 (p. 3-105), 8 (p. A-9)
VX	6.00-6.50	2.72-2.94	98.9-101	44.8-45.8	-	1 (p. 3-106), 2 (p. 5-10), 3 (p. 34), 4 (p. 146), 5 (p. 4-149), 7 (p. 8-32), 8 (p. A-11)

Shipping/Packing

The projectiles were packed eight on a pallet with a total weight of 831 pounds (1 p. 3-106), (8 p. A-9).

Miscellaneous Information

The M121 and M121A1 were used with the M1, M1A1, and M45 howitzer. The M121 VX Chemical Projectile with the M514A1 proximity fuze had the same exterior contour and as-fired weight as the 155-mm HE, MI07 shell.

As of September 1961, there were 41,000 serviceable and 2,000 unserviceable GB-filled M121 projectiles in stock (5 p. 4-147, 4-149), (11).

Key Dates

Projectile, 155-mm, Howitzer, M121, M121A1 (T77) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1954	CCTC 2933 (M121 GB-fill)	12
Standardized	1961	CCTC 3924 (M121A1 GB & VX-fill Standard-A, M121 GB-fill Standard-B)	11

Sources

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15.12 Projectile, 155-mm, Gun, M122 (T179)

Figures

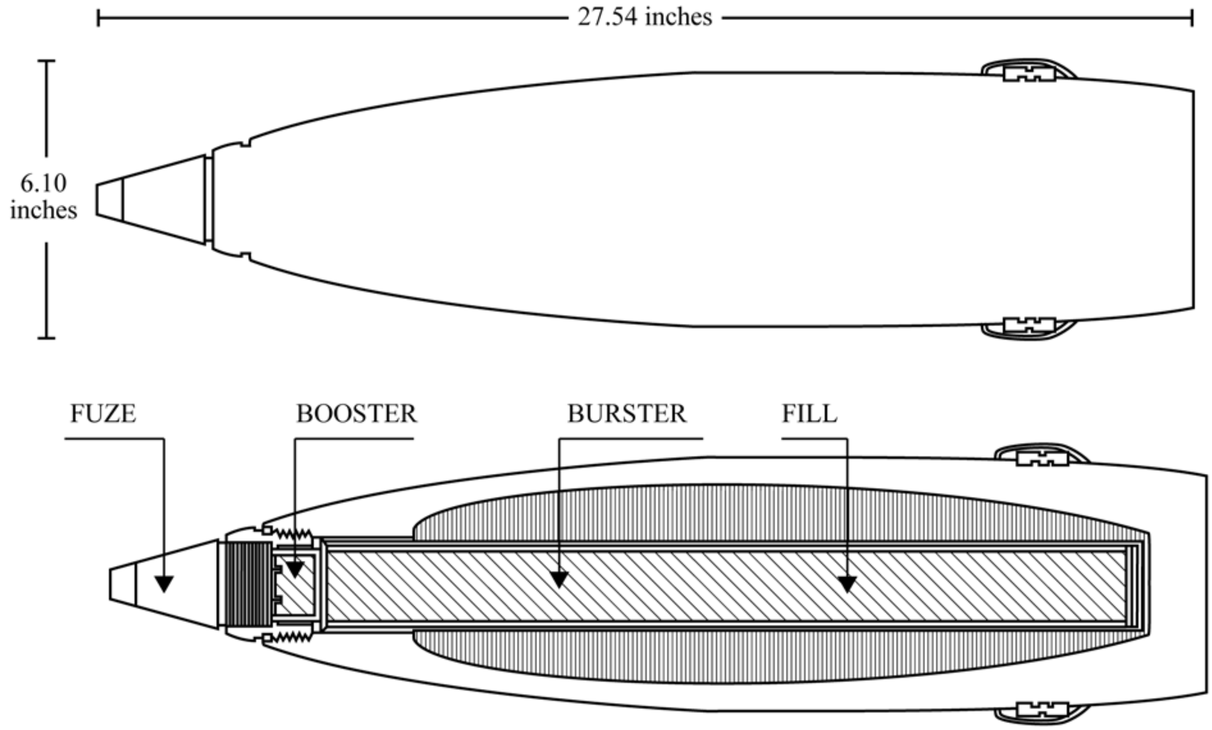

Figure 147: Projectile, 155-mm, Gun, M122 (T179) - Line Drawing

Specifications

Projectile, 155-mm, Gun, M122 (T179) - Specifications and Other Data		**Citation**
Historical Name	Projectile, 155mm: Gas, Nonpersistent GB, M122 (T179)	1 (p. 36a)
Type	Projectile	2 (p. 8-34), 3 (p. 4-157), 4 (p. A-10)
Size	155-mm	2 (p. 8-34), 4 (p. 1-7, A-10), 5 (p. 5-14)
Service	Army, Marine Corps, Navy	3 (p. 4-158), 5 (p. 5-14), 6 (p. 4-157)
Diameter	6.09 inches (155 mm)	2 (p. 8-35), 3 (p. 4-159), 5 (p. 5-14), 6 (p. 4-158)
Length	Fuzed: 27.54 inches (69.9 cm) Unfuzed: 26.7 inches (67.8 cm)	2 (p. 8-35), 3 (p. 4-159), 4 (p. A-10), 5 (p. 5-14), 6 (p. 4-158)
Width	2-inch (5.08 cm) (Rotating band)	2 (p. 8-34), 5 (p. 5-14), 6 (p. 4-157)
Other Engineering Data	The M122 was designated T179 during development.	2 (p. 8-34)
Body Construction Material	Forged steel	2 (p. 8-34), 7 (p. 29.1)
Propellant	Charge: M19, Propellant: M6, 31 pounds	2 (p. 8-35), 5 (p. 5-14), 7 (p. 29.1)
Maximum Range	25,715 yards	2 (p. 8-35), 5 (p. 5-14), 7 (p. 29.1)
B/M Dwg	75-14-704	2 (p. 8-34), 5 (p. 4-159), 6 (p. 4-158)
NSN	1320-00-592-9034 1320-00-529-9033	2 (p. 8-34)

Projectile, 155-mm, Gun, M122 (T179)

General Use and Description

The M122 was designed to provide toxic chemical offensive capability using GB (2), (3), (5), (6).

The M122 consists of forged steel body containing a filler of GB and a burster charge of 4.7 pounds of HE. The burster charge is contained in an aluminum burster tube that extends the full length of the projectile cavity. The burster tube is supported at the forward end by an adapter which holds the point detonating fuze. A two-inch wide rotating band encircles the projectile body near the base and is protected by a grommet which is removed before loading the projectile in the weapon.

The T179 is the same as the shell, chemical, 155-mm, T77 except for the size of the rotating band (2 p. 8-34), (3 p. 4-158), (5 p. 5-14), (6 p. 4-157), (8).

Explosive Train

Upon impact, the point detonating fuze detonates the burster which ruptures the projectile case and heats the chemical agent fill so that dispersal is in the gaseous state (2 p. 8-34), (3 p. 4-158), (5 p. 5-14), (6 p. 4-157).

Fuzing

Projectile, 155-mm, Gun, M122 (T179) - Fuzing		
Fuze	**Note**	**Citation**
M508	Point detonating	2 (p. 8-35), 3 (p. 4-159), 5 (p. 5-14), 6 (p. 4-158)
M557	Point detonating	7 (p. 29.1)
M728	Variable time	7 (p. 29.1)
M739	Point detonating	7 (p. 29.1)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, Gun, M122 (T179) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M16 Burster	4.7 pounds	HE	Used with M37 burster charge	2 (p. 8-34, 8-35)
M17 (T32) Burster casing	N/A	N/A	-	8
M37 Burster	2.75 pounds	Tetrytol	Supplemental charge: 0.3-pound TNT	4 (p. A-10), 7 (p. 29)

Fills

Projectile, 155-mm, Gun, M122 (T179) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	6.50	2.94	97.7-100	44.3-45.4	-	2 (p. 8-34), 3 (p. 4-159), 4 (p. A-10), 5 (p. 5-14), 6 (p. 4-158)

Shipping/Packing

The projectile is packed eight per pallet. The filled pallet weighs approximately 804 pounds (2 p. 8-34), (4 p. A-10).

Miscellaneous Information

The M122 projectile was used with M2, M2A1 and M46 (T80) 155-mm gun (5 p. 5-14).

Projectile, 155-mm, Gun, M122 (T179)

Key Dates

Projectile, 155-mm, Gun, M122 (T179) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1954	CCTC 2934 (GB fill Standard-B)	8

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15.13 Projectile, 155-mm, M687

Figures

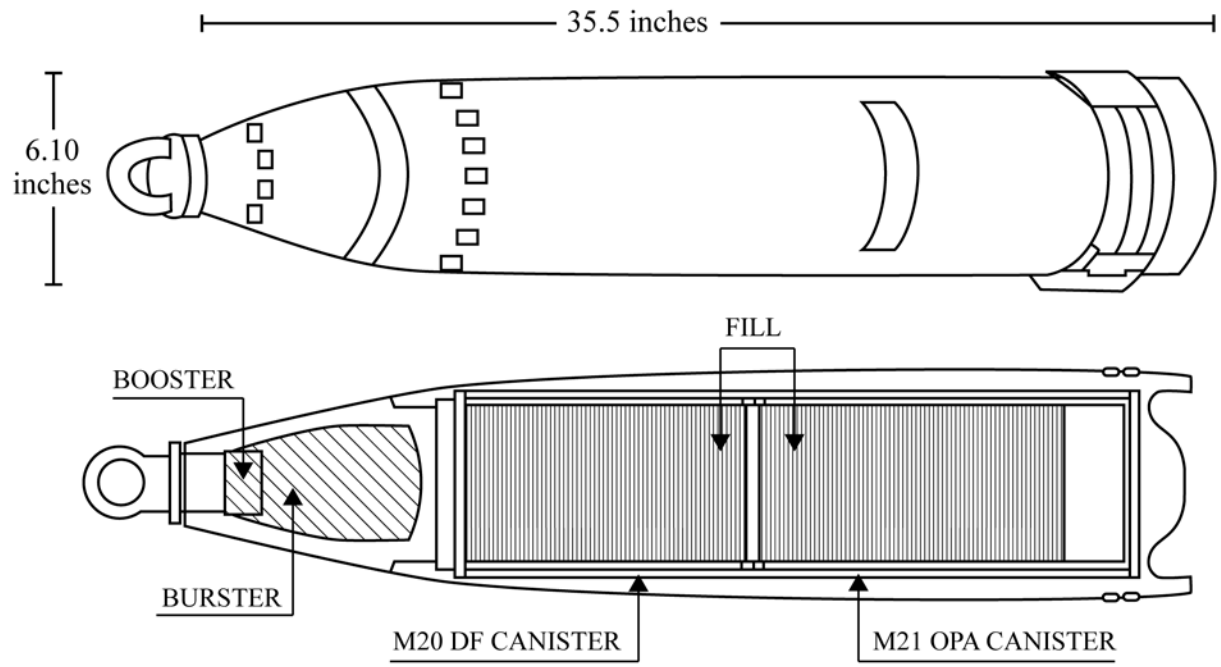

Figure 148: Projectile, 155-mm, M687 - Line Drawing

Figure 149: Projectile, 155-mm, M687 - Photograph - Top: Intact, Bottom: Cutaway View

Projectile, 155-mm, M687

Specifications

Projectile, 155-mm, M687 - Specifications and Other Data		**Citation**
Historical Name	Projectile, 155mm, Gas, GB2 (binary sarin), Binary, M687	1 (p. 8-37)
Type	Projectile	1 (p. 8-37), 2 (p. 3-125)
Size	155-mm	1 (p. 8-37), 2 (p. 3-125)
Conflict	Cold War	-
Service	Army, Navy	1 (p. 3-125)
Diameter	M687: 6.1 inches (155 mm) M20/M21 canisters: 5.0 inches (12.7 cm)	1 (p. 18-38), 2 (p. 3-125), 3 (p. 2-10.2), 4 (p. 1-9)
Length	Unfuzed: 35.5 inches (90.2 cm) Fuzed: 37.0 inches (93.98 cm) M20 DF canister: 7.82 inches (19.87 cm) M21 OPA canister: 13.87 inches (35.23 cm)	1 (p. 1-1), 2 (p. 3-125), 3 (p. 2-10.2), 4 (p. 1-9)
Body Construction Material	Steel	1 (p. 8-37), 2 (p. 3-125)
Propellant	M3 Series, M4 Series, M119 Series, M203 Series propelling charges	2 (p. 3-136, B-9)
B/M Dwg	M687: E15-12-330 M20 Canister: D15-12-61 M21 Canister D15-12-62	2 (p. 3-126)
NSN	1320-00-431-6249 D594	3 (p. 2-10.2), 4 (p. 1-9)

General Use and Description

The M687 Binary 155mm projectile was intended to provide a lethal agent retaliatory capability commensurate with existing system that would not present a lethal agent hazard during storage and handling (1 p. 1-1), (2 p. 3-125), (3 p. 2-10.2), (4 p. 1-1).

The M687 projectile consisted of a modified M485A1 steel projectile body with two separate canisters containing two relatively nontoxic chemicals, an aluminum closed bottom ogive, and a domed steel base. The two canisters combine during functioning to produce the lethal agent GB2 for release on target. The closed bottom ogive contained the explosive burster (Composition-B/Oxamide), the projectile body was internally keyed to prevent relative spin of the canister during launch and flight. The improved domed steel base allowed firing with the M203/M203A1 propelling charge in the M198 howitzer (1 p. 1-1), (2 p. 3-125), (3 p. 2-10.1), (4 p. 1-1).

Explosive Train

When the weapon was fired, the burning propellant charge generated rapidly expanding gases to propel the projectile through the barrel with the velocity required to reach to target. Setback forces ruptured the adjacent rupture discs, which allowed the methylphosphonic difluoride (DF) in the M20 canister and an isopropyl alcohol and isopropylamine solution (OPA) in the M21 canister to combine. The in-flight spin aided in the mixing of DF and OPA; the chemical reaction from the two chemicals would produce the lethal agent GB2. The fuze used would start the chain reaction of exploding the M687 projectile, which would then release the lethal agent into the atmosphere (1 p. 1-1), (2 p. 3-125), (3 p. 2-10.1), (4).

Fuzing

Projectile, 155-mm, M687 - Fuzing		
Fuze	**Note**	**Citation**
M557	Point detonating	1 (p. 8-38), 2 (p. 3-126, B-4), 3 (p. 2-10.1), 4 (p. 1-1), 5
M572	Point detonating	2 (p. B-4)
M739	Point detonating	2 (p. 3-126), 3 (p. 2-10.1), 4 (p. 1-1)
M739A1	Point detonating	2 (p. 3-126), 3 (p. 2-10.1)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, M687 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M57 Burster	N/A	Composition B/oxamide	Weight range 2.20-2.27 pounds	1 (p. 8-38), 2 (p. 3-125), 3 (p. 2-10.2)

Fills

Projectile, 155-mm, M687 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	24.2-24.6	10.9-11.1	93.0	42.2	Agent GB2 (binary sarin). The forward container held 10.1 pounds of DF, while a rear container held 14.5 pounds of OPA.	1 (p. 1-1), 2 (p. 3-125), 3 (p. 2-10.2), 4 (p. 1-9)

Shipping/Packing

For safety reasons, the M687 projectiles were shipped and stored with only the aft M21 OPA canister in place and a forward and aft spacer filling the cavity provided for the M20 DF canister. The M20 DF canisters were individually packed in a fiberboard container with eight canisters in packed in a wooden shipping and storage container.

Eight projectiles were packed and stored horizontally on a pallet. Loaded pallets were 784 pounds and were packed per 36 x 32 x 25 inches (2 p. 3-126), (4 p. 1-1).

Miscellaneous Information

The M687 projectile was delivered by an M185 cannon on the M109A2 and M109A3 howitzer; the M199 cannon on the M198 howitzer; or the M1A2 cannon on the M114A2 howitzer (2 p. 3-126), (3 p. 2-10.1), (4 p. 1-1).

Key Dates

Projectile, 155-mm, M687 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Type Classified	1977	MSR 01776009 (Standard)	5 (p. 129)

Sources

1. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.

2. Department of the Army. 1994. Technical Manual, TM 43-0001-28, Army Ammunition Data Sheets for Artillery Ammunition: Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers and Artillery Fuzes. U.S. Government Printing Office.

3. Department of the Army. 1982. Technical Manual, TM 43-0001-26-2, Army Equipment Data Sheets, Chemical Weapons and Munitions. U.S. Government Printing Office.

4. Headquarters, Department of the Army. 1989. Technical Manual, TM 3-1320-242-10, Operators Manual Projectile, 155 millimeter: GB2, M687 NSN 1320-00-431-6249. Department of the Army.

5. Department of the Army. 1977. Materiel Status Record Submission, MSR 08776018, Reclassification of Smoke Tank, Airplane: M10 and Accessory Equipment as Obsolete. Headquarters, United States Army Armament Command.

15.14 Projectile, 155-mm, Howitzer, T387

Figures

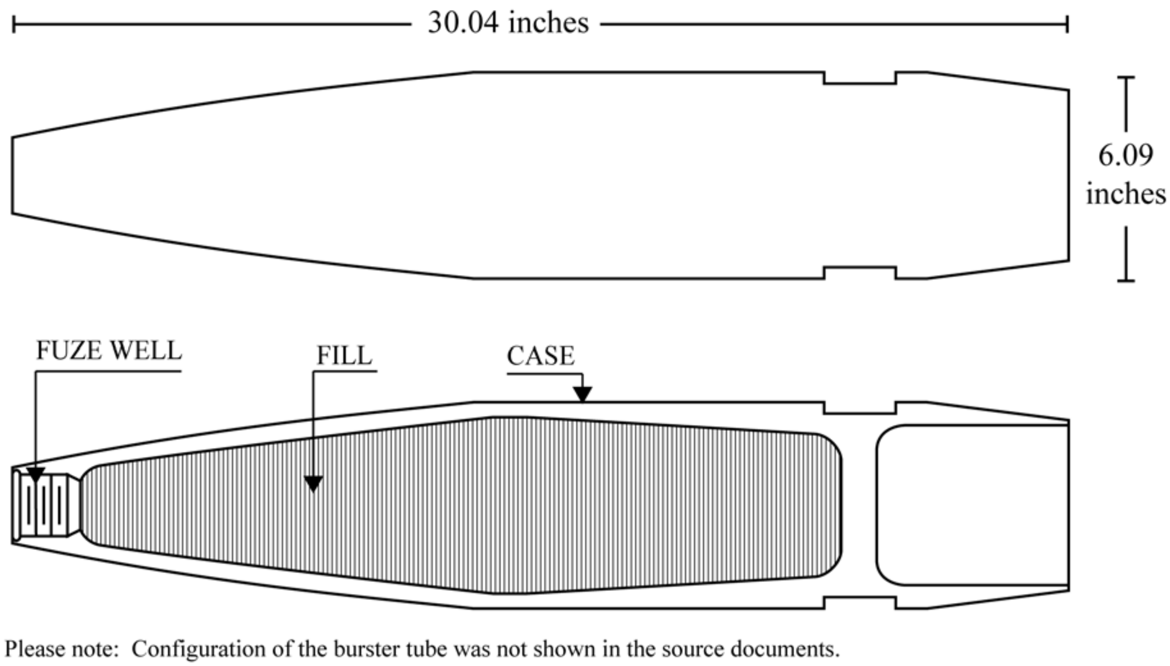

Figure 150: Projectile, 155-mm, Howitzer, T387 - Line Drawing (Note: unfuzed)

Specifications

Projectile, 155-mm, Howitzer, T387 - Specifications and Other Data		**Citation**
Historical Name	Projectile, Howitzer, Gas, Persistent, VX, 155mm, T387	1 (p. 4-160)
Type	Projectile	2 (p. 4-159)
Size	155-mm	2 (p. 4-159)
Service	Navy	2
Diameter	6.09 inches (15.45 cm)	1 (p. 4-161), 2 (p. 4-160)
Length	30.04 inches (77.22 cm) with fuze	1 (p. 4-161), 2 (p. 4-160)
Height	155 mm (6 inches)	1 (p. 4-161), 2 (p. 4-160)
Other Engineering Data	Primer T106 was used and was to be replaced by XM82.	1 (p. 4-161), 2 (p. 4-160)
Propellant	T34 (15 pounds)	1 (p. 4-161), 2 (p. 4-160)
Maximum Range	2,898-20,013 yards	2 (p. 4-160)
B/M Dwg	FD 21551	1 (p. 4-161)

General Use and Description

The T387 projectile was designed to provide a long range toxic chemical offensive capability (1 p. 4-160), (2 p. 4-159).

This was a thin-walled, extended range, projectile that held approximately 50% more agent than the M121. It was a separate loaded, central burst round filled with VX for antipersonnel effects. It was similar to the HE round except for the filling and the burster. The burster charge, contained in a thin metal tube, was held in place in the burster casing by a fuze well cup.

The forward end of the burster casing was assembled to the adapter in the nose of the round and extended the full length of the cavity. The adapter was thin-walled steel with a nose formed to a long ogive. A single rotating band was located near the base of the projectile.

