NAVSEA SW073-AC-MMA-010

0640-LP-668-1694

TECHNICAL MANUAL

MISCELLANEOUS CHEMICAL MUNITIONS

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This Publication Supersedes NAVORD OP 2217 First Revision Dated 30 October 1964.

Published by Direction of Commander, Naval Sea Systems Command.

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CERTIFICATION STATEMENT

This is to certify that responsible NAVSEA activities have reviewed the above identified document for acquisition compliance, technical coverage, and printing quality. This form is for internal NAVSEA management use only, and does not imply contractual approval or acceptance of the technical manual by the Government, nor relieve the contractor of any responsiblity for delivering the technical manual in accordance with the contract requirement.

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FOREWORD

NAVSEA Technical Manual SW073-AC-MMA-010 describes miscellaneous chemical munitions and equipment used by the Navy and provides instructions for their safe and effective use. NAVSEA SW073-AC-MMA-010 supersedes NAVORD OP 2217 (First Revision).

This manual consists of one volume and is arranged in chapters as follows:

Chapter 1: Introduction
Chapter 2: Safety Precautions and Disposal Instructions
Chapter 3: Reporting Accidents and Incidents
Chapter 4: Chemical Agents
Chapter 5: Riot Control Agents
Chapter 6: Riot Control Grenades and Associated Equipment
Chapter 7: Riot Control Dispersers
Chapter 8: Chemical and Riot Control Cartridges and Projectiles
Chapter 9: Chemical Mines
Chapter 10: Chemical Bombs and Clusters
Chapter 11: Chemical Spray Tanks
Chapter 12: Chemical Agent Bulk Containers
Chapter 13: Chemical Filling Equipment
Chapter 14: Chemical Training Devices
Chapter 15: Obsolete and Unserviceable Items

Ships, training activities, supply points, depots, Naval Shipyards and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvements to NAVSEA technical manuals shall be reported to the Commander, Port Hueneme Division, Naval Surface Warfare Center (Code 5B00), 4363 Missile Way, Port Hueneme, CA 93043-5007 on NAVSEA Technical Manual Deficiency/Evaluation Report, NAVSEA Form 4160/1. To facilitate such reporting, three copies of NAVSEA Form 4160/1 are included at the end of this technical manual. Feedback comments will be thoroughly investigated, and originators will be advised of action resulting therefrom. Extra copies of NAVSEA Form 4160/1 may be requisitioned from the Defense Distribution Depot Susquehanna Pennsylvania (DDSP), Bldg. 05, 5450 Carlisle Pike, Mechanicsburg, Pennsylvania 17055-0789.

The contents of this manual are official and reflect the engineering and maintenance data available. Cutoff data from information contained herein is 1 June 2000. This manual is stocked at NPFC. Activities within the Department of Defense having need of this manual may refer to NAVSUP PUBLICATION 2002 for requisitioning instructions. Activities within the Department of Defense may be placed on distribution list for this manual by making application to Commander, Port Hueneme Division, Naval Surface Warfare Center (Code 5B00), 4363 Missile Way, Port Hueneme, CA 93043-5007.

Marine Corps units/activities requiring copies of this manual should submit requisitions as directed by current edition of MCO P5600.31. Correspondence involving distribution, quantities, address changes, etc. should be forwarded to CMC (HQSP-2), Washington, DC.

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SAFETY SUMMARY

Listed below is every WARNING and CAUTION contained in this manual and the page on which the WARNING or CAUTION is located. All personnel engaged in the handling, firing, and storage of these chemical munitions must fully understand these WARNINGS and CAUTIONS and the procedures by which hazardous conditions are to be reduced or eliminated.

The following WARNINGS appear in the text of this manual and are repeated here for emphasis.

WARNINGS

Under no circumstances shall untrained personnel attempt to use this technical manual as a text for self-teaching. (Page 1-1.)

Never pick up a riot control grenade if dropped after removal of safety pin. Move immediately to safe area. (Page 2-3.)

A protective mask and protective clothing must be worn when preparing and laying chemical mines. (Page 2-4.)

Containers filled with toxic agents must not be vented directly to the atmosphere, but must be properly filtered through an appropriate vent-equipped canister. (Pages 2-6, 12-4, 12-6.)