The T387 was used with the M1, M1A1 and M45 howitzers 155-mm (1 p. 4-159, 4-160), (2 p. 4-159).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Projectile, 155-mm, Howitzer, T387 - Fuzing		
Fuze	**Note**	**Citation**
M513	Variable time	1 (p. 4-161), 2 (p. 4-160)
M514	Point detonating	2 (p. 4-159, 4-160)

Booster, Adapter-Booster, or Burster

Projectile, 155-mm, Howitzer, T387 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	1.25 pounds	HE	-	1 (p. 4-161)

Fills

Projectile, 155-mm, Howitzer, T387 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
VX	9.50	4.30	95.0	43.0	-	1 (p. 4-160), 2 (p. 4-159)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
2. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

15.15 Projectile, 175-mm, Gun, T223

Figures

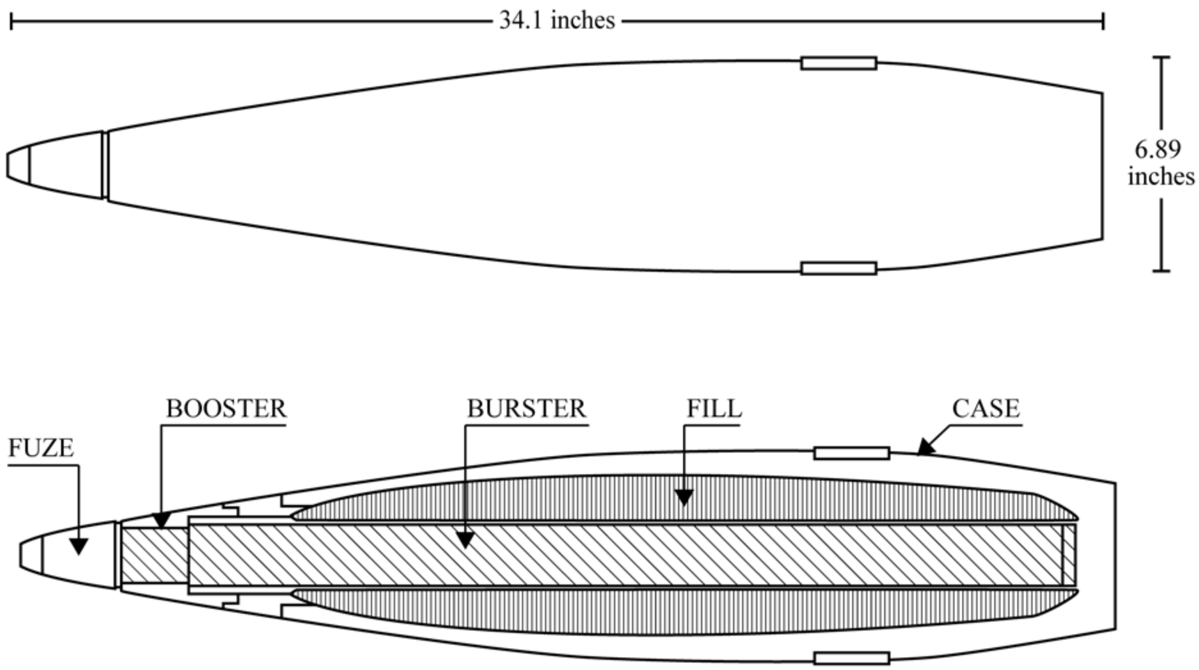

Figure 151: Projectile, 175-mm, Gun, T223 - Line Drawing

Specifications

Projectile, 175-mm, Gun, T223 - Specifications and Other Data		**Citation**
Historical Name	Projectile, 175mm, Gun (GB) T-223	1 (p. 4-163)
Type	Projectile	2 (p. 4-164)
Size	175-mm	1 (p. 4-163), 2 (p. 4-164)
Service	Navy	1 (p. 4-163)
Diameter	6.89 inches (175 mm)	1 (p. 4-163), 2 (p. 4-165)
Length	34.1 inches (86.7 cm)	1 (p. 4-164), 2 (p. 4-165)
Other Engineering Data	The T223 was used with 175 mm gun T145 or T256. The T-223 was not standardized.	1 (p. 4-164), 2 (p. 4-165)
Maximum Range	35,000 yards	1 (p. 4-164)

General Use and Description

The T223 was designed to provide a toxic chemical offensive capability for an antipersonnel effect (1 p. 4-163), (2 p. 4-164).

The T223 was a separate loaded, central burst munition that was used for antipersonnel effects. 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 (1 p. 4-163), (2 p. 4-165).

Projectile, 175-mm, Gun, T223

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Projectile, 175-mm, Gun, T223 - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Point detonating	1 (p. 4-163), 2 (p. 4-164)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Projectile, 175-mm, Gun, T223 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	14.7	6.66	147	66.6	-	1 (p. 4-164), 2 (p. 4-164)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The T223 was a non-standard item that was undergoing engineering tests in the 1960s (1 p. 4-163), (2 p. 4-164).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

15.16 Projectile, 240-mm, Field Artillery, Howitzer, M1918

Figures

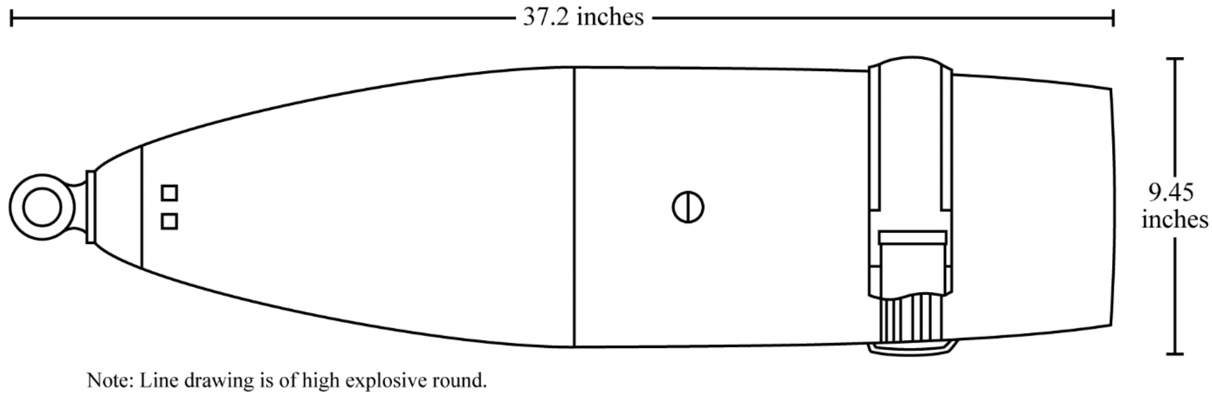

Figure 152: Projectile, 240-mm, Field Artillery, Howitzer, M1918 - Line Drawing

Specifications

Projectile, 240-mm, Field Artillery, Howitzer, M1918 - Specifications and Other Data		Citation
Historical Name	240-mm Heavy Howitzer	1 (p. 462)
Type	Projectile	1 (p. 462)
Size	240-mm	1 (p. 477), 2 (p. 208), 3 (p. 24)
Conflict	WWI	1 (p. 462, 477), 3 (p. 26)
Diameter	240 mm (9.45 inch)	2 (p. 209)
Length	37.2 inches (94.49 cm) (including eyebolt)	2 (p. 209)
Other Engineering Data	boat-tailed	2 (p. 209)

General Use and Description

Available references did not provide information on specific use.

When the United States entered WWI, it was decided to adopt types of artillery in use by the Allies to facilitate early quantity production and to secure as much uniformity in artillery materiel as possible. Accordingly, the United States was equipped with the 240-mm heavy Howitzer. Chemical shells were approved for this caliber; however, no available information suggests that chemical fills were implemented (1 p. 495), (2 p. 208-209).

Explosive Train

Available references did not provide specific information on explosive train.

Projectile, 240-mm, Field Artillery, Howitzer, M1918

Fuzing

Projectile, 240-mm, Field Artillery, Howitzer, M1918 - Fuzing		
Fuze	**Note**	**Citation**
French I. A. Model 1915	Point detonating, superquick	4 (p. 60, 62)
French I.A.L. Model 1916	Point detonating, superquick	4 (p. 60, 62)
French R.Y. Model 1917	Point detonating; only to be used if other fuzes were unavailable	4 (p. 60, 62)
Modified British No. 106	Point detonating, superquick	4 (p. 42, 62)
U.S. Mark III	Point detonating, superquick	4 (p. 36, 62)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Projectile, 240-mm, Field Artillery, Howitzer, M1918 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BA	54.4	24.6	356	161	Chemical fill volumes were based on the HE shell. (Approved, but not fielded)	1 (p. 462), 3 (p. 24), 4 (p. 24)
CA	40.4	18.3	343-342	155	-	1 (p. 462), 3 (p. 24), 4 (p. 24)
CG	36.5	16.5	340	154	-	1 (p. 462), 3 (p. 24), 4 (p. 24)
FM	47.4	21.5	350	159	-	1 (p. 462), 3 (p. 24), 4 (p. 24)
H	37.5	17.0	341	155	-	1 (p. 462), 3 (p. 24), 4 (p. 24)
HE	49.8	22.6	345	156	-	1 (p. 462), 3 (p. 24), 4 (p. 24)
NC	48.2	21.8	351	159	-	1 (p. 462), 3 (p. 24), 4 (p. 24)
PS	45.3	20.5	348	157	-	1 (p. 462), 3 (p. 24), 4 (p. 24)
WP	52.6	23.8	356	161	-	1 (p. 462), 3 (p. 24), 4 (p. 24)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Prentiss, Augustin M. 1937. Chemicals in War: A Treatise on Chemical Warfare. McGraw-Hill Book Company, Inc.

2. War Department. 1944. Technical Manual, TM 9-1901, Artillery Ammunition, 29 June 1944. War Department.

3. American Expeditionary Forces. 1919. Gas Manual Part II, Use of Gas by the Artillery, A.E.F. No. 1475-2 G-5. War Department.

4. Army Ordnance. 1921. No. 1939, History of Artillery Projectiles, 1917-1919. Government Printing Office.

15.17 Projectile, 4.7-inch, Common Steel, MK II, MK V

Figures

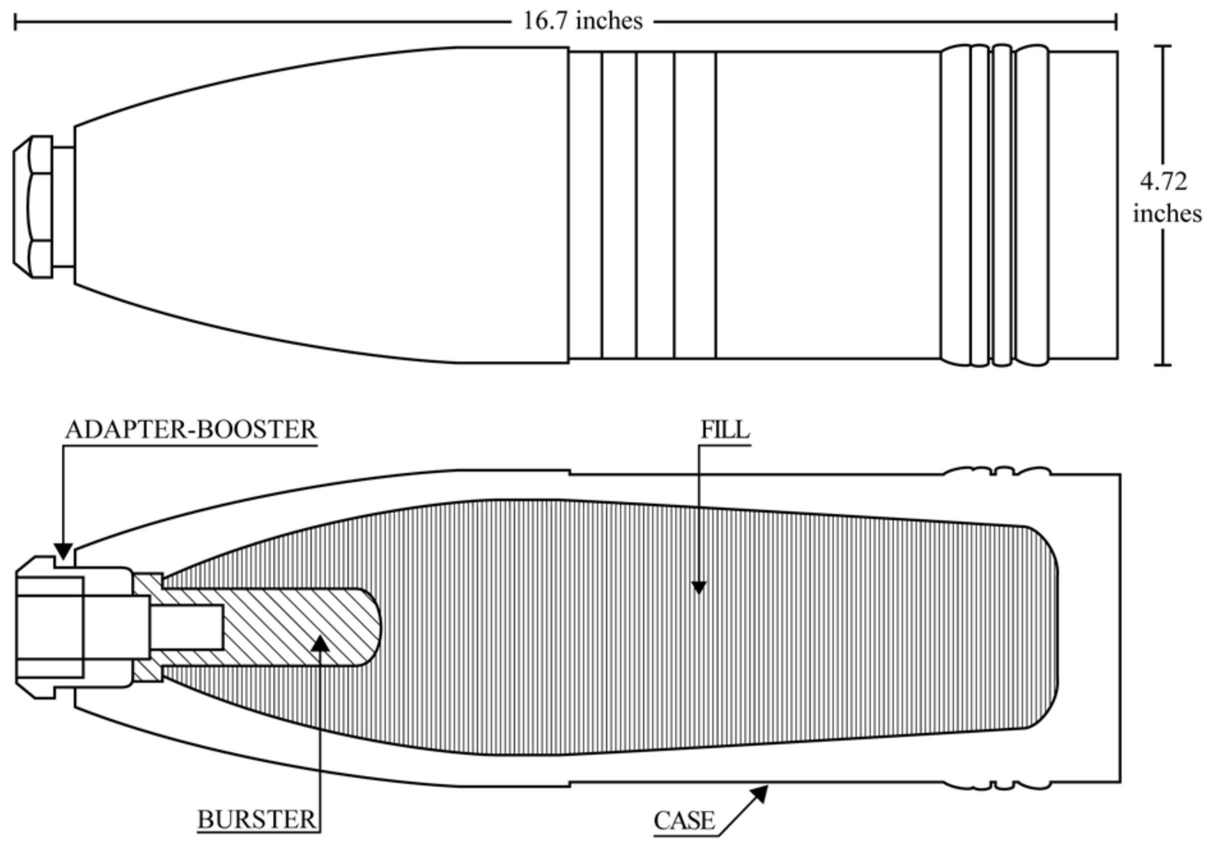

Figure 153: Projectile, 4.7-inch, Common Steel, MK II, MK V - Line Drawing

Specifications

Projectile, 4.7-inch, Common Steel, MK II, MK V - Specifications and Other Data		**Citation**
Historical Name	4.7-Inch, Common Steel Shell, MK II, MK V	1 (p. 46-47)
Type	Projectile	1 (p. 46)
Size	4.7-inch	1 (p. 46)
Conflict	WWI	1
Diameter	4.72 inches (11.99 cm)	1 (p. 46-47)
Length	16.7 inches (42.4 cm)	1 (p. 46-47)
Body Construction Material	MK II - Steel MK IV - Semi-steel	1 (p. 46)
B/M Dwg	75-2-172 (MK II) 75-2-183 (MK IV)	2 (p. 40)

General Use and Description

Available references did not provide information on specific use.

When the United States entered WWI, it was decided to adopt types of artillery in use by the Allies to facilitate early quantity production and to secure as much uniformity in artillery materiel as possible. Accordingly, U.S. artillery was equipped with 4.7-inch guns. The common steel shell was provided with an ogival head, and was fitted with a copper rotating band. Chemical shells were provided with pipe-threading securing a gastight closure between the gaine and the projectile body. A 4.7-inch semi-steel shell MK V was also developed which differed from the steel shell only in that the net capacity was reduced from 92.4 cubic inches to 90.9 cubic inches (1 p. 46).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Projectile, 4.7-inch, Common Steel, MK II, MK V - Fuzing		
Fuze	**Note**	**Citation**
French Model 1915	Point detonating, superquick	1 (p. 34, 46)
French Model 1916	Point detonating, superquick	1 (p. 34, 46)
French R.Y. Model 1917	Point detonating, superquick; only to be used if other fuzes were unavailable	1 (p. 38, 46)
Modified British No. 106	Point detonating, superquick	1 (p. 42, 46)
U.S. Mark III	Point detonating, superquick	1 (p. 34, 46)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Projectile, 4.7-inch, Common Steel, MK II, MK V - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BA	6.36	2.88	43.8	19.8	-	1 (p. 24, 46)
CA	4.44-5.73	2.01-2.59	41.8-45.0	18.9-20.4	-	1 (p. 24, 46), 3
CG	4.27-5.04	1.93-2.28	41.7-45.0	18.9-20.4	-	1 (p. 24, 46), 2 (p. 42), 3
FM	5.53-6.50	2.00-2.94	42.9-45.0	19.4-20.4	-	1 (p. 24, 46), 3
H	4.38-4.73	1.98-2.14	41.8-45.0	18.9-20.4	-	1 (p. 24, 46), 3
NC	5.62-6.47	2.54-2.93	43.0-45.0	19.5-20.4	-	1 (p. 24, 46), 3
PS	5.30-6.16	2.40-2.79	42.7-45.0	19.3-20.4	-	1 (p. 24, 46), 3
WP	6.14-6.98	2.78-3.16	43.5-45.0	19.9-20.4	-	1 (p. 24, 46), 3

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. American Expeditionary Forces. 1919. Gas Manual Part II, Use of Gas by the Artillery, A.E.F. No. 1475-2 G-5. War Department.

2. Army Ordnance. 1921. No. 1939, History of Artillery Projectiles, 1917-1919. Government Printing Office.

3. Edgewood Arsenal. 1921. Weight of Chemical Fillings (NARA II. RG 175. E 1 (P1-8). Box 520.). Mechanical Division.

15.18 Projectile, 5-inch, Common Steel, MK VI

Figures

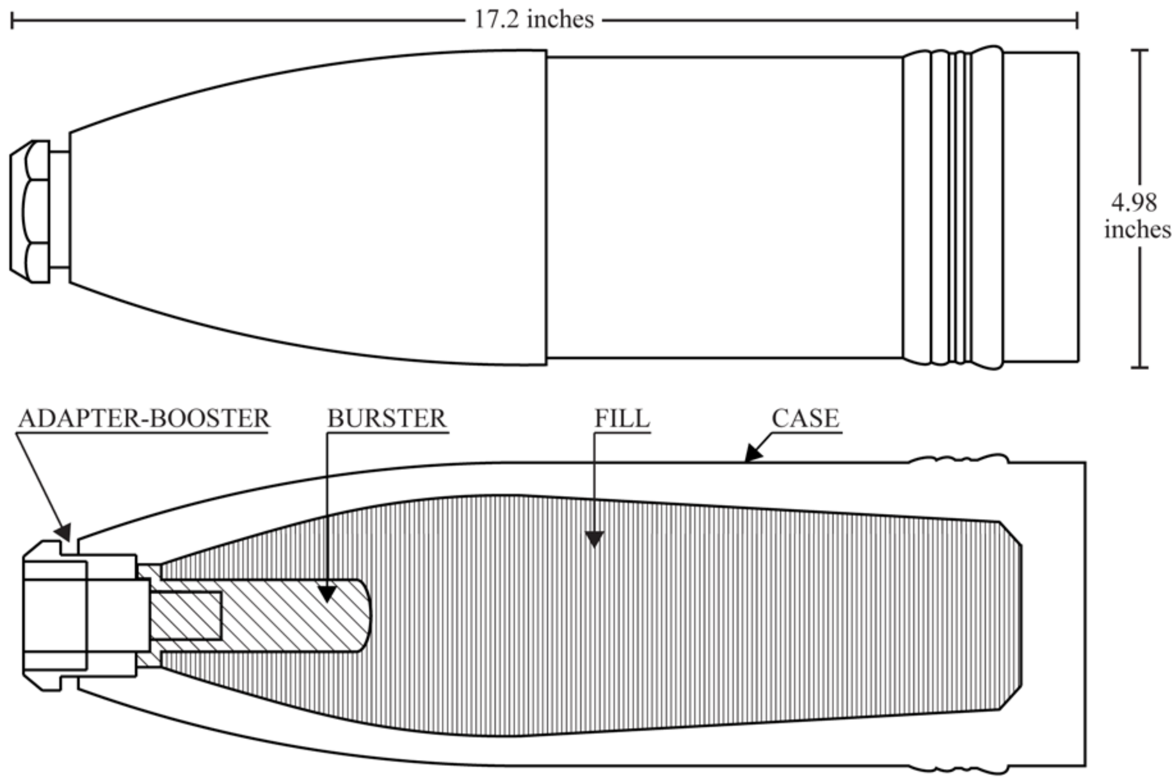

Figure 154: Projectile, 5-inch, Common Steel, MK VI - Line Drawing

Specifications

Projectile, 5-inch, Common Steel, MK VI - Specifications and Other Data		**Citation**
Historical Name	5-Inch, Common Steel Shell, MK VI	1 (p. 48-49)
Type	Projectile	1 (p. 24)
Size	5-inch	1 (p. 49)
Conflict	WWI	1 (p. 48)
Diameter	4.98 inches (12.6548 cm)	1 (p. 48)
Length	17.2 inches (43.69 cm)	1 (p. 48)
Other	0.48-inch thickness	1 (p. 48)
Other Engineering Data	The shell weighed 42.84 pounds (19.43 kilograms) when empty.	1 (p. 24)
Body Construction Material	Steel	1 (p. 48)

General Use and Description

Available references did not provide information on specific use.

When the United States entered WWI, it was decided to adopt types of artillery in use by the Allies to facilitate early quantity production and to secure as much uniformity in artillery materiel as possible. Accordingly, U.S. artillery was equipped with 5-inch guns. The common steel shell was provided with an ogival head, and was fitted with a copper rotating band. Chemical shells were pipe-threaded to ensure a gastight closure between the gaine and the projectile body. A 5-inch semi-steel shell was also developed, which differed from the steel projectile only in the reduced internal cavity (1 p. 48-49).

Explosive Train

Available references did not provide specific information on explosive train.

Fuzing

Projectile, 5-inch, Common Steel, MK VI - Fuzing		
Fuze	**Note**	**Citation**
French I. A. L. Model 1916	Point detonating, superquick	1 (p. 34, 49)
French I. A. Model 1915	Point detonating, superquick	1 (p. 34, 49)
French R.Y.	Point detonating, superquick; only to be used if other fuzes were unavailable	1 (p. 34, 49)
Mark III	Point detonating, superquick	1 (p. 34, 49)
Modified British No. 106	Point detonating, superquick	1 (p. 34, 49)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Projectile, 5-inch, Common Steel, MK VI - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
FM	6.79	3.07	49.6	22.5	Without fuze.	1 (p. 24)
H	5.38	2.44	48.2	21.8	Without fuze.	1 (p. 24)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. American Expeditionary Forces. 1919. Gas Manual Part II, Use of Gas by the Artillery, A.E.F. No. 1475-2 G-5. War Department.