Do not stand directly downwind from burning grenades even if equipped with a protective mask. (Pages 6-3, 6-6, 6-9, 6-12, 6-15, 6-18, 6-20, 6-24, 6-26, 6-29.)

Wait 30 minutes before approaching a suspected dud-fired grenade. Deterioration or dampness may prolong burning of the pyrotechnic delay. (Page 6-18.)

Do not block nozzle with your finger or thumb when discarding agent. CSX agent will irritate your skin. (Page 7-9.)

Do not rub eyes or skin if you have been contaminated. Thoroughly wash affected skin areas with soap and cold water. For eyes, flush with cold water and seek medical treatment. (Pages 7-9, 7-12.)

To prevent injury to personnel, do not expose the disperser to temperatures above 130°F. The disperser is pressurized and when exposed to excessive heat, it could explode. (Pages 7-9, 7-12.)

To prevent injury to personnel, do not destroy or puncture the pressurized disperser. (Pages 7-10, 7-13.)

Do not block nozzle with your fingers or thumb when discharging agent. CR agent will irritate your skin. (Page 7-12.)

Since the burster in this projectile is loaded with tetrytol, the projectile is not to be stored or fired at temperatures exceeding +125°F. (Pages 8-22, 8-25.)

Since the burster in this projectile is loaded with Composition B, the projectile is not to be stored or fired at temperatures exceeding +125°F. (Pages 8-28, 8-31, 8-37, 8-40, 8-43.)

Since the burster in this projectile is loaded with high explosives, the projectile is not to be stored or fired at temperatures exceeding +125°F. (Page 8-34.)

Use copious amounts of water to wash affected areas of the body, and seek medical help immediately when exposed to either isopropyl alcohol-isopropylamine (OPA) or difluoromethylphosphine oxide (DF). OPA is a highly flammable liquid and emits harmful vapors that will affect the human body. DF, when exposed to air or water, becomes highly acidic, causing it to be very corrosive. It also emits vapors harmful to the human body. (Page 8-38.)

When handling the Mk 94 nonpersistent gas bomb, personnel should wear impermeable protective clothing, consisting of butyl rubber suite, hood, gloves, boots, and foot covers, impregnated underwear, socks, and gloves, and protective masks to guard against leaking GB. (Page 10-4.)

Wear adequate protective clothing and a protective mask during all loading and handling procedures. (Page 10-6.)

Use caution when working around the unactuated fins. The extendible fins are under spring tension, and release of these components could cause serious injury. (Page 10-6.)

Aircraft should never land with full tanks; in case of an abortive mission, the contents must be discharged in a safe area. In the event that either nose or tail explosives fail to detonate, the smoke cannot escape properly, and the tank must be jettisoned. (Page 11-10.)

FS reacts violently with water. The reaction releases heat and causes sulfuric acid to be formed. When loading FS into a receptacle, be sure that personnel stay away from openings in the receptacle until any violent reaction has subsided. Start FS flowing slowly, and stop the flow immediately if a violent reaction takes place. Resume the flow when the reaction has ceased. (Page 12-2.)

The agent simulants are harmful if inhaled or swallowed. Avoid contact with eyes, skin, and clothing. Use with adequate ventilation. Wash thoroughly after handling. (Page 14-11.)

When handling the M70A1 persistent gas bomb, personnel should wear permeable protective clothing, rubber aprons, gloves, boot covers, and protective masks to guard against possible leaking HD. Check for the agent in the burster well when removing the nose plug. (Page 15-2.)

Do not attempt to disarm an armed fuze. Only EOD personnel should undertake disarming and disposal of fuzes. (Pages 15-3, 15-6, 15-10.)

When handling the AN-M78 gas bomb, personnel should wear protective masks to guard against possible leaking CG or CK. (Page 15-6.)

When handling the AN-M79 nonpersistent gas bomb, personnel must wear protective masks to guard against possible leaking CG, AC, or CK. (Page 15-10.)

The following CAUTIONS appear in the text of this manual and are repeated here for emphasis.

CAUTIONS

Filled mines should not be stored for more than 30 days and should be vented periodically to prevent pressure from building up and to minimize leaks. (Page 9-5.)