15.19 Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0

Figures

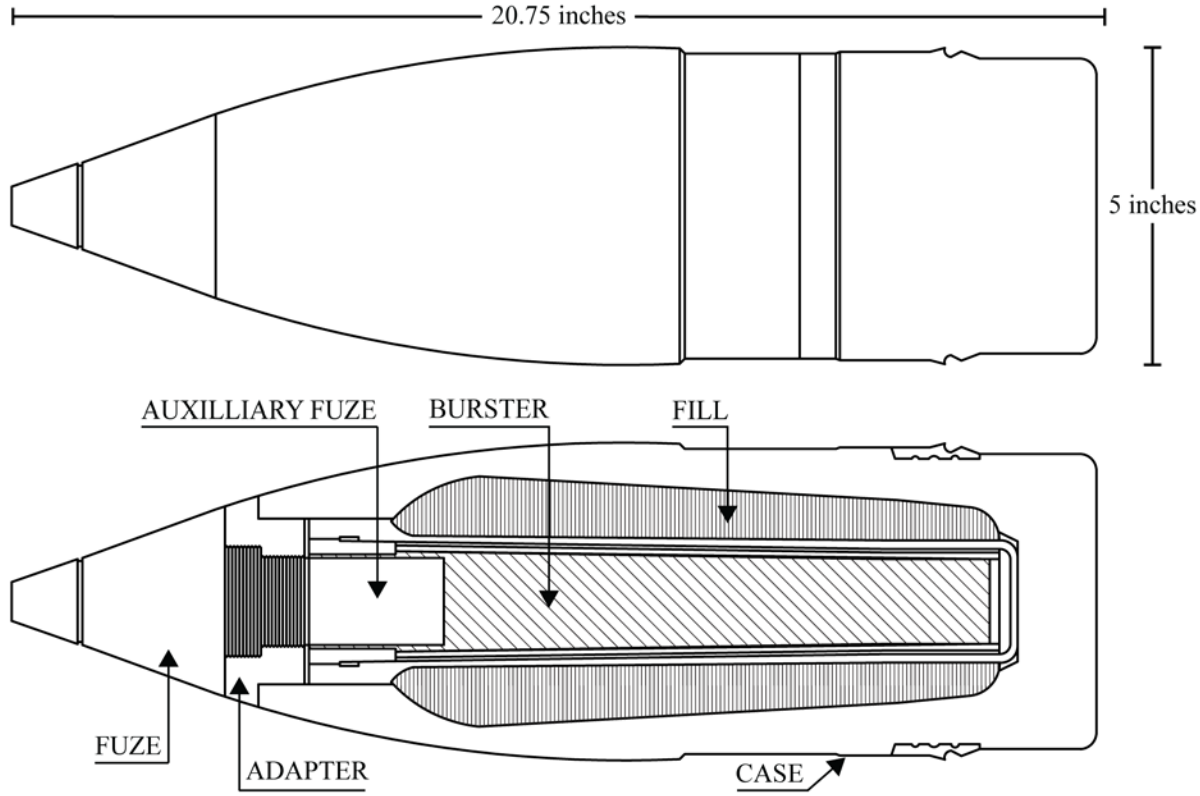

Figure 155: Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0 - Line Drawing

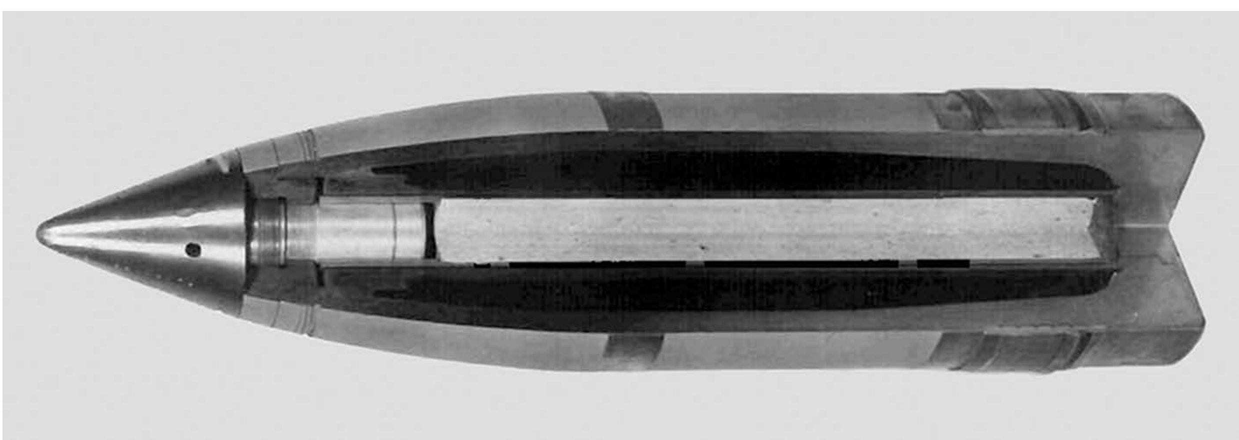

Figure 156: Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0 - Photograph - EX 34

Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0

Specifications

Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0 - Specifications and Other Data		**Citation**
Historical Name	Projectile, Gun, 5-Inch/38, Gas (GB), MK 53 Mod 0	1 (p. 4-135)
Type	Projectile	1 (p. 4-135), 2 (p. 1)
Size	5-inch/.38 Caliber	1 (p. 4-135)
Service	Navy	2 (p. 1), 3 (p. 16)
Diameter	5 inches (12.7 cm)	1 (p. 4-136), 2 (p. 2)
Length	20.75 inches (52.7 cm) with fuze	1 (p. 4-136), 2 (p. 2)
Propellant	MK5 Mod 0	1 (p. 4-136)
Maximum Range	17,280 yards	2 (p. 2)

General Use and Description

The MK 53 was used for antipersonnel effects (1 p. 4-135).

The MK 53 was a semifixed, central burst gas projectile loaded with GB and used for antipersonnel effects. A central burster tube extended the full length of the projectile cavity and was press fit into the fuze adapter. A one-piece forging eliminated joints, and minimized leakage possibilities (1 p. 4-136).

Explosive Train

A point detonating fuze with auxiliary booster was located on the forward end of the projectile, which on functioning initiated the burster charge to explode the projectile and release the chemical agent fill (1 p. 4-135).

Fuzing

Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0 - Fuzing		
Fuze	**Note**	**Citation**
AD-MK54 Mod 1	Auxiliary	1 (p. 4-136)
MK29 Mod3	-	1 (p. 4-136)

Booster, Adapter-Booster, or Burster

Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	1.5 pounds	Explosive D	-	1 (p. 4-136), 2 (p. 2)

Fills

Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	3.25-3.30	1.47-1.49	55.2-56.3	25.0-25.5	-	1 (p. 4-136), 2 (p. 13)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The MK 53 Mod 0 was designated EX 34 during development (1 p. 4-136).

Projectile, 5-inch/.38 Caliber, Gun, MK 53 Mod 0

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
2. Pascazio, A.J., & Norton, J.E. 1957. CWL Technical Memorandum 30-17, Navy Gas Projectile, 5"/38, EX 34, Mod 0, Development of (U). Chemical Warfare Laboratories.
3. Departments of the Army, Navy, and Air Force. 1966. Field Manual, FM 3-10, Employment of Chemical and Biological Agents. Department of the Army.

15.20 Projectile, 5-Inch/.54 Caliber, Gun, MK 54 Mod 0

Figures

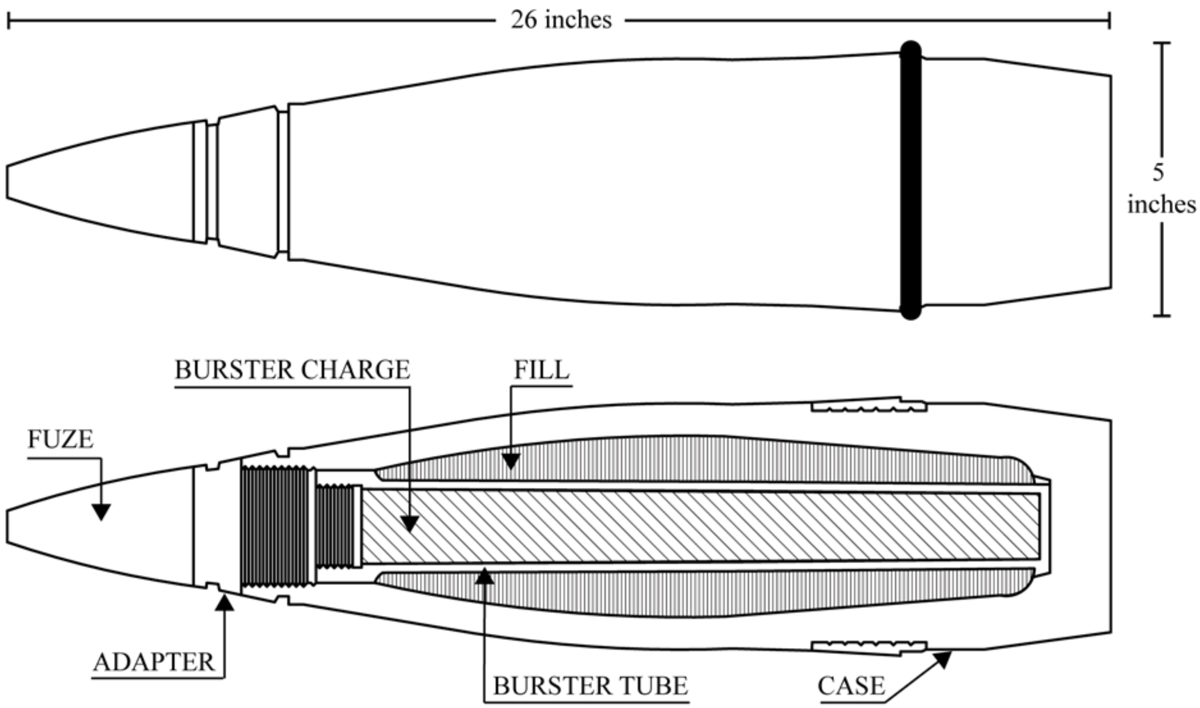

Figure 157: Projectile, 5-Inch/.54 Caliber, Gun, MK 54 Mod 0 - Line Drawing

Specifications

Projectile, 5-Inch/.54 Caliber, Gun, MK 54 Mod 0 - Specifications and Other Data		Citation
Historical Name	Projectile, Gun, Gas, Nonpersistent, GB, 5-Inch/54, MK 54 Mod 0	1 (p. 4-140)
Type	Projectile	1 (p. 4-140)
Size	5-Inch/.54 Caliber	1 (p. 4-140), 2 (p. 3)
Service	Navy	3 (p. 4-139), 4 (p. 16)
Diameter	5 inches (12.7 cm)	3 (p. 4-140)
Length	26 inches (66.04 cm)	3 (p. 4-140)
Other Engineering Data	The MK 54 was designated EX 36 during development.	1 (p. 4-141), 2, 3 (p. 4-139)
Body Construction Material	Burster casing: steel alloy Burster tube: steel alloy	2 (p. 8)
B/M Dwg	75-4-85	-

General Use and Description

The MK 54 Mod 0 projectile was designed to provide ships with toxic chemical offensive capability (3 p. 4-139).

This was a semifixed, central burst projectile loaded with GB and used for antipersonnel effects. The projectile was unique in that the stress figures for the metal components were markedly more robust than for other projectiles due to the high acceleration required to reach the desired muzzle velocity. One-piece forged construction and accurately machined press fit closures eliminated joints, minimized leakage possibilities, and provided maximum safety. A burster tube extended the entire length of the projectile cavity and was press fit into the fuze adapter (3 p. 4-139).

Explosive Train

A point detonating fuze with auxiliary booster was located on the forward end, which on functioning initiated the burster charge to explode the projectile and release the chemical agent fill (3 p. 4-139).

Fuzing

Projectile, 5-Inch/.54 Caliber, Gun, MK 54 Mod 0 - Fuzing		
Fuze	**Note**	**Citation**
MK 30 Mod 3	-	3 (p. 4-140)
MK 30 Mod 4	Point detonating, used with fuze auxiliary detonator MK 43	2 (p. 8)
MK 43-AD	Auxiliary detonator	2 (p. 8), 3 (p. 4-140)

Booster, Adapter-Booster, or Burster

Projectile, 5-Inch/.54 Caliber, Gun, MK 54 Mod 0 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	1.75 pounds	Explosive "D"	-	2 (p. 8), 3 (p. 4-140)

Fills

Projectile, 5-Inch/.54 Caliber, Gun, MK 54 Mod 0 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	4.20-4.75	1.90-21.5	64.0	29.0	-	2 (p. 8), 3 (p. 4-140), 4 (p. 16)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The flight characteristics of the MK 54 were similar to the MK 41 HC projectile, which was used for prototype design (2 p. 8), (3 p. 4-139).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
2. Dugway Proving Ground. 1960. Dugway Proving Ground Report, DPGR 245, Final Engineering Testing of the 5"/54 Gas Projectile (Navy) (U), Volume I: Physical and Dissemination Testing. U.S. Army Chemical Corp Research and Development Command.
3. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
4. Departments of the Army, Navy, and Air Force. 1966. Field Manual, FM 3-10, Employment of Chemical and Biological Agents. Department of the Army.

15.21 Projectile, 6-inch, Common Steel, MK III

Figures

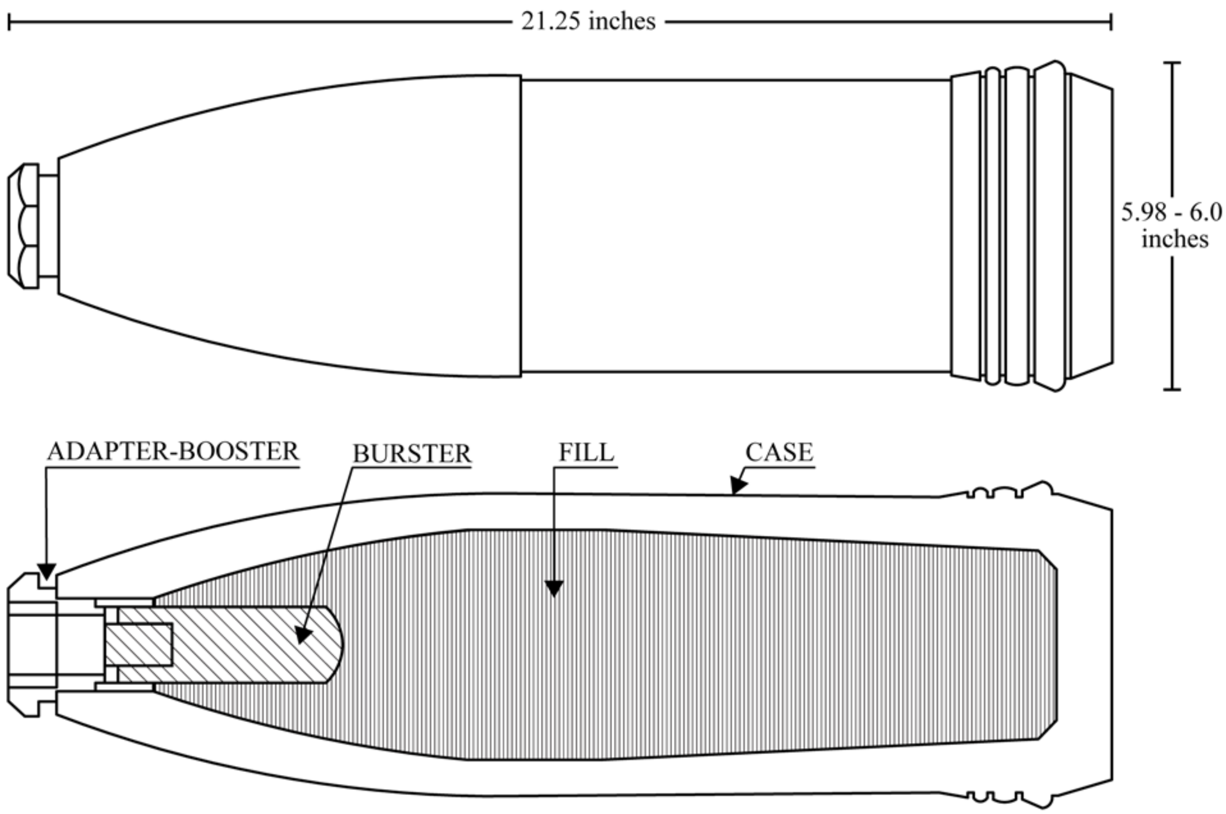

Figure 158: Projectile, 6-inch, Common Steel, MK III - Line Drawing

Specifications

Projectile, 6-inch, Common Steel, MK III - Specifications and Other Data		Citation
Historical Name	6-Inch Common Steel Shell, MK III	1 (p. 50, 51)
Type	Projectile	1 (p. 50)
Size	6-inch	1 (p. 50)
Conflict	WWI	1 (p. 50)
Diameter	5.98-6.0 inches (15.19-15.2 cm)	1 (p. 50-51)
Length	21.25 inches (53.98 cm)	1 (p. 50-51)
Other	0.58-inch thickness	1 (p. 50-51)
Other Engineering Data	The projectile weighed 74.95 pounds (34.01 kilograms) when empty.	1 (p. 24)
Body Construction Material	Steel	1 (p. 51)

General Use and Description

The main objective of the MK III was to produce a cloud of the highest possible initial concentration that would drift downwind and completely envelop the position attacked (1 p. 50).

The MK III, 6-inch gas shell consisted of the projectile body that contained the chemical agent, the gaine tube (adapter and booster casing), which screwed into the nose of the shell and contained the bursting charge. The bursting charge consisted of a small quantity of HE sufficient to open the projectile, and, in some cases, to atomize the liquid contents.

A six-inch semi-steel projectile was developed which differed from the steel projectile only in reduced capacity (1 p. 50).

Explosive Train

Upon impact, the point detonating fuze would function. The fuze would detonate the burster, split the shell, and spread the chemical agent fill (1 p. 50).

Fuzing

Projectile, 6-inch, Common Steel, MK III - Fuzing		
Fuze	**Note**	**Citation**
French I.A. Model 1915	Point detonating, superquick	1 (p. 34, 50)
French I.A.L. Model 1916	Point detonating, superquick	1 (p. 34, 50)
French R.Y. Model 1917	Point detonating, superquick; only to be used if other fuzes were unavailable	1 (p. 38, 50)
Mark III	Point detonating, superquick	1 (p. 34, 50)
Modified British No. 106	Point detonating, superquick	1 (p. 42, 50)

Booster, Adapter-Booster, or Burster

Projectile, 6-inch, Common Steel, MK III - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	N/A	N/A	Adapter-booster and bursting charge were noted; however, no details were provided in available references.	1 (p. 50)

Fills

Projectile, 6-inch, Common Steel, MK III - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
FM	13.2	5.98	87.4	39.6	Without fuze	1 (p. 24, 50)
H	10.5	4.76	84.6	38.3	Without fuze	1 (p. 24, 50)

Shipping/Packing

Available references did not provide this information.

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. American Expeditionary Forces. 1919. Gas Manual Part II, Use of Gas by the Artillery, A.E.F. No. 1475-2 G-5. War Department.

15.22 Projectile, 8-inch, Common Steel, Howitzer and Gun, MK III

Figures

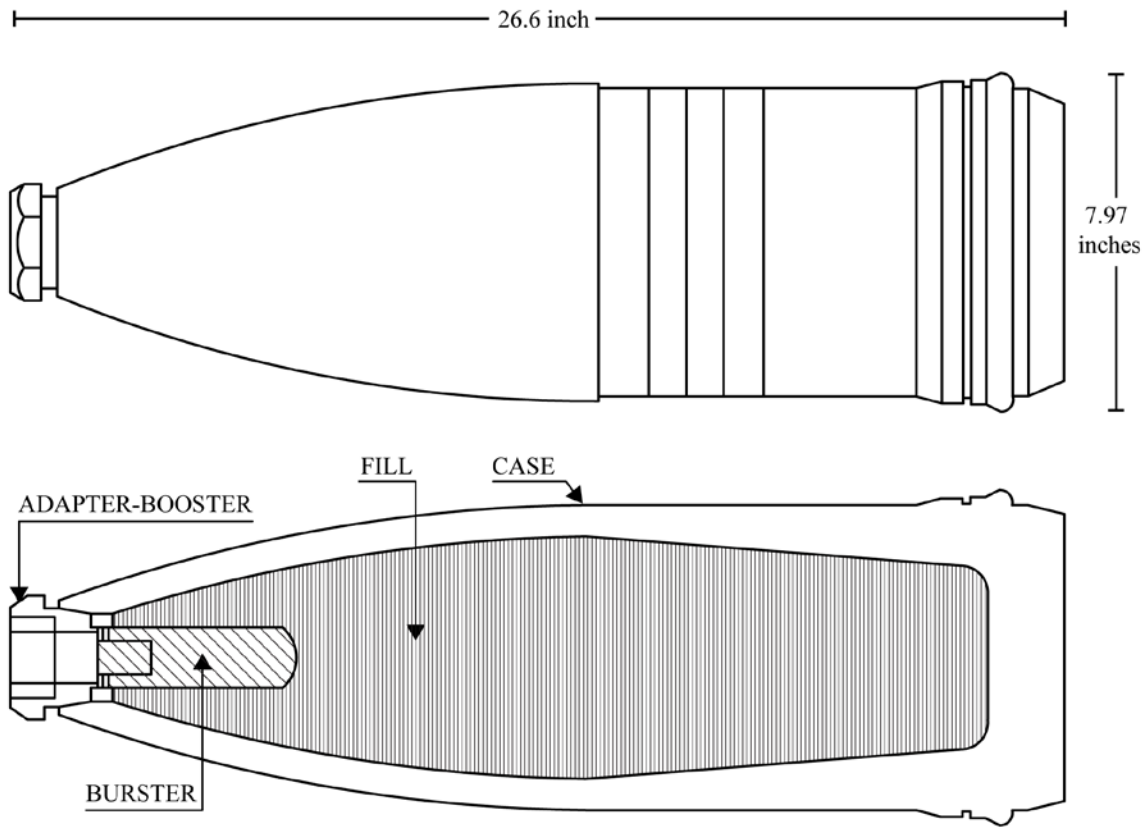

Figure 159: Projectile, 8-inch, Common Steel, Howitzer and Gun, MK III - Line Drawing

Specifications

Projectile, 8-inch, Common Steel, Howitzer and Gun, MK III - Specifications and Other Data		**Citation**
Historical Name	8-Inch, Common Steel Shell, MK III	1 (p. 60)
Type	Projectile	1 (p. 60)
Size	8-inch	1 (p. 60)
Conflict	WWI	1
Diameter	7.97 inches (20.3 cm)	1 (p. 61)
Length	26.6 inches (67.5 cm)	1 (p. 61)
Other Engineering Data	When empty the MK III weighed 169.75 pounds (76.99 kg).	1 (p. 24, 60)
Body Construction Material	Semi-steel	1 (p. 60)

General Use and Description

The main objective of the MK III was to produce a cloud of the highest possible initial concentration of chemical agent, which would drift downwind and completely envelop the position attacked (1 p. 12-16).