When dry STB (Supertropical Bleach) comes in contact with mustard, sufficient heat is usually generated to produce a fire. (Page 4-14.)

CHAPTER 1

INTRODUCTION

1-1. SCOPE

NAVSEA SW073-AC-MMA-010 describes lethal, incapacitating, and harassing munitions and associated delivery systems, storage units, and training devices currently available for Navy use. Data on chemical munitions includes chemical and riot control grenades, bombs, spray tanks, projectiles, cartridges and dispersers, and related training materials. The information presented in this manual does not apply to tactical use or defense against chemical agents. The information is intended to provide a reference guide as an aid in training, familiarization, and identification of chemical munitions and associated equipment. This will permit Fleet personnel to store, handle, and operate the items covered in a correct and safe manner to achieve maximum effectiveness from their use. Subsequent changes and additions will be issued as required to keep this manual correct and current.

1-1.1. GENERAL. Chemical munitions produce toxic and irritating effects upon the body, a screening, or signaling smoke, or an incendiary or name action. Although smoke producing agents and incediaries are considered chemical munitions, this manual only covers items containing chemical or riot control agents. (Smoke producing items are covered in NAVSEA SW050-AB-MMA-010 and incendiary items are covered in NAVSEA SW060-AA-MMA-010.) The effects of chemical munitions depend primarily upon the chemical agent with which they are filled rather than with explosion or fragmentation, even though they may contain explosives, ignition elements or pyrotechnic materials to activate them. Many of these filler agents are extremely toxic, while other agents which are normally designed to incapacitate personnel temporarily, can produce toxic or even lethal effects under certain circumstances involving exposure for long periods of time or to excessive concentrations. Therefore, the characteristics of the various filler agents must be understood and the necessary cautions must be observed in the handling, storage, or disposal of the munitions.

1-1.1.1. Limitations On The Use of This Manual. All personnel who deploy or use chemical munitions must be specially trained for such work. They must be fully acquainted with the various chemical agents used and with their characteristics, with the types of associated equipment, and with approved chemical practices and techniques.

WARNING

UNDER NO CIRCUMSTANCES SHALL UNTRAINED PERSONNEL ATTEMPT TO USE THIS TECHNICAL MANUAL AS A TEXT FOR SELF-TEACHING.

1 1.1.2. Unauthorized Uses of Ammunition. No ammunition or explosive assembly shall be used in any gun or equipment for which it is not designated, nor shall any explosive or chemical device be manufactured, purchased, or assembled for use in displays, demonstrations, tests or for any other purpose unless authorized by the Naval Sea Systems Command.

1-1.2. CHEMICAL MUNITIONS IN THE U.S. NAVY. Chemical munitions are designed and intended to be used in Navy operations not only on the sea, but also in amphibious landing, carrier based air operations, and in land or airborne operations involving Marine Corps. Naval weapons and Navy aircraft may provide chemical support to the Army in amphibious and coastal operations. The chief value of chemical weapons is their potentiality for creating casualties. There are two kinds of chemical casualty effects on personnel.

1. Effects which impair or destroy the individual's physical functioning.

2. Effects which impair the individual's mental capacity to perform his duties.

Chemical munitions add a wide variety of offensive and defensive weapons to the Navy's arsenal. For example, delivery of chemicals can be by bombs, spray tanks, and dispensers mounted on carrier based aircraft or helicopters or by projectiles fired from Navy and Marine Corps guns and howitzers. Chemical smokes can screen and protect Navy operations, toxic chemical agents can put hostile troops out of service, and riot control agents can be used to prevent loss of life and property.

1-2. FORMAT

NAVSEA SW073-AC-MMA-010 is divided into chapters, sections, paragraphs, and subparagraphs, with every subdivision being numbered for easy reference as an example, the number 6-2.3.5 is applied to the fifth subparagraph of the third paragraph of the second section of Chapter 6.

1-2.1. ARRANGEMENT OF CONTENTS. The major elements comprising the contents of this manual are arranged in chapters as follows:

1-2.1.1. Chapter 1: Information of a general nature pertaining to all devices and materials described herein, excepting only accident, malfunction, and incident reporting which is covered by Chapter 3.