The MK III, 8-inch gas shell consisted of the projectile body that contained the chemical agent, the gaine tube (adapter and booster casing), which screwed into the nose of the shell and contained the bursting charge. The bursting charge consisted of a small quantity of HE sufficient to open the shell, and, in some cases, to atomize the liquid contents.

An 8-inch semi-steel shell was also developed, which differed from the steel shell only in reduced internal capacity (1 p. 60).

Explosive Train

Upon impact, the point detonating fuze functioned. The fuze detonated the burster, which would split the shell and spread the chemical agent fill (1).

Fuzing

Projectile, 8-inch, Common Steel, Howitzer and Gun, MK III - Fuzing		
Fuze	**Note**	**Citation**
French I.A. Model 1915	Point detonating, superquick	1 (p. 34, 60)
French I.A.L. Model 1916	Point detonating, superquick	1 (p. 34, 60)
French R.Y. Model 1917	Point detonating, superquick; only to be used if other fuzes were unavailable	1 (p. 38, 60)
Modified British No. 106	Point detonating, superquick	1 (p. 42, 60)
U.S. MK III	Point detonating, superquick	1 (p. 34, 60)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Projectile, 8-inch, Common Steel, Howitzer and Gun, MK III - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BA	32.6	14.7	202	91.6	Without fuze	1 (p. 24, 60)
CA	24.2	10.9	193	87.5	Without fuze	1 (p. 24, 60)
CG	22.0	9.97	191	86.6	Without fuze	1 (p. 24, 60)
FM	28.4	12.8	198	89.8	Without fuze	1 (p. 24, 60)
HS	22.4	10.1	191	86.6	Without fuze	1 (p. 24, 60)
NC	28.9	13.1	198	89.8	Without fuze	1 (p. 24, 60)
PS	27.2	12.3	196	88.9	Without fuze	1 (p. 24, 60)
WP	31.5	14.2	201	91.1	Without fuze	1 (p. 24, 60)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

Only the HS and FM fillings were to be used in the gun; all other fillings were to be used in the howitzer (1 p. 60).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. American Expeditionary Forces. 1919. Gas Manual Part II, Use of Gas by the Artillery, A.E.F. No. 1475-2 G-5. War Department.

15.23 Projectile, 8-inch, Howitzer, M426 (T174 series)

Figures

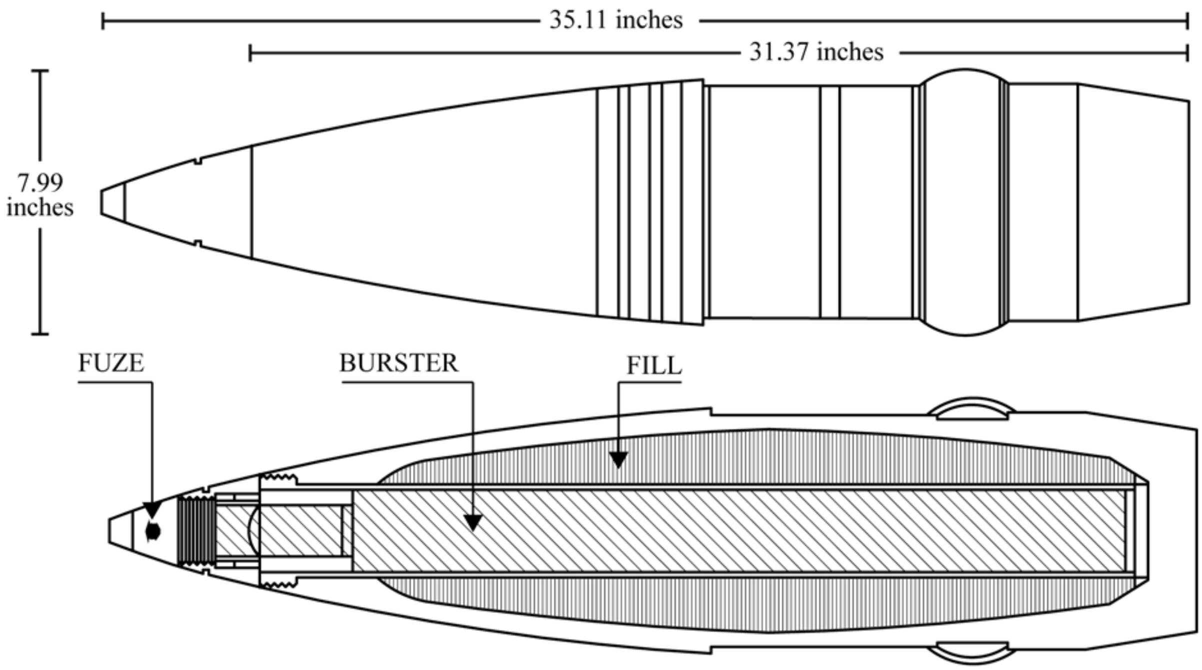

Figure 160: Projectile, 8-inch, Howitzer, M426 (T174 series) - Line Drawing

Specifications

Projectile, 8-inch, Howitzer, M426 (T174 series) - Specifications and Other Data		**Citation**
Historical Name	Projectile, 8-Inch: Agent, GB (non-persistent) and VX (persistent), M426	1 (p. 3-179)
Type	Projectile	2 (p. 5-16), 3 (p. 4-165)
Size	8-inch	2 (p. 5-16)
Conflict	Cold War	4
Service	Army, Marine Corps	2 (p. 5-19), 5 (p. 4-168), 6 (p. 16)
Diameter	7.99 inches (20.29 cm)	1 (p. 3-179), 2 (p. 5-16, 5-18), 5 (p. 4-167, 4-169), 7 (p. 11-2)
Length	With fuze: 35.11 inches (89.18 cm) Without fuze: 31.37 inches (79.68 cm)	1 (p. 3-179), 2 (p. 5-16), 5 (p. 4-167, 4-169), 7 (p. 11-2)
Other Engineering Data	The M426 was designated T174 during development.	3 (p. 4-165, 4-167), 5 (p. 4-167)
Body Construction Material	Forged Steel	1 (p. 3-180), 7 (p. 8-40)
Propellant	M1: 13.3 pounds (green bag) M2: 28.3 pounds (white bag)	1 (p. 3-180), 2 (p. 5-16), 5 (p. 4-167)
Maximum Range	16,900	2 (p. 5-18), 7 (p. 8-44)
B/M Dwg	GB: 8860620-1, VX: 8860620-2	1 (p. 3-179), 7 (p. 11-2)
NSN	GB: 1320-00-892-4305, 1320-00-763-6879 VX: 1320-00-892-4306, 1320-00-892-4306	7 (p. 11-2), 8 (p. 33-34)

Projectile, 8-inch, Howitzer, M426 (T174 series)

General Use and Description

The M426 was developed to provide a toxic agent-filled round designed for the 8-Inch Howitzer, which would match the standard HE, M106 shell. The M426 projectile was used in 8-inch howitzers to deliver and disperse casualty producing agents. When filled with VX agent, the projectile was also designed to contaminate habitable areas and thus deny such areas to the enemy (1 p. 3-179), (2 p. 5-16, 5-18), (3 p. 4-166), (5 p. 4-167), (7 p. 11-2).

The T174 was a one-piece separate loaded central burst gas round for GB or VX agent. It was similar to the M106 HE round in external configuration but had a burster tube, burster charge, and a supplemental charge. The burster tube extended the full length of the cavity and was press fit. A single rotating band was located about 6.06 inches from the base and had two cannelures or grooves.

The T174 and T174E1 projectiles were identical from a ballistic point of view, but the T174 had a brazed-on nosepiece whereas the T174E1 was of one-piece construction. The T174E1 design differed from the T174E2 projectile only in that an "O" ring was added at the joint between the fuze adapter and projectile body in the T174E2 projectile. The T174E2 became the M426.

The M426 projectile was ballistically similar to the standard HE projectile M106. A tubular burster casing that contained a Composition B burster, occupied the center of the projectile and sealed in the fill. The remainder of the interior space was filled with liquefied GB nonpersistent, or VX persistent agent. A threaded steel adapter provided a receptacle for a point detonating or proximity fuze. For shipment and handling, an eyebolt lifting plug was installed in the fuze cavity of the adapter. A rotating band of gilding metal encircled the casing near the rear, and was protected by a grommet (1 p. 3-179), (2 p. 5-16 - 5-20), (4), (5 p. 4-166 - 4-169), (7 p. 11-2).

Explosive Train

A point detonating or VT fuze was located on the forward end, which on functioning initiated the burster charge to explode the projectile and release the filling agent.

When a point detonating fuze was employed, impact caused the fuze to detonate the supplementary charge and the supplementary charge detonated the burster tube. The burster ruptured the projectile case, and released the fill. The liquefied agent expanded to a gaseous state by heating from the burster charge. If a proximity fuze was fitted, action on the burster tube was direct from the booster element of the fuze, and projectile rupture occurred on approach to the target (1 p. 3-179), (3 p. 4-167), (7 p. 8-40, 8-43).

Fuzing

Projectile, 8-inch, Howitzer, M426 (T174 series) - Fuzing		
Fuze	**Note**	**Citation**
M508	Point detonating (GB-fill)	4
M514 series	Proximity	7 (p. 8-41)
M514A1	Variable time (VX-fill)	4
M51A5	Nose- point detonating	1 (p. 3-180), 2 (p. 5-16, 5-18), 3 (p. 4-166, 4-168), 5 (p. 4-167, 4-169), 6 (p. 16)
M557	Point detonating	1 (p. 3-180), 7 (p. 8-41)
M728	Proximity	1 (p. 3-180), 7 (p. 8-41)
M739	Point detonating	1 (p. 3-180)
T2061	Variable time (VX-fill)	6 (p. 16)

Projectile, 8-inch, Howitzer, M426 (T174 series)

Booster, Adapter-Booster, or Burster

Projectile, 8-inch, Howitzer, M426 (T174 series) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M83	6.95 pounds	Composition B	Central bursting, supplemental charge 0.3-pound TNT	2 (p. 5-16, 5-18), 3 (p. 4-166, 4-168), 4, 9 (p. A-16)

Fills

Projectile, 8-inch, Howitzer, M426 (T174 series) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	14.5-15.9	6.57-7.21	200	90.7	-	1 (p. 3-179), 2 (p. 5-16), 3 (p. 4-165), 5 (p. 4-166), 7 (p. 11-2)
VX	14.1-14.5	6.39-6.57	200	90.7	-	1 (p. 3-179), 2 (p. 5-18), 5 (p. 4-169), 7 (p. 11-2)

Shipping/Packing

The projectile was packed six per pallet. The filled pallet weighed approximately 1,253 pounds (1 p. 3-180), (7 p. 11-2), (9 p. A-16).

Miscellaneous Information

The M426 was used with M2 and M2A1 8-inch howitzers, as well as the M47 8-inch cannon (2 p. 5-16, 5-18), (5 p. 4-167, 4-169), (7 p. 8-43).

Key Dates

Projectile, 8-inch, Howitzer, M426 (T174 series) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1961	CCTC 3911 (GB and VX-fill, Standard-A)	3 (p. 4-168), 4, 10

Sources

1. Department of the Army. 1994. Technical Manual, TM 43-0001-28, Army Ammunition Data Sheets for Artillery Ammunition: Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers and Artillery Fuzes. U.S. Government Printing Office.
2. U.S. Naval Ordnance Laboratory. 1968. NAVORD Ordnance Pamphlet, OP 2217, Miscellaneous Chemical Munitions, Description and Operation, First Revision, Change 1. Naval Ordnance Systems Command.
3. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.
4. Chemical Corps Technical Committee. 1961. CCTC Item # 3911, Classification of Projectile, 8-Inch, Gas Nonpersistent GB, M426 (T174E2) & Projectile, 8-Inch, Gas Persistent VX, M426 (T172E2) as Standard-A Types. Department of the Army.
5. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
6. Secretary of the Army. 1962. Field Manual, FM 3-10, Chemical and Biological Weapons Employment. Department of the Army.
7. Naval Surface Warfare Center. 1996. Technical Manual - Miscellaneous Chemical Munitions, NAVSEA SW073-AC-MMA-010, Change B 1 October 1996. Naval Sea Systems Command.
8. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.

9. Chu, S.C., Skinner, L.R., & Smith, W.H. 1987. Chemical Stockpile Disposal Program, Transportation of Chemical Agents and Munitions: A Concept Plan, Report No. SAPEO-CDE-IS-87003. PEO-PM Cml Demil.

10. Chemical Corps Technical Committee. 1958. CCTC Item # 3434, Development of VX Chemical Shell. Department of the Army.

15.24 Projectile, 8-inch, XM736

Figures

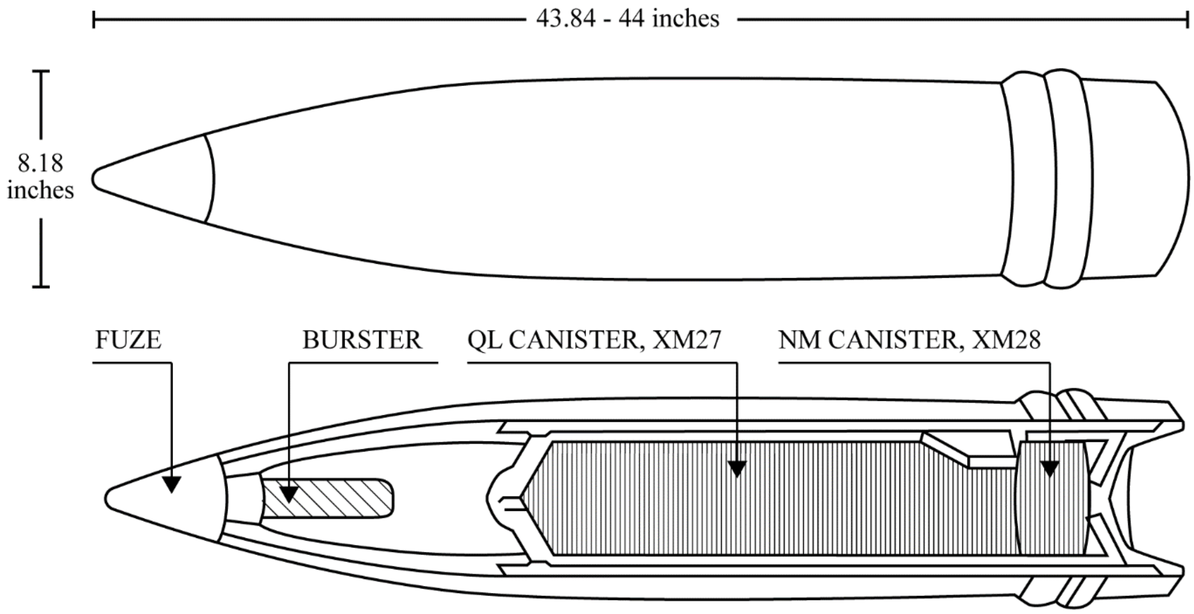

Figure 161: Projectile, 8-inch, XM736 - Line Drawing

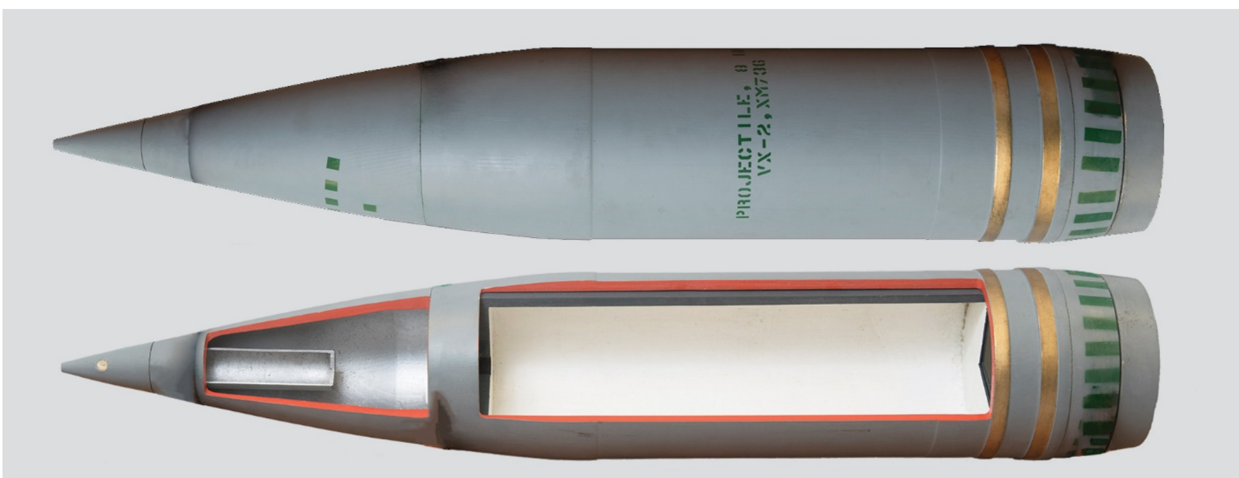

Figure 162: Projectile, 8-inch, XM736 - Photograph - Top: Intact, Bottom: Cutaway View

Projectile, 8-inch, XM736

Specifications

Projectile, 8-inch, XM736 - Specifications and Other Data		**Citation**
Historical Name	Projectile, 8-Inch, VX-2, XM736	1
Type	Projectile	2 (p. 7), 3 (p. 4)
Size	8-inch	1, 2 (p. 7)
Service	Army	2
Diameter	Canisters: 6.9 inches (17.5 cm)	1
Length	Complete round: 43.8-44 inches (111-112 cm) Projectile: 16.3-16.7 inches (41.3-42.4) XM28 canister: 4 inches (10.2 cm) XM27 canister: 21 inches (53.3 cm)	1, 3 (p. 5)
Body Construction Material	Steel	1, 2 (p. 7)
Propellant	M2	1, 3 (p. 4)

General Use and Description

Munitions, including the XM736, filled with lethal chemical agents were required by the military for a retaliatory chemical capability. The XM736 consisted of a steel body that contained a dual canister payload, an expulsive charge assembly, an aluminum ogive, and a steel projectile base. Each canister contained a nonlethal, liquid chemical intermediate: one with ethyl-2-diisopropylaminoethyl-methylphosphonite (QL) (canister XM27), and one with polymethylsulfide (NM) (canister XM28). When the NM reacted with QL, the two formed the agent VX. The canisters were designed with a burst disk at one end so that upon projectile firing, the adjacent ends were ruptured by setback forces. The two chemicals combined, and the chemical mixing was enhanced by in-flight spin on the way to the target (1), (2 p. 7), (3).

The XM27 canister contained 14.8 pounds of QL and the XM28 contained 2.8 pounds of NM (2 p. 80).

Explosive Train

The mechanical time and superquick fuze would initiate the expulsive charge (XM172) over the targeted area that ejected the canisters from the rear of the projectile body and disseminated the thickened agent in droplet form (1).

Fuzing

Projectile, 8-inch, XM736 - Fuzing		
Fuze	**Note**	**Citation**
M577	Mechanical time, superquick	1, 2 (p. 7), 3 (p. 4)
M73	Dummy	1

Booster, Adapter-Booster, or Burster

Projectile, 8-inch, XM736 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
XM 172 Expelling Charge	0.29 pounds	M10 flake propellant	-	1, 4

Fills

Projectile, 8-inch, XM736 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
VX2	17.6	7.98	204	92.5-92.5	-	1, 2 (p. 80), 3

Projectile, 8-inch, XM736

Shipping/Packing

The normal mode of shipping consists of six XM736 projectiles per side-loading pallet with a single XM27 reactant canister installed in each projectile and the XM28 canister packed separately, six per box. The palletized projectiles were equipped with live, XM172 expulsion charges and lifting plugs (3), (4).

Miscellaneous Information

The XM736 program was terminated. During development, test firings of the XM736 Projectile, observations along the projectile's trajectory were interpreted as evidence of leakage of the liquid payload. These observations contributed to the termination of the program. When the XM736 program was cancelled, emphasis was shifted to the Bigeye Bomb (BLU-80/B) (1), (2 p. 10).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Vavra, B.L., & Oaks, S.A. 1976. Engineer Design Test, Phase IV (In-flight mixing) of Projectile, 8-Inch, VX-2, XM736. Department of the Army.
2. Jackson, A., & Gadde, K., & Goheen, J., & Semiatin, W. 1987. Chemical Research, Development & Engineering Center, CRDEC-TR-87042, Fill, Close, Load, Assemble, and Packout Technology for the 8-Inch, VX-2, XM736 Projectile and the Bigeye Bomb (BLU-80/B). Chemical Research, Development & Engineering Center.
3. Spitler, Joseph, Jr. 1976. Letter Report, Engineer Design Test (Air Transport/Airdrop) of Projectile, 8-Inch, VX2, XM736, TECOM Project No. 2-MU-003-736-019. Department of the Army.
4. Chemical Systems Laboratory. 1979. Final Report Engineer Design Test of Projectile, 8-inch: VX-2, XM736 (RDTE Project No. 1X464610DF94, TECOM Project No. 2-MU-003-736-032, Test Agency Report No. APG-MT-5274). U.S. Army.

15.25 Projectile, 9.2-inch

Figures

Figure 163: Projectile, 9.2-inch - Photograph - Cutaway View

Specifications

Projectile, 9.2-inch - Specifications and Other Data		**Citation**
Historical Name	9.2-Inch Chemical Shell	1 (p. 62)
Type	Projectile	1 (p. 62)
Size	9.2-inch	1 (p. 62), 2 (p. 12)
Conflict	WWI	2
Other	Available references did not provide information on the dimensions of the projectile.	
Body Construction Material	Steel and semi-steel	1 (p. 62)

General Use and Description

The 9.2-inch howitzer ammunition provided portability between field artillery and heavy seacoast artillery. The 9.2-inch howitzer ammunition had the advantage over those of smaller calibers in its longer range and the increased capacity of agent it could hold. The United States did not adopt the 9.2-inch caliber until 1917 after joining with the Allies (2 p. 56).

In general, the chemical shell was similar to the HE shell. The projectile consisted of the shell body, which contained chemical agent or smoke, and the gaine tube (adapter and booster casing), which screwed into the nose of the shell and contained the bursting charge. The bursting charge consisted of a small quantity of HE sufficient to open the shell, and to atomize the liquid contents (1), (3).

Explosive Train

Available references did not provide specific information on explosive train (1), (3).

Projectile, 9.2-inch

Fuzing

Projectile, 9.2-inch - Fuzing		
Fuze	**Note**	**Citation**
French I.A. Model 1915	Point detonating, superquick	1 (p. 60, 62)
French I.A.L. Model 1916	Point detonating, superquick	1 (p. 60, 62)
French R.Y.	Point detonating, superquick; only to be used if other fuzes were unavailable.	1 (p. 60, 62)
Modified British No. 106	Point detonating, superquick	1 (p. 42, 62)
U.S. MK III	Point detonating, superquick	1 (p. 36, 62)

Booster, Adapter-Booster, or Burster

Projectile, 9.2-inch - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
MK VII	N/A	HE	Adapters and boosters.	2 (p. 58)

Fills

Projectile, 9.2-inch - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
BA	42.7	19.3	295	120	Volume was based on HE shell. Gross weight is the shell and fill without fuze.	1 (p. 24)
CA	31.7	14.3	284	128	Volume is based on HE shell.	1 (p. 24)
CG	28.6	12.9	281	127	Volume is based on HE shell.	1 (p. 24)
FM	37.2	16.8	289	131	Volume is based on HE shell.	1 (p. 24)
HS	29.4	13.3	282	128	Volume is based on HE shell.	1 (p. 24)
NC	37.8	17.1	290	131	Volume is based on HE shell.	1 (p. 24)
PS	35.6	16.1	288	130	Volume is based on HE shell.	1 (p. 24)
WP	41.3	18.7	294	133	Volume is based on HE shell.	1 (p. 24)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

Through late 1918, no 9.2-inch gas munitions were loaded (2 p. 61).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. American Expeditionary Forces. 1919. Gas Manual Part II, Use of Gas by the Artillery, A.E.F. No. 1475-2 G-5. War Department.
2. Army Ordnance. 1921. No. 1939, History of Artillery Projectiles, 1917-1919. Government Printing Office.
3. Prentiss, Augustin M. 1937. Chemicals in War: A Treatise on Chemical Warfare. McGraw-Hill Book Company, Inc.

16 Rocket

A rocket is a self-propelled, unguided weapon system powered by a rocket motor. A rocket primarily differs from a missile by its lack of an active guidance system. Rockets can be surface-to-surface or air-to-surface.

16.1 Rocket, 115-mm, M55 (T238), Bolt

Figures

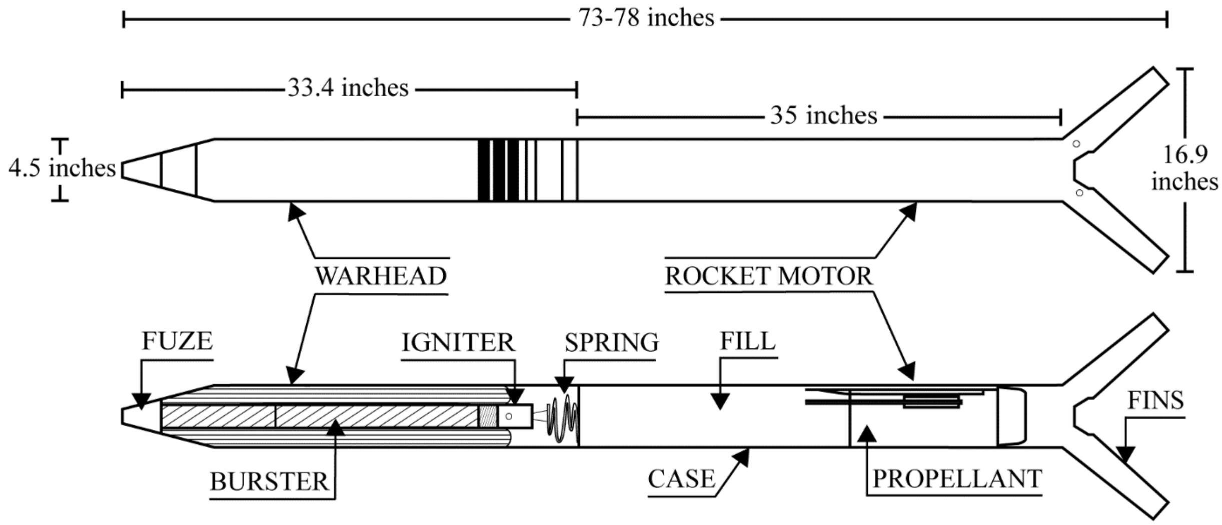

Figure 164: Rocket, 115-mm, M55 (T238), Bolt - Line Drawing

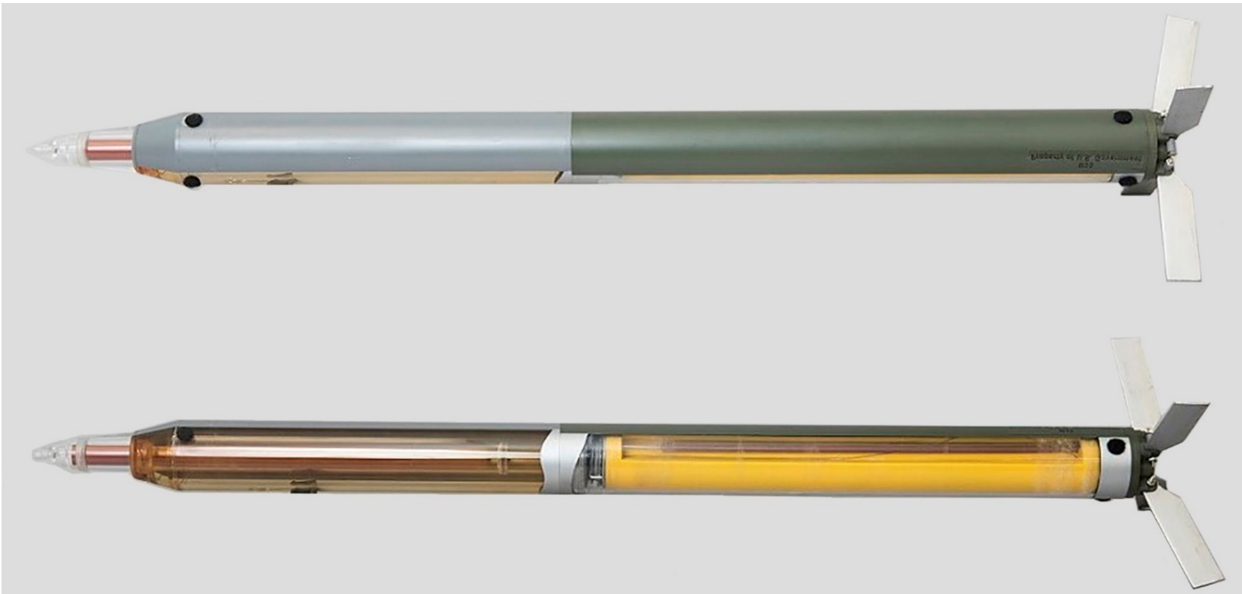

Figure 165: Rocket, 115-mm, M55 (T238), Bolt - Photograph - Top: Exterior, Bottom: Cutaway View

Rocket, 115-mm, M55 (T238), Bolt

Specifications

Rocket, 115-mm, M55 (T238), Bolt - Specifications and Other Data		Citation
Historical Name	Rocket, Gas, 115-mm, M55 "BOLT" (T-238)	1 (p. 4-57)
Type	Rocket	2 (p. 4-55)
Size	115-mm	2 (p. 4-55)
Service	Army, Marine Corps	1 (p. 4-57), 2 (p. 4-55), 3 (p. 16)
Diameter	115 mm (4.5 inches)	1 (p. 4-56), 2 (p. 4-55), 4 (p. 15), 5 (p. 83)
Length	Rocket: 73-78 inches (185-198 cm) Warhead: 33.4 inches (84.8 cm) Rocket Motor: 35.0 inches (88.9 cm)	1 (p. 4-57), 2 (p. 4-55), 4 (p. 15), 5 (p. 83), 6 (p. 65)
Width	Fins: 16.9 inches (42.9 cm)	5 (p. 83)
Other	Motor Length: 44.8 inches (114 cm) Warhead length: 33.4 inches (84.8 cm)	1 (p. 4-57), 2 (p. 4-55)
Other Engineering Data	During development, it was designated T-238. Fin assembly: M150 Motor: M67	1 (p. 4-57), 2 (p. 4-54 - 4-58), 4 (p. 14)
Body Construction Material	Extruded aluminum	4 (p. 14)
Propellant	M28 (19.3 pounds)	1 (p. 4-56), 2 (p. 4-55)
Maximum Range	12,000 meters	4 (p. 15)
B/M Dwg	E 90-1-10	1 (p. 4-57), 2 (p. 4-58)
FSN	1340-716-1450 1340-724-3567	6 (p. 67)

General Use and Description

The M55 rocket provided toxic chemical offensive capability for a large target area (1 p. 4-56), (2 p. 4-55).

It was a folding, fin stabilized, surface-to-surface rocket designed for the delivery of chemical agent against large targets. The major components were a warhead filled with agent, a point detonating fuze, burster, auxiliary burster, headspring, igniter, motor with fins, and propellant. The system could be air lifted by helicopter or could be fired from a truck or by ground emplacement. The launcher could deliver 45 rockets in 15 seconds and was loaded and operated by a crew of six. A battalion could fire 1,620 rounds in the first 30 seconds (1 p. 4-56), (2 p. 4-55).

Explosive Train

Upon impact, an anvil was driven against the firing pin to be driven into the detonator, which would function the lead and booster. The booster initiated the burster, which ruptured the warhead and dispersed the filler (5 p. 90).

Fuzing

Rocket, 115-mm, M55 (T238), Bolt - Fuzing		
Fuze	**Note**	**Citation**
M417 (T2058)	Point detonating	1 (p. 4-56), 2 (p. 4-56, 4-58), 4 (p. 14)
T2061	Tests were also made with a VT fuze	1 (p. 4-59)

Booster, Adapter-Booster, or Burster

Rocket, 115-mm, M55 (T238), Bolt - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M34	N/A	Composition B	-	1 (p. 4-59)
M36 Auxiliary burster	N/A	Composition B	-	1 (p. 4-59)

Fills

Rocket, 115-mm, M55 (T238), Bolt - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	10.0-11.4	4.53-5.17	56.9-59.0	25.8-26.7	Burnout weight 39.7 pounds (18.0 kg)	1 (p. 4-56), 2 (p. 4-56), 4 (p. 14)
VX	10.7-11.0	4.85-4.98	58.0-58.2	26.3-26.4	-	1 (p. 4-58), 2 (p. 4-57), 3 (p. 16)
WP	17.5	7.93	65.0	29.4	-	1 (p. 4-60)

Shipping/Packing

Fifteen rockets, in individual shipping and firing containers that were made of resin reinforced fiberglass, were packed in a wood crate. The shipping and firing containers were 82 inches long with a diameter of 4.9 inches, and weighed 16 pounds empty, 74 pounds with the rocket. The wood crate was 83 inches long, 30 inches wide, 28 inches high, and weighed 1,350 pounds loaded (4 p. 14-16).

Miscellaneous Information

The M56 warhead weighed 20.60 pounds (1), (2 p. 4-55).

Key Dates

Rocket, 115-mm, M55 (T238), Bolt - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Obsoleted	-	MSR 09846001 (VX and GB-fill)	7 (p. 52)
Standardized	1960	CCTC 3704 (VX and GB fill)	8

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

2. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

3. Secretary of the Army. 1962. Field Manual, FM 3-10, Chemical and Biological Weapons Employment. Department of the Army.

4. Anderson, Andrew W. 1966. Technical Procedures, Disposal, Unserviceable M55 Rockets, GB Filled (U). Chemical Process Laboratory.

5. Secretary of the Army. 1967. Technical Manual, TM 9-1385-51, Identification of Ammunition (Conventional) for Explosive Ordnance Disposal. Department of the Army.

6. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

7. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.

8. Chemical Corps Technical Committee. 1960. CCTC Item # 3704, Classification of Rocket, Gas, 115-mm, M55 (T238) as a Standard-A Type & Authorization of Nonpersistent Agent, GB & Persistent Agent VX as Fillings Therefore (Popular Name-The Bolt). Department of the Army.

16.2 Rocket, 115-mm, Dummy Training, M60 (E49)

Figures

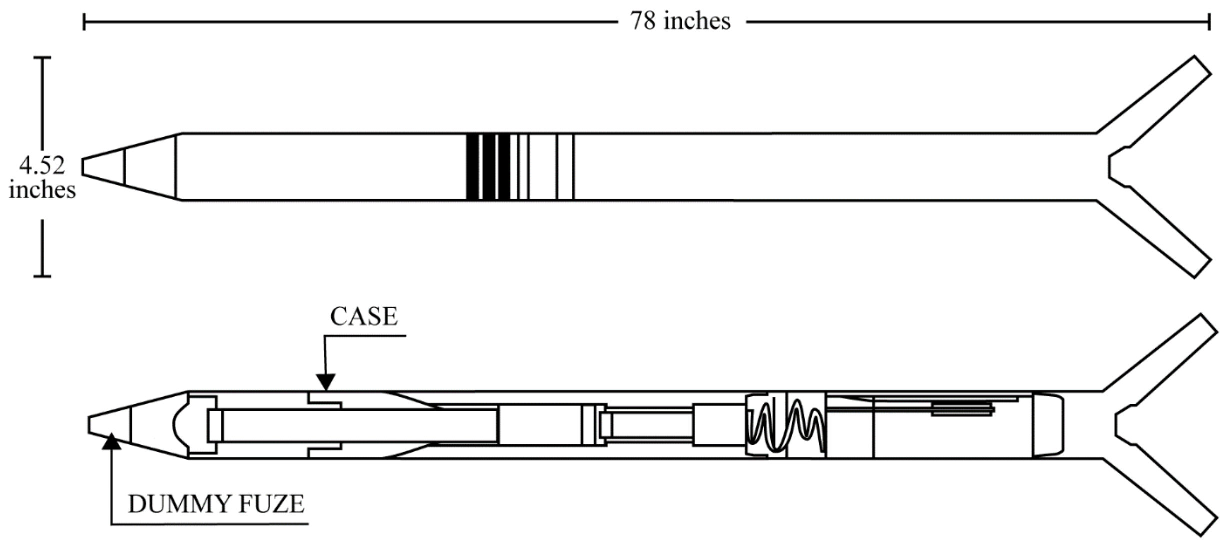

Figure 166: Rocket, 115-mm, Dummy Training, M60 (E49) - Line Drawing

Specifications

Rocket, 115-mm, Dummy Training, M60 (E49) - Specifications and Other Data		Citation
Historical Name	Rocket, Training, Dummy, 115-mm, M60 (E49)	1 (p. 62)
Type	Rocket	1 (p. 34a), 2 (p. 250), 3 (p. 52)
Size	115-mm	1 (p. 34a), 2 (p. 250)
Service	Army, Marine Corps	2 (p. 250), 4 (p. i)
Diameter	115 mm (4.5 inches)	2 (p. 250)
Length	78 inches (198 cm)	2 (p. 250, 65, 67), 4 (p. 166)
Other Engineering Data	During development, this round was designated E49	1 (p. 62)
Body Construction Material	Aluminum	4 (p. 166)
Spec/PD No	MIL-R-46986, PD 196-131-773	2 (p. 250)
FSN	1340-861-9817	2 (p. 250)

General Use and Description

The M60 115-mm dummy training rocket was used for training personnel in the techniques of loading rockets into the M91 multiple rocket launcher and preparing rockets for firing (2 p. 250), (4 p. 166).

The M60 115-mm dummy training rocket was identical to the M55 115-mm gas rocket except that it was a completely inert round. It was readily identified by a blue decal that contained its nomenclature affixed to the shipping and firing container (2 p. 250), (4 p. 166).

Explosive Train

This item required no explosive train.

Fuzing

Rocket, 115-mm, Dummy Training, M60 (E49) - Fuzing		
Fuze	**Note**	**Citation**
Not designated	Point detonating, dummy	4 (p. 166)

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Rocket, 115-mm, Dummy Training, M60 (E49) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
EG (simulant agent for GB and VX)	10.0	4.54	55.0-58.0	24.9-26.3	-	2 (p. 251), 4 (p. 166)

Shipping/Packing

The rockets were packed 15 rounds per wood crate, which weighed between 1,340 and 1,400 pounds (1 p. 34a), (2 p. 250).

Key Dates

Rocket, 115-mm, Dummy Training, M60 (E49) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Obsoleted		MSR 09846001	3 (p. 52)
Standardized	1961	CCTC 3933	5 (p. 34a), 6

Sources

1. Chemical Corps Technical Committee. 1969. Chemical Corps Book of Standards, 2nd Abridged Edition, Revision No. 29. Department of the Army.
2. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.
3. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.
4. School Munitions Department Redstone Arsenal. 1976. Chemical Munitions EOD/TE Study Guide. U.S. Army Missile and Munitions Center.
5. Chemical Corps Technical Committee. 1955. Chemical Corps Book of Standards, 1955. Department of the Army.
6. Chemical Corps Technical Committee. 1961. CCTC Item # 3933, Classification of Rocket, Training, Dummy, 115-mm, M60 (E49) as a Standard-A Type. Department of the Army.

16.3 Rocket, 115-mm, Practice, M61 (E50)

Figures

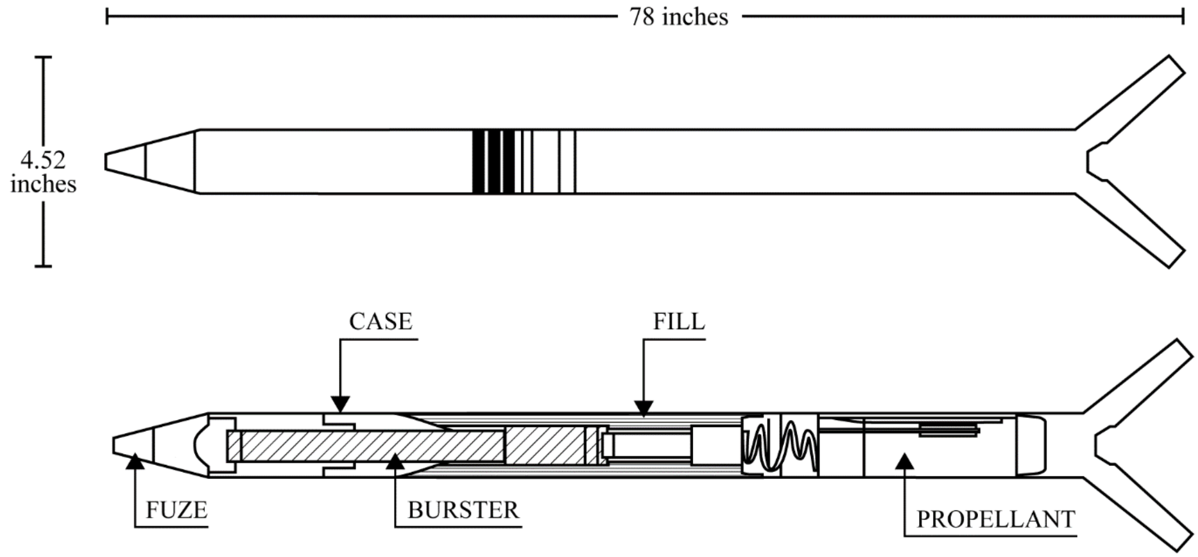

Figure 167: Rocket, 115-mm, Practice, M61 (E50) - Line Drawing

Specifications

Rocket, 115-mm, Practice, M61 (E50) - Specifications and Other Data		Citation
Historical Name	Rocket, Practice; Simulant EG, 115-mm, M61 (E50)	1 (p. 53d)
Type	Rocket	1 (p. 34a, 53d), 2 (p. 86)
Size	115-mm	1 (p. 34a, 53d), 3 (p. 251)
Service	Army	3
Diameter	115 mm (4.5 inches)	2, 3 (p. 251), 4 (p. 165)
Length	Rocket, fuzed: 73-78 inches (185-198 cm) Fuze: 3.3 inches (8.38 cm) Warhead, fuzed: 33.4 inches (84.8 cm) Rocket motor: 35 inches (88.9 cm) Fins (extended) 4.6 inches (11.7 cm)	2, 3 (p. 251, 65, 67), 4 (p. 165)
Width	Fin: 16.9 inches (42.9)	2
Other Engineering Data	The rocket motor weighed 35 pounds.	2
Body Construction Material	Rocket motor case: steel Fuze: steel Warhead: aluminum Fins: aluminum	2 (p. 83, 86, 89), 4 (p. 165)
Spec/PD No	MIL-R-46983	3 (p. 251)
B/M Dwg	C90-1-17	3 (p. 251)

General Use and Description

The M61 115-mm simulant EG practice rocket was used for practice firing from the M91 multiple rocket launcher (2), (3 p. 251).

Rocket, 115-mm, Practice, M61 (E50)

The M61 115-mm simulant EG practice rocket was identical to the M55-115 mm chemical agent rocket except that the warhead was filled with simulant EG. It was readily identified by a blue decal containing its nomenclature and one yellow band affixed to the shipping and firing container.

These rockets were folding fin stabilized, surface-to-surface type, fuzed with a point detonating fuze. The warhead contains a central burster that was threaded at one end to receive the fuze adapter. The rocket motor was threaded at the forward end to receive the warhead and at the rear end to receive the nozzle plate and fin-nozzle assembly. The fin-nozzle assembly contained a nozzle plate and four nozzles. Four folding fins were attached to the nozzle plate. The igniter lead wire passed through one of the four nozzles (2), (3 p. 251), (4 p. 165).

Explosive Train

Upon impact, the anvil was driven against the firing pin, which stripped the locking ring, that allowed the firing pin to be driven into the detonator to initiate the lead and booster. The booster initiated the burster which ruptured the warhead and dispersed the filler (2).

Fuzing

Rocket, 115-mm, Practice, M61 (E50) - Fuzing		
Fuze	**Note**	**Citation**
M417	Point detonating, contained an M63 detonator and RDX booster	2 (p. 87), 3 (p. 251, 65, 67), 4 (p. 165)

Booster, Adapter-Booster, or Burster

Rocket, 115-mm, Practice, M61 (E50) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	1 pound	Composition B	Auxiliary burster	2 (p. 89)
Not designated	3 pounds	Composition B	Burster.	2 (p. 89)

Fills

Rocket, 115-mm, Practice, M61 (E50) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
EG	10.0	4.53	58.0	26.3	EG is a simulant for GB and VX.	3 (p. 251), 4 (p. 165)

Shipping/Packing

The rockets were packed 15 rounds per wood crate, which weighed 1,400 pounds (1 p. 34a), (3 p. 252).

Key Dates

Rocket, 115-mm, Practice, M61 (E50) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Classified	between 1958 and 1964	CCTC 4016, 4055	1 (p. 53d)
Obsoleted	-	MSR 09846001	5 (p. 52)
Standardized	1962	CCTC 4055 (Standard-A)	3 (p. 252)

Sources

1. Chemical Corps Technical Committee. 1969. Chemical Corps Book of Standards, 2nd Abridged Edition, Revision No. 29. Department of the Army.

2. Secretary of the Army. 1967. Technical Manual, TM 9-1385-51, Identification of Ammunition (Conventional) for Explosive Ordnance Disposal. Department of the Army.

3. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

4. School Munitions Department Redstone Arsenal. 1976. Chemical Munitions EOD/TE Study Guide. U.S. Army Missile and Munitions Center.

5. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.

16.4 Rocket, 318-mm, Warhead, E20, Little John

Figures

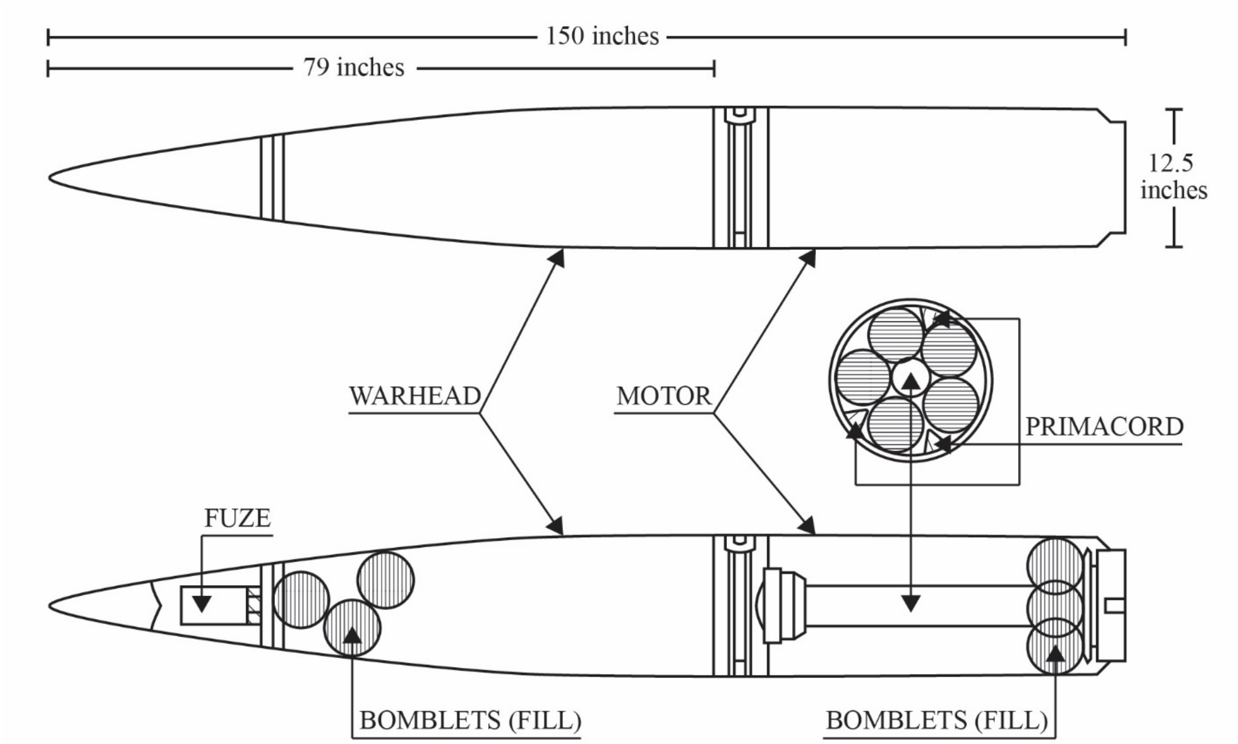

Figure 168: Rocket, 318-mm, Warhead, E20, Little John - Line Drawing

Figure 169: Rocket, 318-mm, Warhead, E20, Little John - Photograph

Rocket, 318-mm, Warhead, E20, Little John

Specifications

Rocket, 318-mm, Warhead, E20, Little John - Specifications and Other Data		**Citation**
Historical Name	Warhead, 318mm Rocket, Gas, Nonpersistent, GB, E20 (Little John)	1 (p. 4-74)
Type	Rocket	2 (p. 52a), 3 (p. 4-75)
Size	318-mm	1 (p. 4-74), 2 (p. 52a)
Conflict	Cold War	3 (p. 4-75)
Service	Army	4 (p. 16)
Diameter	Warhead: 12.5 inches (31.8 cm)	1 (p. 4-75), 2 (p. 52a), 3 (p. 4-76)
Length	Rocket: 150 inches (381 cm) Warhead: 79 inches (200.66 cm)	1 (p. 4-75), 3 (p. 4-76)
Other	Wall thickness: 0.81 inch (2.06 cm)	3 (p. 4-75)
Other Engineering Data	Rocket: XM51 Warhead: E20 Motor: XM26E1 Launcher: XM34	1 (p. 4-75), 3 (p. 4-76)
Body Construction Material	Aluminum alloy	3 (p. 4-75)
Maximum Range	26,000 meters	1 (p. 4-75), 3 (p. 4-76)

General Use and Description

Little John provided toxic chemical offensive capability (1 p. 4-74), (3 p. 4-75).

Little John was a surface-to-surface warhead used to carry 52 each 4.5-inch M139 (E130R2) spherical bombs. The warhead for the Little John missile was based on a modification of the quadrant design and was helicopter transportable on its launching gear. It was sealed at three stations with gaskets to protect against any leakage that might occur. Two thrust cones aided the ejection of the bombs. The bombs in the lower part of the warhead were deflected outward by the upper thrust cone (1 p. 4-74), (3 p. 4-75).

Explosive Train

Three extruded longeron members were initiated through a detonator block. This block had a small central tetryl pellet into which a detonating cord was led and accepted the two flask tubes extending from the fuze. Upon functioning, the skin severed into three sections, aft and ram air pressure ejected the munitions (1 p. 4-74), (3 p. 4-75).

Fuzing

Rocket, 318-mm, Warhead, E20, Little John - Fuzing		
Fuze	**Note**	**Citation**
T2075	Mechanical time (warhead)	1 (p. 4-75), 3 (p. 4-76)
XM912	Centrifugal, all ways (bomblet)	3 (p. 4-76)

Booster, Adapter-Booster, or Burster

Rocket, 318-mm, Warhead, E20, Little John - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Primacord ™	N/A	N/A	Warhead opening.	3 (p. 4-75)

Rocket, 318-mm, Warhead, E20, Little John

Fills

Rocket, 318-mm, Warhead, E20, Little John - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	67.6	30.6	262	118	52 bomblets; 1.3-2.4 pounds each. Weight is for the warhead.	1 (p. 4-75), 2 (p. 52a), 4 (p. 30)
VX	67.6	30.6	262	118	52 bomblets; 1.3-2.4 pounds each. Weight is for the warhead.	3 (p. 4-75), 4 (p. 30)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The E20 318 mm rocket was used with 52 each M139 (E130R2) bomblets, and was usually referred to as Little John (1 p. 4-74), (3 p. 4-75).

Key Dates

Rocket, 318-mm, Warhead, E20, Little John - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1964	CCTC 4185 (M206 Standard-A)	-
Standardized	1964	AMCTC 2442	-
Obsoleted	1969	AMCTC 7165 (Little John System)	-

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

2. Chemical Corps Technical Committee. 1969. Chemical Corps Book of Standards, 2nd Abridged Edition, Revision No. 29. Department of the Army.

3. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

4. Secretary of the Army. 1962. Field Manual, FM 3-10, Chemical and Biological Weapons Employment. Department of the Army.

16.5 Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John

Figures

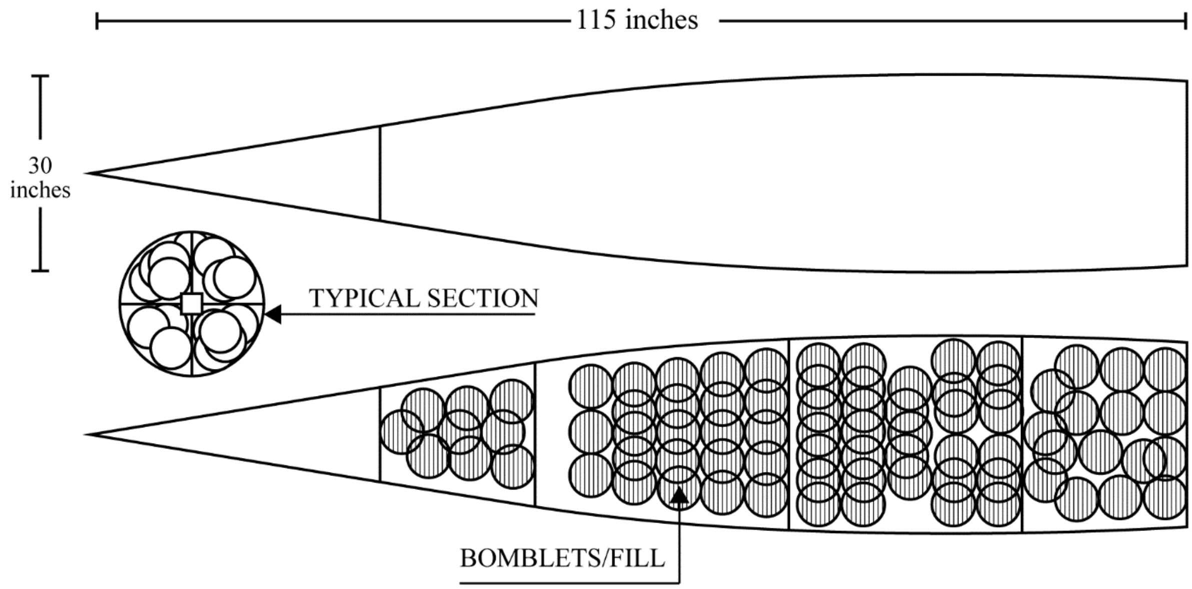

Figure 170: Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John - Line Drawing

Figure 171: Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John - Photograph

Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John

Specifications

Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John - Specifications and Other Data		Citation
Historical Name	Warhead Section, 762mm, M190 (E19R2) and M79 (E19R1)	1 (p. 81)
Type	Rocket	2 (p. 4-80)
Size	762-mm	3 (p. 4-81)
Service	Army, Marine Corps	2 (p. 4-80, 4-82, 4-84), 3 (p. 4-82), 4 (p. 16)
Diameter	30 inches (762 mm)	2 (p. 4-81, 4-83, 4-85), 3 (p. 4-82, 4-84)
Length	Warhead Length: 115 inches (292.1 cm)	2 (p. 4-81, 4-83, 4-85), 3 (p. 4-82, 4-84)
Other Engineering Data	In development, the M79 was designated E19R1 and the M190 was designated E19R2. The complete rocket, including M79 warhead and M6A1 rocket motor, was M31A1C The XM50 rocket consisted of an E19R2 warhead and an XM31 rocket motor.	1 (p. 4-27), 2 (p. 4-80, 4-82, 4-84), 3 (p. 4-82, 4-84)
Body Construction Material	Aluminum alloy	1
Propellant	Rocket Motor: M6A1 for M79 Rocket motor XM-31 for E19R2 Rocket motor MGR-1A or MGR-1B for the M190	1 (p. 4-27), 2 (p. 4-80, 4-82, 4-84), 3 (p. 4-84)
Spec/PD No	MIL-W-46646	1 (p. 81)
B/M Dwg	D90-11-3, DL90-11-8	1 (p. 81), 3 (p. 4-82)
FSN	1340-720-3763	5 (p. 35)

General Use and Description

The 762-mm rocket provided toxic chemical offensive capability. The M190 was designed to provide a capability for the delivery of nonpersistent GB by the 762-mm (Honest John) rocket system (1 p. 81), (2 p. 4-80, 4-82, 4-84), (3 p. 4-81, 4-83, 4-85).

This concept was known as the quadrant warhead design and consisted of partitioning the missile nose cone casing into four longitudinal quadrants within which bomblets were packed. The warhead casing was made of an aluminum alloy sheet and was reinforced with internal structural members. A conical wedge was provided at the rear end of the warhead to assist in effecting clean ejection of the bomblets (1 p. 81), (2 p. 4-80), (3 p. 4-81).

Explosive Train

At a preset time along the flight path, the fuze would function, which in turn would detonate the detonating cord, separating the outer skin along the quadrant partitions thereby releasing the bomblets into the airstream. Upon impact, the fuzes within the individual bomblets would function to release the agent (1 p. 81), (2 p. 4-80, 4-82, 4-84), (3 p. 4-81, 4-83).

Fuzing

Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John - Fuzing		
Fuze	**Note**	**Citation**
M421 (T2075E1)	Mechanical time	1 (p. 81)
T2075	Mechanical time	2 (p. 4-81)
XM 912	Centrifugal arming, all-ways impact, used with the E19R2	3 (p. 4-83)

Booster, Adapter-Booster, or Burster

Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Primacord ™	N/A	Detonating cord	Warhead opening	3 (p. 4-84)

Fills

Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	462-477	209-216	1,168-1,626	529-737	Agent weight and fill weight were dependent on type and quantity of bomblet used.	2 (p. 4-80), 3 (p. 4-83)
VX	410-462	185-209	1,238-1,625	561-737	Fill weight was dependent on type and quantity of bomblet used.	2 (p. 4-81, 4-85, 4-87), 3 (p. 4-82, 4-84)

Shipping/Packing

The M190 warhead section was packaged in a heat-sealed barrier bag with five sampling ports. The warhead section in the barrier bag was secured on the cradle of an M480E2 shipping and storage container. The warhead section weighed approximately 1,240 pounds. The warhead section in the M480E2 shipping container had a gross weight of approximately 1,725 pounds and a cubage of 179 cubic feet (1 p. 82).

Miscellaneous Information

The M190 762-mm rocket warhead was used with 368 each M139 bomblets and was referred to as Honest John. The M79 rocket was used with 356 each M134 bomblets and 356 each E130R1 bombs (2 p. 4-81, 4-85, 4-87), (3 p. 4-82, 4-84), (4 p. 16).

Key Dates

Rocket, 762-mm, Warhead, M79 (E19R1) and M190 (E19R2), Honest John - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Military Characteristics Approved	1958	CCTC 3406 (M79)	6
Standardized	1960	CCTC 3694 (M79 Standard-B)	7
Obsoleted	1962	CCTC 4080 (M79 GB- fill)	7
Obsoleted	1964	AMCTC 2621 (M79)	8
Standardized	1964	AMCTC 2621 (M190 Standard-A)	8

Sources

1. Secretary of the Army. 1967. Technical Manual, TM 750-5-15, Army Equipment Data Sheets, Chemical Weapons and Defense Equipment. Department of the Army.

2. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.

3. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

4. Secretary of the Army. 1962. Field Manual, FM 3-10, Chemical and Biological Weapons Employment. Department of the Army.

5. Chemical Research and Development Center. 1985. Data Book on Type Classification/Standard Chemical Agents, Weapons and Defense Materiel, CRDC-SP-85009. U.S. Army Armament, Munitions & Chemical Command.

6. Chemical Corps Technical Committee. 1958. CCTC Item # 3406, Revised Military Characteristics for GB Warhead for HONEST JOHN Rocket. Department of the Army.

7. Chemical Corps Technical Committee. 1962. CCTC Item # 4080, Classification of Warhead Section, 762-mm Rocket, Gas, Non-persistent GB M190 (E19R2) as a Standard-A Type & Obsoletion of the Superseded M79 Warhead. Department of the Army.

8. Chemical Biological Subcommittee. 1964. AMCTC Item # 2621, Classification of Warhead Section, 762-mm Rocket, Gas, Non-persistent GB M190 (E19R2) as a Standard-A Type & Obsoletion of the Superseded M79 Warhead. U.S. Army Materiel Command.

16.6 Rocket, 2.36-inch, M26, M10, M10A1, M10A2, M10A3

Figures

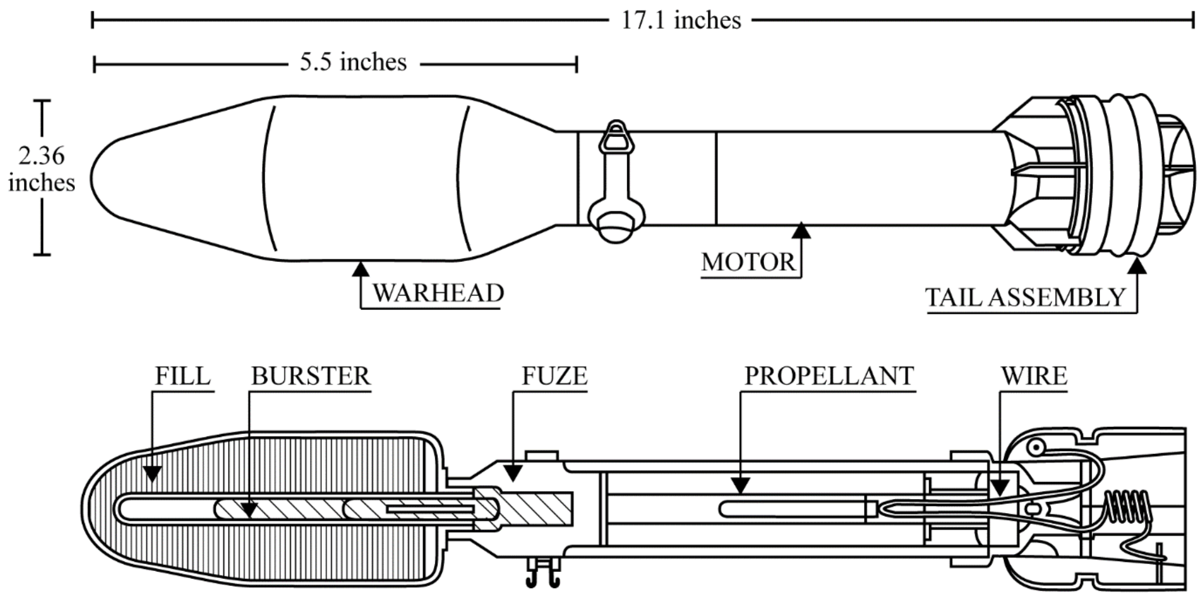

Figure 172: Rocket, 2.36-inch, M26, M10, M10A1, M10A2, M10A3 - Line Drawing - M10

Specifications

Rocket, 2.36-inch, M26, M10, M10A1, M10A2, M10A3 - Specifications and Other Data		**Citation**
Historical Name	2.36-Inch, Gas M26 and Smoke (WP) M10	1 (p. 151-152)
Type	Rocket	1 (p. contents)
Size	2.36-inch	1 (p. 151-152)
Service	Army	1 (p. 151, 152)
Diameter	2.36 inches (5.99 cm)	1 (p. 151)
Length	M10 Rocket: 17.1 inches (43.43 cm) M26 Rocket: 17.66 inches (44.85 cm) Warhead: 5.5 inches (13.97 cm) M26: 17.6 inches (44.7 cm)	1 (p. 151)
Other Engineering Data	The 2.36-inch Smoke Rocket M10 is fired from the Launcher M1A1 or M9, the "bazooka."	1 (p. 152)
Propellant	T1E1 salted powder, M7 Powder	1 (p. 152)

General Use and Description

This rocket was designed as both a screening agent and a causality agent (1 p. 151).

The components of the rocket were the motor and the head assembly. The head assembly consisted of a container for the chemical fill with a long burster well containing PETN inserted from the aft end. A collar was soldered to the base of the container. The spacer slipped over the threads of the collar, and was held against the flat surfaces of the collar by the fuze body. The M10A1 and M10A2 differed from the M10 in the type of propellant used. Except for its increased length, the 2.36-inch gas rocket M26 was structurally identical to the 2.36-inch M10A2 (1 p. 151-152).

Rocket, 2.36-inch, M26, M10, M10A1, M10A2, M10A3

Explosive Train

After the safety pin was removed, the firing pin would overcome the spring upon impact and detonate the burster, expelling the chemical filler (1 p. 151).

Fuzing

Rocket, 2.36-inch, M26, M10, M10A1, M10A2, M10A3 - Fuzing		
Fuze	**Note**	**Citation**
M400 series	-	1 (p. 152)

Booster, Adapter-Booster, or Burster

Rocket, 2.36-inch, M26, M10, M10A1, M10A2, M10A3 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
M10 Burster	2.3 grams	Hexanitromannite and PETN	-	2 (p. 3)
Not designated	4 grams	PETN	-	1 (p. 151-152)

Fills

Rocket, 2.36-inch, M26, M10, M10A1, M10A2, M10A3 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CK	0.77	0.35	3.40	1.54	3.1 fluid ounces / 91.6 mL	1 (p. 152)
WP	0.89	0.40	3.40	1.54	-	1 (p. 151)

Shipping/Packing

Available references did not provide this information.

Key Dates

Rocket, 2.36-inch, M26, M10, M10A1, M10A2, M10A3 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1944	M10 (Standard)	3 (p. 124)
Standardized	1945	M10 (Limited Edition)	4 (p. 124)

Sources

1. Bureau of Ordnance. 1947. Ordnance Pamphlet, OP 1664 (Vol. 1), U.S. Explosive Ordnance. Department of the Navy.
2. Briggs, D.A. 1945. Technical Division Memorandum Report, TDMR 1051, Development of 2.36 Inch Rocket E22 for CK Filling, Project B1.5-1. Chemical Warfare Service.
3. Brophy, L., Miles, W., & Cochrane, R. 1959. History of the Chemical Warfare Service, From Laboratory to Field. In S. Conn (Ed.), "United States Army in World War II". U.S. Government Printing Office.
4. Finklestein, Leo. 1964. History of Research and Development of the Chemical Warfare Service in World War II (1 July 1940 - 31 December 1945) Screening Smokes Part III. Chemical Research and Development Laboratories (CRDL).

16.7 Rocket, 3.5-inch, Kit, E8

Figures

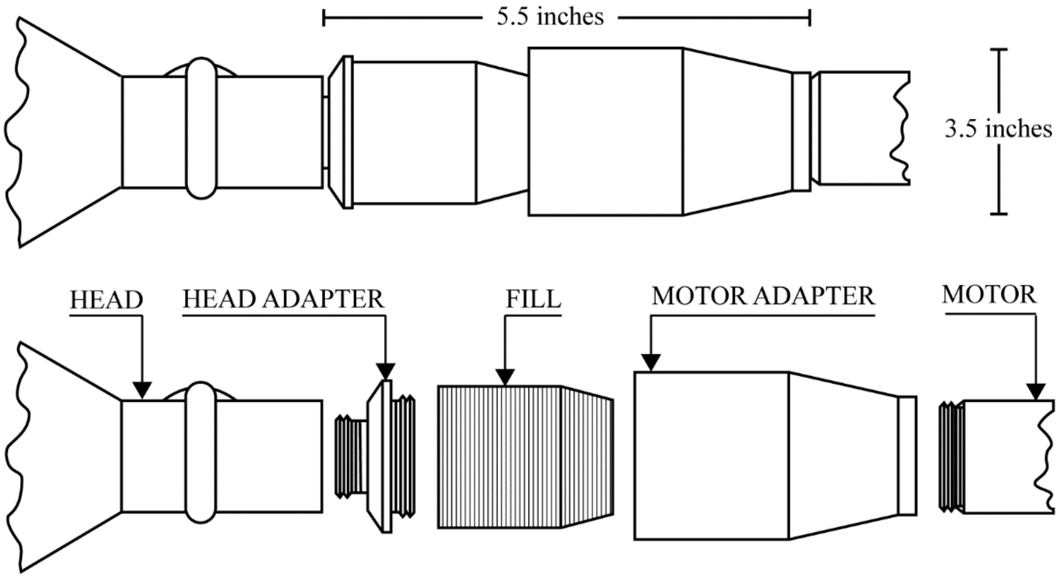

Figure 173: Rocket, 3.5-inch, Kit, E8 - Line Drawing

Figure 174: Rocket, 3.5-inch, Kit, E8 - Photograph

Specifications

Rocket, 3.5-inch, Kit, E8 - Specifications and Other Data		**Citation**
Historical Name	Kit, Agent, Toxic, GB, 3.5-Inch Rocket, E8	1 (p. 4-54)
Type	Rocket	2 (p. 4-53)
Size	3.5-inch	1 (p. 4-54)
Service	Marine Corps, Navy	1 (p. iv)
Diameter	3.5 inches (8.89 cm)	2 (p. 4-53, 4-54)
Length	5.5 inches (13.79 cm)	2 (p. 4-53, 4-54)
Other Engineering Data	Rocket: M28A2 Launchers: M20, M25, or M30	1 (p. 4-54, 4-55), 2 (p. 4-53, 4-54)

General Use and Description

The E8 kit was used to introduce a lethal dosage of toxic agent into a tank for neutralizing effect (1 p. 4-54), (2 p. 4-53, 4-54).

Rocket, 3.5-inch, Kit, E8

The E8 toxic agent kit was designed to be adapted by the individual soldier to the standard 3.5-inch high explosive anti-tank (HEAT) rocket M28A2. The kit consisted of a container and two component adapters. The two-component liquid adapter was made of aluminum and held the agent container between the motor and the rocket head. No special tools were required in the field and it was fired from the standard 3.5-inch rocket launcher (1 p. 4-54), (2 p. 4-53, 4-54).

Explosive Train

Available references did not provide specific information on the explosive train.

Fuzing

Available references did not include information regarding fuzes for this item.

Booster, Adapter-Booster, or Burster

Available references did not include information regarding boosters, adapter-boosters, or bursters for this item.

Fills

Rocket, 3.5-inch, Kit, E8 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	0.04	0.18	1.25	0.56	-	1 (p. 4-55), 2 (p. 4-54)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

For more information see CWLR 2328 (1 p. 4-55), (2 p. 4-54, 4-53).

Key Dates

Available references did not include information regarding key dates for this item.

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
2. Bureau of Naval Weapons. 1961. NAVORD Report 6954, Fourth Consolidated Report of BW/CW Study (U). Department of the Navy.

16.8 Rocket, 4.5-inch, T164, T165, T166

Figures

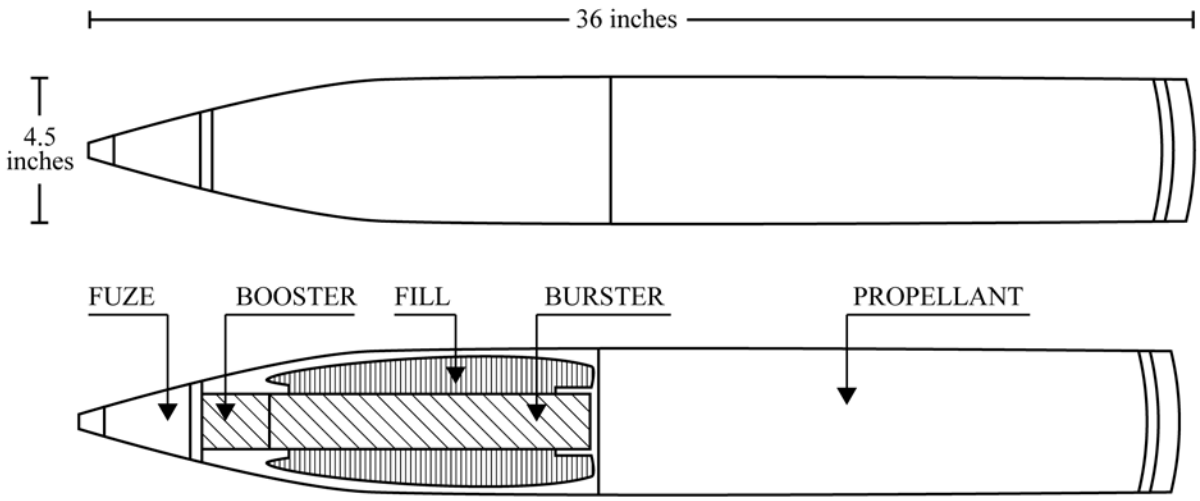

Figure 175: Rocket, 4.5-inch, T164, T165, T166 - Line Drawing

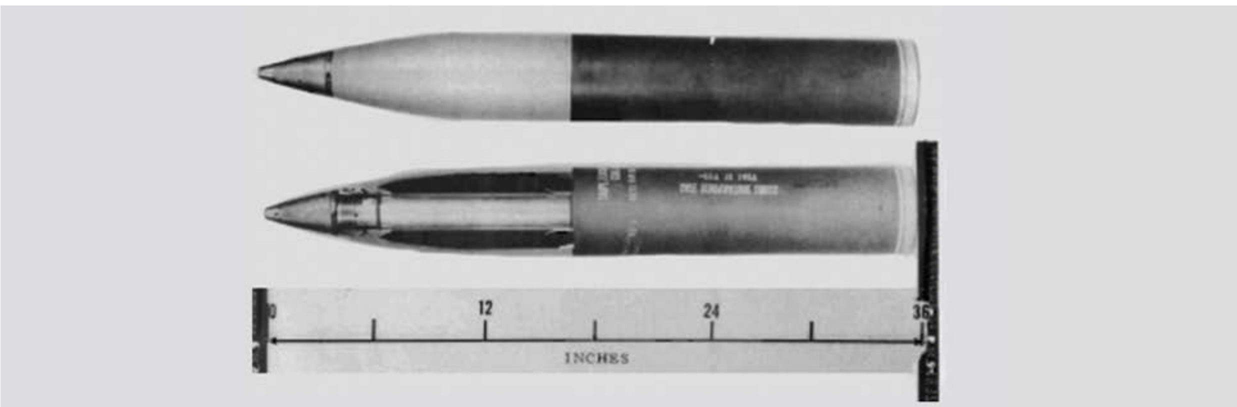

Figure 176: Rocket, 4.5-inch, T164, T165, T166 - Photograph - Top: Exterior, Bottom: Cutaway View

Specifications

Rocket, 4.5-inch, T164, T165, T166 - Specifications and Other Data		**Citation**
Historical Name	4.5-Inch Chemical Rockets, T164 (GB), T165 (HD), and T166 (HD)	1
Type	Rocket	2
Size	4.5-inch	3 (p. 5)
Conflict	Cold War	2
Service	Marine Corps	3 (p. 6)
Diameter	4.5 inches (11.43 cm)	2
Length	~36 inches (91.44 cm)	1
Other Engineering Data	Used with T123 series launcher, or T66 Multiple Launch Rocket System (MLRS).	3 (p. 5-6)

General Use and Description

The T160 series chemical rocket was developed as an interim weapon for dissemination of toxic agents. Its purpose was to deliver a rapid and effective gas attack (2), (3 p. 7).

Rocket, 4.5-inch, T164, T165, T166

The complete round consisted of the warhead, motor, burster charge, and fuze assembly.

The T160 series 4.5-inch chemical rockets, T164, T165, and T166 were modifications of the T160E4 4.5-inch HE rocket. The rockets utilized the M81 standard artillery fuze with the M24 booster. The burster wells of the T164 and T165 rockets weighed approximately 1.5 pounds; the T166 burster well weighed approximately 1.0 pound (1 p. 21), (3 p. 17).

Explosive Train

Upon impact, the point detonating fuze would be initiated. The fuze would set off the booster, which would initiate the burster. The burster would break the shell and disseminate the agent filler.

Fuzing

Rocket, 4.5-inch, T164, T165, T166 - Fuzing		
Fuze	**Note**	**Citation**
M81	Used with M24 booster	1 (p. 16), 2 (p. Appendix A)
M81A1	Point detonating	1 (p. iii), 3 (p. 28)

Booster, Adapter-Booster, or Burster

Rocket, 4.5-inch, T164, T165, T166 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
T164	1.45 pounds	Tetryl	-	2 (p. Appendix A), 3 (p. 28)
T165	1.45 pounds	Tetryl	-	2 (p. 1, Appendix A)
T166	0.14 pounds	Tetrytol	-	2 (p. 1, Appendix A)

Fills

Rocket, 4.5-inch, T164, T165, T166 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	3.30	1.49	38.0-39.6	17.2-17.9	The T164 was filled with GB. Weight is for T164.	1, 3 (p. 5)
HD	3.88	1.75	38.0	17.2	The T165 and T166 were filled with HD. Weight is for T165.	1 (p. 16)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The agent to burster ratio was as follows:

- T164: 2.3 to 1,
- T165: 2.68 to 1, and
- T166: 40 to 1 (1 p. 9)

Key Dates

Rocket, 4.5-inch, T164, T165, T166 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Military Characteristics Approved	1951	CCTC 2233 (T165 and T166)	2

Rocket, 4.5-inch, T164, T165, T166

Sources

1. Test Division. 1953. Chemical and Biological Laboratories Report, CRLR 198, Final Engineering Test No. 37A, Rocket, Gas, GB, 4.5-Inch, T164. Test Division, Chemical Corps Chemical and Radiological Laboratories.
2. Liberman, David S. 1954. Final Engineering Test, No. 37B - Rocket, Nonpersistent Gas, HD, 4.5-Inch, T165E1, No. 37C - Rocket, Persistent Gas, HD, 4.5 Inch, T166E1. Chemical Corps, Chemical and Radiological Laboratories, Army Chemical Center.
3. Gibby, I., Layton, L., Stone, W., & Clay, J. 1953. Dugway Proving Ground Report, DPGR 117, 4.5-Inch Chemical Rocket Evaluation: operational evaluation of the rocket, chemical, 4.5-inch, T164; DPG CW 6-52. Chemical Warfare Division.

16.9 Rocket, 5-inch, E43, E45

Figures

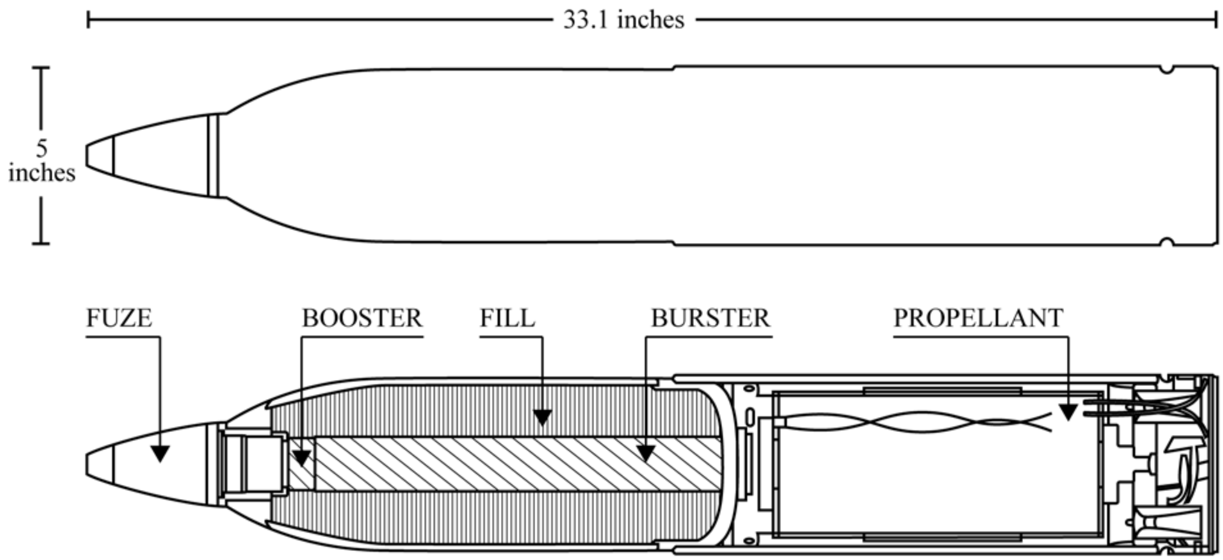

Figure 177: Rocket, 5-inch, E43, E45 - Line Drawing

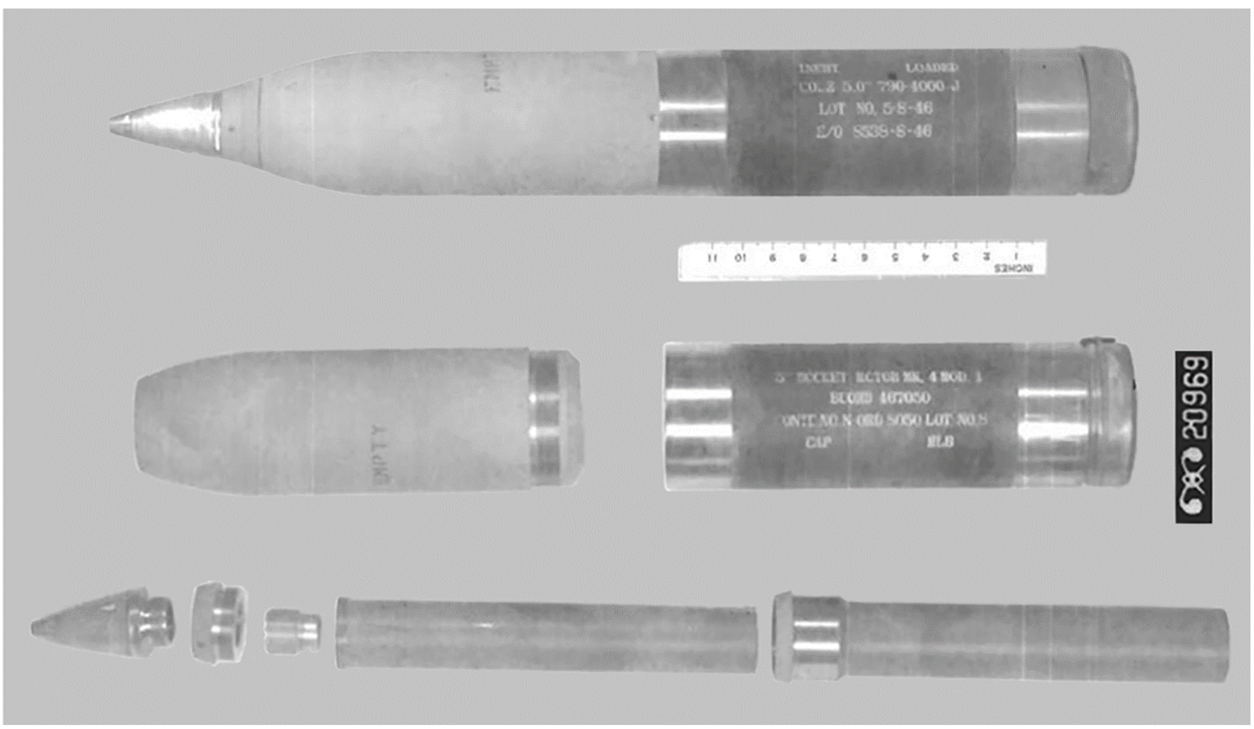

Figure 178: Rocket, 5-inch, E43, E45 - Photograph - Top: Complete Rocket, Middle and Bottom: Rocket Components

Rocket, 5-inch, E43, E45

Specifications

Rocket, 5-inch, E43, E45 - Specifications and Other Data		Citation
Historical Name	Rocket, Persistent Gas (HD), 5-Inch, E45	1 (p. 30)
Type	Rocket	1 (p. 3), 2 (p. 1)
Size	5-inch	1 (p. 3), 2 (p. 1)
Service	Navy	1 (p. 3)
Diameter	5-inches (12.7 centimeters)	1 (p. 3), 2 (p. 1), 3 (p. 7)
Length	Overall Length: 33.1 inches (84.07 cm) Rocket head with fuze: 19.5 inches (49.5 cm) Rocket head without fuze: 15.8 inches (40.13 cm) With fuze: 19.5 inches (49.5 cm)	2 (p. 5, 10)
Other	The overall length of the E45 head was approximately 3/16-inch shorter than the MK14 and 1-1/16 inches longer than the MK 10.	2 (p. 10)
Propellant	MK 4 Mod 1 spin-stabilized-rocket motor, or MK 4 Mod 4	2 (p. 64)
Maximum Range	3,700	3 (p. 9)
B/M Dwg	329675	2 (p. 5)

General Use and Description

The E43 and E45 rockets were developed to meet the requirement for a HD-filled warhead for the 5-inch spin stabilized rocket system. The primary purpose of this munition was for offshore bombardment of land targets within range of Naval gunfire with possible use against enemy surface forces (2 p. 3, 64).

The E-43 was patterned after the standard MK14, Mod 0 warhead. The E43 and E45 warheads were designed for use with Navy 5-inch spin-stabilized-rocket systems. The E43 and E45 rockets were identical except for the type of chemical filling employed. The E43 was GB-filled whereas the E45 was HD-filled.

The E45 used a modified MK14 Mod 0 rocket warhead during development. The rocket employed a conventional press-fit burster well closure. The length of the burster well allowed the bottom of the well to seat on the base of the head (2 p. 3, 64).

Explosive Train

Upon impact, the point detonating fuze initiated the burster, which would break the shell and disseminate the filler (2 p. 58).

Fuzing

Rocket, 5-inch, E43, E45 - Fuzing		
Fuze	**Note**	**Citation**
MK 30, Mod 13	Used with a MK 44 Mod 1 tetryl auxiliary detonating fuze	3 (p. 9)
MK 30, Mod 3	Used with a MK 44 Mod 1 tetryl auxiliary detonating fuze	2 (p. 2, 4)

Booster, Adapter-Booster, or Burster

Rocket, 5-inch, E43, E45 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
EK28	N/A	Composition B	Weight range 2.79-2.84 pounds.	2 (p. 4)

Rocket, 5-inch, E43, E45

Fills

Rocket, 5-inch, E43, E45 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	4.75-5.50	2.15-2.49	28.8	13.0	GB was only used in the E43.	2 (p. 3-4), 3 (p. 9)
HD	5.64	2.55	28.3	12.8	Gross weight is for the warhead.	1 (p. 3), 2 (p. 10)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

The E43 and E45 were designed to be fired from the MK102 rocket launcher (2 p. 2).

Key Dates

Rocket, 5-inch, E43, E45 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1952	CCTC 2661 (E43 GB-fill, E45 HD-fill)	-

Sources

1. Edgewood Arsenal. 1959. Project and Associate Project Engineers EA. U.S. Army Chemical Corps.

2. Wagner, P., & Scherer, R., & LaMonica, V. 1956. Munitions Development Division, Technical Memorandum, TM 12, Development of Rocket, Non-Persistent Gas (GB), 5-Inch, E43 and Rocket, Persistent Gas (HD), 5-Inch, E45. Chemical Warfare Laboratories.

3. Dugway Proving Ground. 1958. Dugway Proving Ground Trial Record, DPGTR 231, CW 363 Dissemination Phase of the Final Engineering Testing of the Navy E-43, 5-Inch Spin-Stabilized, Agent-Filled, Rocket (U). U.S. Army, Chemical Corps Research and Development Command.

16.10 Rocket, 5-inch, Warhead, MK 40 Mod 0 (E43)

Figures

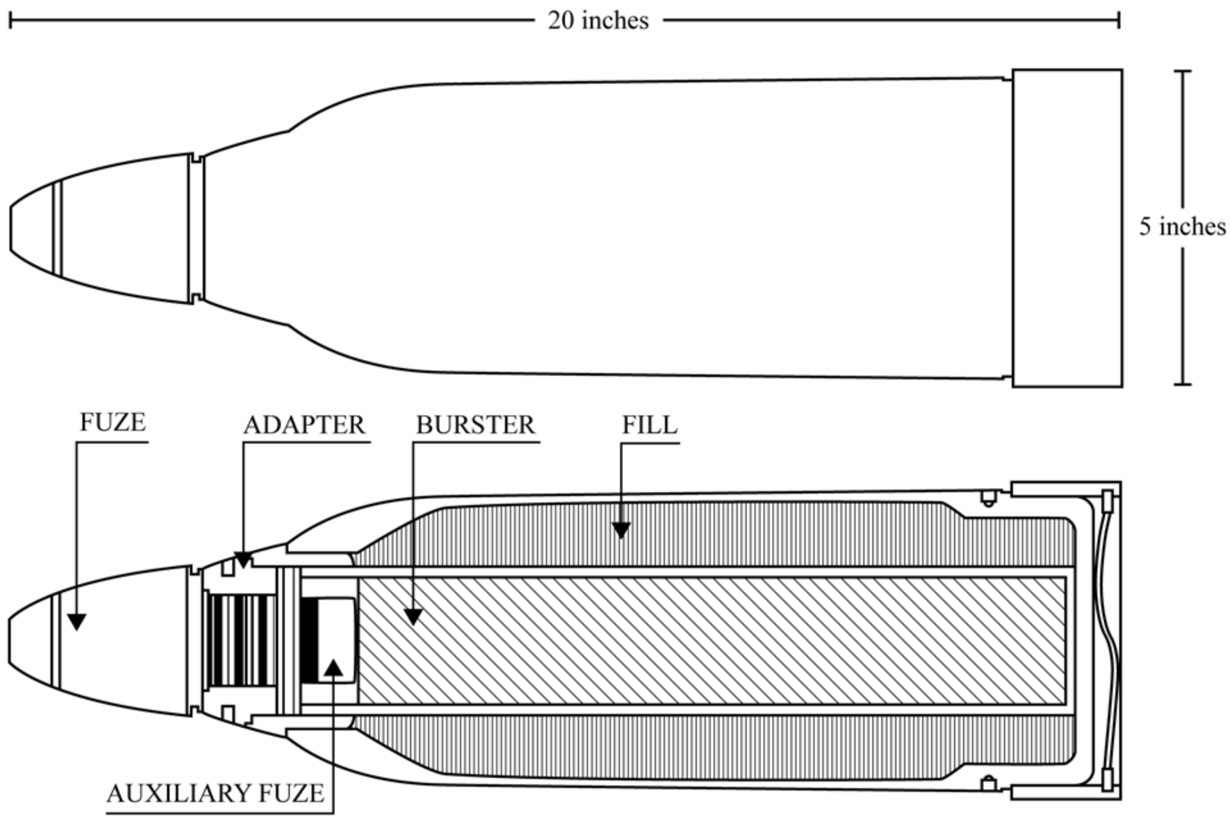

Figure 179: Rocket, 5-inch, Warhead, MK 40 Mod 0 (E43) - Line Drawing

Specifications

Rocket, 5-inch, Warhead, MK 40 Mod 0 (E43) - Specifications and Other Data		**Citation**
Historical Name	Warhead, 5-Inch Rocket, Gas, Nonpersistent, GB, Mk 40 Mod 0 (E43)	1 (p. 4-66)
Type	Rocket	2 (p. 4-65)
Size	5-inch	1 (p. 4-66), 2 (p. 4-65), 3 (p. 16)
Service	Navy	2 (p. 4-65), 3 (p. 16)
Diameter	5.0 inches (12.7 cm)	1 (p. 4-67), 2 (p. 4-66)
Length	Rocket: 32.2 inches (81.79 cm) Warhead with fuze: 20.0-28.8 inches (50.8-73.1 cm)	1 (p. 4-67), 2 (p. 4-66)
Other Engineering Data	Launcher: MK 50, MK 51, MK 52, MK 101, MK 105	1 (p. 4-67), 3 (p. 16)
Propellant	Rocket Motor: MK 4 Mod 4	1 (p. 4-67), 2 (p. 4-66)
Maximum Range	4,200 meters	3 (p. 16)
B/M Dwg	1380991	1 (p. 4-66)

Rocket, 5-inch, Warhead, MK 40 Mod 0 (E43)

General Use and Description

The MK40 provided a toxic chemical offensive capability (1 p. 4-66), (2 p. 4-65).

It was a spin-stabilized, surface-to-surface rocket warhead, which was developed to fulfill a Navy requirement for a chemical filled 5-inch warhead for use in offshore bombardment. To afford interchangeability with existing 5-inch Naval rockets the MK 40 was patterned after the standard MK 14 Mod 0 warhead. The principal modifications of this head were an adaptation for a larger burster, providing for a nominal agent to burster ratio of 7:1, which provided better dissemination of the fill in aerosol form, and improved sealing of the burster well within the warhead to minimize leakage. The metal parts of the warhead were designed for use with standard Navy rocket motor and fuzes (1 p. 4-66), (2 p. 4-65).

Explosive Train

Upon impact, the point detonating fuze would function to set off the auxiliary fuze, which in turn ignited the burster charge to explode the munition and release the agent (1 p. 4-66), (2 p. 4-65).

Fuzing

Rocket, 5-inch, Warhead, MK 40 Mod 0 (E43) - Fuzing		
Fuze	**Note**	**Citation**
MK 30 Mod 3	Point detonating	3 (p. 16)
MK 30 Mod 4	Point detonating	1 (p. 4-67), 2 (p. 4-66)
MK 44 Mod 2	Auxiliary	1 (p. 4-67)

Booster, Adapter-Booster, or Burster

Rocket, 5-inch, Warhead, MK 40 Mod 0 (E43) - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	2.8 pounds	Composition "B"	-	1 (p. 4-37)

Fills

Rocket, 5-inch, Warhead, MK 40 Mod 0 (E43) - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
GB	4.80	2.17	50.5	22.9	-	1 (p. 4-66)
HD	N/A	N/A	N/A	N/A	-	3 (p. 16)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

During development, this item was designated E43 (1 p. 4-67), (2 p. 4-65).

Key Dates

Rocket, 5-inch, Warhead, MK 40 Mod 0 (E43) - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Developed	1952	CCTC 2462	4

Sources

1. Naval Ordnance Laboratory. 1963. NAVWEPS Ordnance Pamphlet, OP 3142, Characteristics of Biological and Chemical Munitions and Delivery Systems (U). Department of the Navy.
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16.11 Rocket, 7.2-inch, M25, M27, T24

Figures

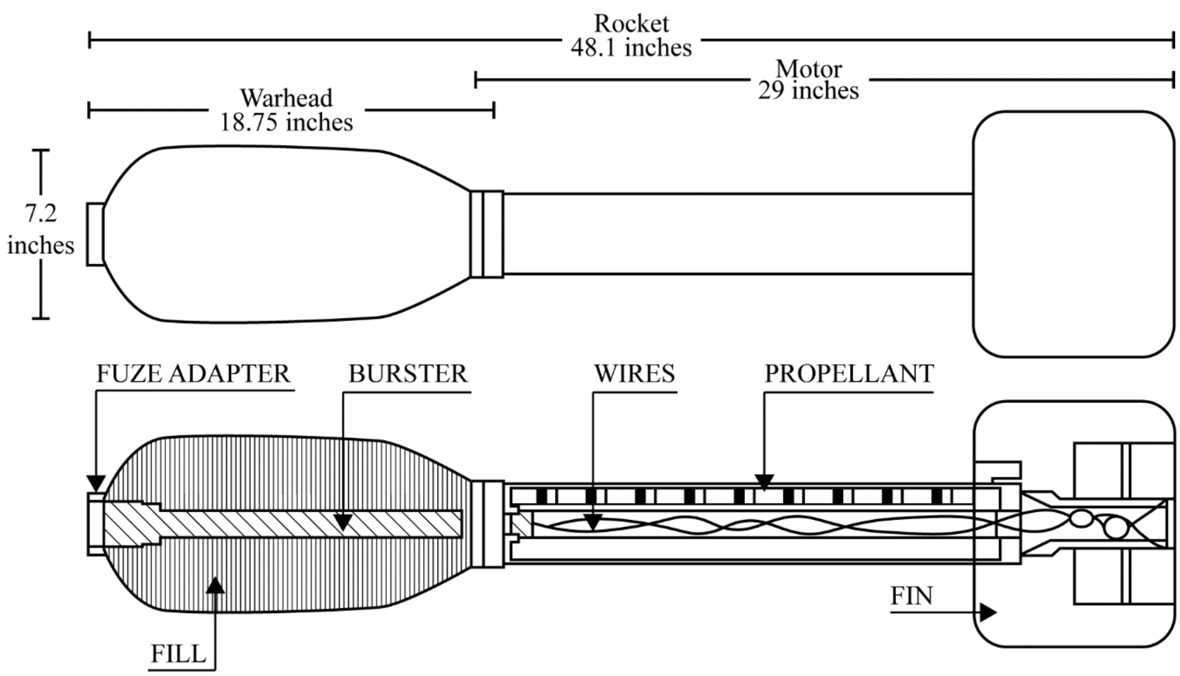

Figure 180: Rocket, 7.2-inch, M25, M27, T24 - Line Drawing

Figure 181: Rocket, 7.2-inch, M25, M27, T24 - Photograph

Rocket, 7.2-inch, M25, M27, T24

Specifications

Rocket, 7.2-inch, M25, M27, T24 - Specifications and Other Data		Citation
Historical Name	7.2-Inch C.W.R.-N and M25, M27, and T24	1 (p. 156, 178-179)
Type	Rocket	2 (p. 91)
Size	7.2-inch	1 (p. 156)
Service	Army, Marine Corps, Navy	1 (p. 156, 178), 3
Length	Overall: 48.1 inches (122.17 cm) Motor: 29 inches (73.66 cm) Head: 18.75 inches (47.63 cm)	1 (p. 178)
Width	Warhead: 7.2 inches (18.29 cm)	1 (p. 178)
Other Engineering Data	Motor: MK 5 Warhead: MK 7 or MK 9 The M25 was known as the T21 and the M27 was known as T52 during development.	1 (p. 178), 4, 5
Body Construction Material	Steel	1 (p. 178-179)
Propellant	Navy: Grain MK 11 (single grain of solventless extruded ballistite) Army: four sticks of ballistite	1 (p. 178)
B/M Dwg	82-6-14 (M25) 82-5-107 (M27)	6 (p. 41)

General Use and Description

The rocket was fired from a 24-rail demountable, variable-elevation launcher carried in a 2.5-ton truck. The salvo was fired in 2.5 seconds, and the launcher could be reloaded in 1.5 minutes (1 p. 178).

The warhead container was a bulb-shaped steel tube open at both ends. The adapter fit inside the flange on the forward end of the container. 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 the adapter were held together by a press fit and sealed with white-lead paste. The rear end of the tube was closed. 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 is welded to the inner edge of the motor body rim. The tail assembly had four tail vanes spot-welded 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 were welded to the rear shroud. The lead wires were connected to the two shrouds that served as contacts.

The Army rocket M27 was structurally the same as the Navy rocket, but was filled with CK. The TNT filled HE head, MK 9, similar to the MK 7, was known as the round T24and was fitted with the Fuze MK 147 and was fitted with the Fuze Mk 147 (1 p. 178).

Explosive Train

When the propellant was ignited, the forward motion allowed the fuze to arm. On impact, the striker was driven into the lead azide detonator which initiated the burster tube, breaking open the warhead and ejecting the chemical filler (1 p. 178).

Rocket, 7.2-inch, M25, M27, T24

Fuzing

Rocket, 7.2-inch, M25, M27, T24 - Fuzing		
Fuze	**Note**	**Citation**
MK 137-1	-	-
MK 147	Nose	1 (p. 178)
MK 147 Mod 1	Nose	1 (p. 178)
MK137	Nose - point detonating	6 (p. 41), 7 (p. 5-57)

Booster, Adapter-Booster, or Burster

Rocket, 7.2-inch, M25, M27, T24 - Booster, Adapter-Booster, or Burster				
Type	**Explosive Weight**	**Explosive Type**	**Notes**	**Citation**
Not designated	N/A	N/A	Burster tube	-

Fills

Rocket, 7.2-inch, M25, M27, T24 - Fill Types and Weights						
Chemical	**Fill Weight**		**Gross Weight**		**Notes**	**Citation**
	Pounds	**Kilograms**	**Pounds**	**Kilograms**		
CG	20.6	9.34	51.8-53.2	23.5-24.1	M25 fill	2 (p. 91), 6 (p. 41)
CK	18.8	8.53	51.8	23.5	Estimated	1 (p. 178), 6 (p. 41)
FS	19.7	8.94	53.2	24.1	-	1 (p. 178)

Shipping/Packing

Available references did not provide this information.

Miscellaneous Information

Any chemical filler with specific gravity over 1.2 could be used as fill in the rocket (1 p. 178).

Key Dates

Rocket, 7.2-inch, M25, M27, T24 - Key Dates			
Activity	**Year**	**Notes**	**Citation**
Standardized	1946	CCTC 1617 (M25 with GC-fill) CCTC 1618 (M27 with CK-fill)	4, 5
Obsoleted	1952	CCTC 2471 (M27 with CK-fill)	3

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17 Abbreviations and Acronyms

A

ABS	acrylonitrile-butadiene-styrene
AC	hydrogen cyanide
ACC	Army Chemical Corps
A.E.F.	American Expeditionary Forces
AMCTC	Army Materiel Command Technical Committee
AS	asbestine suspension
AT	anti-tank

B

BA	bromoacetone
BBC	bromobenzyl cyanide
BM	Berger mixture
BZ	3-quinuclidinylbenzilate

C

CA	bromobenzyl cyanide
CAIS	chemical agent identification set
CAITS	Chemical Agent Identification Training Set
CAS	Chemical Abstract Service
CB	chemical biological
CC	cyanogen chloride
CCTC	Chemical Corps Technical Committee
CG	phosgene
CK	cyanogen chloride
Cl	chlorine
cm	centimeter(s)
CN	chloroacetophenone
CNB	chloroacetophenone solution (45% benzene + 10% chloroacetophenone + 45% carbon tetrachloride)
CNC	chloroacetophenone solution (70% chloroacetophenone + 30% chloroform)

CNS	chloroacetophenone solution (38.4% chloropicrin + 23% chloroacetophenone + 38.4% chloroform)
CRDL	Chemical Research and Development Laboratories
CRLR	Chemical and Biological Laboratories Report
CS	2-chlorobenzalmalononitrile
CS_2	carbon disulphide
CWC	Chemical Weapons Convention
CWM	chemical warfare materiel
CWS	Chemical Warfare Service
CWTC	Chemical Warfare Technical Committee
CX	cyanogen chloride

D

DA	diphenylchloroarsine
DF	methylphosphonic difluoride
DM	adamsite
DoD	Department of Defense
DP	diphosgene
DPGLR	Dugway Proving Ground Letter Report
DPGMR	Dugway Proving Ground Memorandum Report
DPGR	Dugway Proving Ground Trial Report

E

EATR	Edgewood Arsenal Technical Report
ED	ethyldichloroarsine
EG	simulant agent for GB and VX
EOD	Explosive Ordnance Disposal

F

FM	titanium tetrachloride
FNH	flashless nonhygroscopic
FS	sulfur trioxide and chlorosulfonic acid
FSN	Federal Stock Number

Abbreviations and Acronyms

G

GA	tabun
GB	sarin
GB2	binary sarin

H

H	mustard
HC	zinc oxide and hexachloroethane
HCN	hydrocyanic acid
HD	distilled mustard
HDV	thickened distilled mustard
HE	high explosive
HEAT	high explosive anti-tank
HL	mustard-lewisite mixture
HN	nitrogen mustard
HN-1	nitrogen mustard (Ethyl)
HN-2	nitrogen mustard (Methyl)
HN-3	nitrogen mustard (Tri)
HP	solution of white phosphorous in distilled mustard with carbon disulphide
HQ	mustard-sesquimustard (Q) mixture
HS	sulfur mustard
HT	distilled mustard and T-mixture
HV	thickened distilled mustard

I

IM	incendiary oil

K

KCN	potassium cyanide
KJ	stannic chloride

Abbreviations and Acronyms

L

L	lewisite
lb.	pound

M

M-1	lewisite
MD	methyldichloroarsine
MK	Mark
mL	milliliter
MLRS	Multiple Launch Rocket System
mm	millimeter(s)
MR	molasses residuum
MSR	Materiel Status Record

N

N/A	information not available
NAVORD	Naval Ordnance
NAVSEA	Naval Sea Systems Command
NAVWEPS	Bureau of Naval Weapons
NC	chloropicrin and stannic chloride
NM	polymethylsulfide
NP	napalm
NSN	national stock number

O

OCM	Ordnance Committee Meeting
OP	Ordnance Pamphlet
OPA	isopropyl alcohol and isopropylamine solution
OPCW	Organisation for the Prohibition of Chemical Weapons
ORSD	Office of Scientific Research and Development

Abbreviations and Acronyms

P

PD	phosgene plus diphenylchlorarsine (CG+DA)
PETN	pentaerythritol tetranitrate
PG	chloropicrin and phosgene
PIG	shipping container
PS	chloropicrin
psi	pounds per square inch
PT	oil and incendiary mixture/thickened fuel
PT-1	oil and incendiary mixture/thickened fuel
PWP	plasticized white phosphorus

Q

Q	sesquimustard
QL	ethyl-2-diisopropylaminoethyl-methylphosphonite

R

RCWM	recovered chemical warfare materiel
RDX	Royal Demolition Explosive (cyclonite - hexahydro-1,3,5-trinitro-1,3,5-triazine)

S

SA	arsine
SCAITS	Simulant Chemical Agent Identification Training Set

T

TB	Technical Bulletin
TCIR	Technical Command Informal Report
TCR	Technical Command Report
TDMR	Technical Division Memorandum Report
Th.	thermite
TH3	thermite
TM	Technical Manual
TNT	trinitrotoluene

TO	Technical Order
TR	Technical Regulation

U

USAF	U.S. Air Force
USATECOM	U.S. Army Test and Evaluation Command
UXO	unexploded ordnance

V

VT	variable time
VX	O-Ethyl S(2-diisopropylaminoethyl) methylphosphonothioate

W

WP	white phosphorous
WW	World War

18 Definitions

Blood Agent: Most blood agents are cyanide-containing compounds, absorbed into the body primarily by breathing; AC and CK are the important agents in this group. Blood agents are highly volatile and, therefore, nonpersistent even at very low temperatures. These agents can be dispersed by artillery shell, mortar, rocket, aircraft spray, or bomb. At high concentrations, both compounds cause effects within seconds and death within minutes in unprotected individuals. The cyanides affect body functions by poisoning the cytochrome oxidase system; this poisoning prevents cell respiration and the normal transfer of oxygen from the blood to body tissues. Cyanogen chloride also acts as a choking agent. The standard protective mask gives adequate protection against field concentrations. (Departments of the Army, Navy, and Air Force, 1990, p. 25)

Blister Agent: Blister agents are also known as vesicants. All the blister agents are persistent, and all may be employed in the form of colorless gases and liquids. Blister agents damage any tissue that they contact. They affect the eyes and lungs and blister the skin. They damage the respiratory tract when inhaled and cause vomiting and diarrhea when absorbed. Vesicants poison food and water and make other supplies dangerous to handle. They may produce lethalities, but skin damage is their main casualty producing effect. The severity of a blister agent burn directly relates to the concentration of the agent and the duration of contact with the skin. In addition to casualty production, blister agents may also be used to restrict use of terrain, to slow movements, and to hamper use of materiel and installations. (Departments of the Army, Navy, and Air Force, 1990, p. 30)

Chemical Agent: An agent that, through its chemical properties, produces lethal or other damaging effects on human beings, except that such term does not include riot control agents, chemical herbicides, smoke, and other obscuration materials. Title 50 U.S.C. § 1511 (2012) (Title 50 U.S.C. § 1521, 2011, p. 303)

Choking Agents: Choking agents injure an unprotected person through the respiratory tract (i.e., nose, throat, and lungs). In extreme cases membranes swell, lungs become filled with liquid, and death results from lack of oxygen; thus, these agents “choke” an unprotected person. Fatalities of this type are called “dryland drownings.” (Departments of the Army, Navy, and Air Force, 1990, p. 14)

Chemical Agent Identification Set (CAIS): Defined in Part 179.3 of Title 32, CFR. For the purposes of this document and the RCWM Program, a site known or suspected to contain CAIS will be investigated and managed as a CWM Site. Until evaluated and identified, CAIS vials/bottles are managed as CWM. CAIS containing non-nerve agent, dilute CA or industrial chemicals are not considered CWM and once recovered are managed, transported and disposed as hazardous substances/waste.

Chemical Warfare Materiel (CWM): Consistent with Section 179.3, items generally configured as a munition containing a chemical compound that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. CWM includes V- and G-series nerve agents or H-series (mustard) and L-series (lewisite) blister agents in other-than-munition configurations; and certain industrial chemicals (e.g., AC, CK, or carbonyl dichloride [called phosgene or CG]) configured as a military munition. Due to their hazards, prevalence, and military-unique application, CAIS are also considered CWM (see definition of CAIS above for clarification). CWM does not include: riot control devices; chemical defoliants and herbicides; industrial chemicals (e.g., AC, CK, or CG) not configured as a munition; smoke and other obscuration producing items; flame and incendiary producing items; or soil, water, debris, or other media contaminated with low concentrations of chemical agents where no CA hazards exist. Defined in DoD Directive 5101.17E

Industrial chemical: A non-military-unique chemical developed or manufactured for use in industrial operations or research, by industry, government, or academia. For example, AC, CK, CG are considered industrial chemicals.

Munitions and certain materials of interest: When recovered, includes munitions that contain an unknown liquid fill; certain materials (e.g., laboratory vials, closed cavity containers encountered at a CWM site) that contain an unknown liquid fill; and chemical agent identification sets. Defined in DoD Directive 5101.17E.

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