1-2.1.2. Chapter 2: General Safety requirements and precautions in the handling of liquid and gaseous chemical agents in bulk quantities and certain specific types of chemical munitions. Disposal instructions for toxic chemical munitions are included.

1-2.1.3. Chapter 3: Regulations for reporting accidents, malfunctions, and incidents involving any of the items described in this manual.

1-2.1.4. Chapter 4: Information on the characteristics and properties of chemical agents (lethal and incapacitating agents) used in munitions, dispersers, and spray tanks as described in the succeeding chapters.

1-2.1.6. Chapter 5: Information on the characteristics and properties of riot control agents used in munitions, grenades, and dispersers as described in the succeeding chapters.

1-2.1.6. Chapter 6: Individual item descriptions of the various riot control hand grenades and associated equipment.

1-2.1.7. Chapter 7: Individual item descriptions of pressurized dispersers for dissemination of riot control agents from aircraft or by hand.

1-2.1.8. Chapter 8: Individual item descriptions of cartridges and projectiles which are filled with chemical and riot control agents.

1-2.1.9. Chapter 9: Descriptions of chemical mines which are designed to disperse chemical agents from fixed locations.

1-2.1.10. Chapter 10: Descriptions of chemical bombs and clusters that can deliver a variety of toxic chemicals.

1-2.1.11. Chapter 11: Descriptions of chemical spray tanks that disseminate chemical agents from aircraft.

1-2.1.12. Chapter 12: Descriptions of bulk containers designed for storage and shipment of bulk quantities of dangerous chemical liquids.

1-2.1.13. Chapter 13: Descriptions of equipment used for filling chemical spray tanks with liquid chemical agents.

1-2.1.14. Chapter 14: Descriptions of instructional devices used to train personnel to handle, store, and deploy chemical munitions.

1-2.1.15. Chapter 15: Descriptions of devices that have been declared obsolete and unserviceable.

1-2.2. INDIVIDUAL ITEM DESCRIPTIONS. Within each of the substantive chapters of this manual, individual devices are covered regarding intended use, external and internal design characteristics, functioning, packaging, and requisitioning. If there is special equipment associated with the installation, attachment, or deployment of the device being described. Make-ready procedures, handling and storage rules, and safety precautions which apply exclusively to individual items are included in the appropriate individual item description.

1-2.3. WARNINGS, CAUTIONS, AND NOTES. The following definitions apply to the "Warnings," "Cautions," and "Notes" found throughout the manual:

WARNING

AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH IS NOT CORRECTLY FOLLOWED, COULD RESULT IN PERSONAL INJURY OR LOSS OF LIFE.

CAUTION

AN OPERATING PROCEDURE, PRACTICE, ETC. WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO, OR DESTRUCTION OF EQUIPMENT.

NOTE

An operating procedure, condition, etc. which it is essential to highlight.

1-3. IDENTIFICATION AND MARKING

Chemical devices, materials, and equipment are identified and marked individually by approved nomenclature, identification numbers, manufacturer's symbol, date of manufacture, and National Stock Number. This information is stenciled either on the item itself or on its shipping container—usually on both. Whenever a basic change in design is made, a new identification number is assigned. When a minor alteration or modification is made, a new mode number is assigned and the identification number remains the same.

1-3.1. NAVY ITEM IDENTIFICATION. Chemical items designed and produced under Navy auspices are identified by Mark (Mk) and Modification (Mod); for example: Bomb, Chemical Agent, Mk 94 Mod 0.

1-3.2. ARMY ITEM IDENTIFICATION. When the Navy procures chemical items that were designed and produced under Army auspices, the originally assigned Army identification

remains with the item. In an item such as Grenade, Hand, Riot, CS1, M26A2, the M corresponds to mark and the A to mod. A minor modification of this kit would result in its being identified as M25A3.

1-3.3. ITEMS WITHOUT IDENTIFICATION NUMBERS. Some chemical items do not have Navy or Army Identification Numbers and are identified by their nomenclature; for example: Container, One Ton, Type A. In some cases, due to procurement from off-the-shelf commercial sources, lot numbers of depot stocks are missing. Stocks should be inspected for manufacturer and year of production to establish local serviceability and homogeneity. Application should then be made to Naval Ammunition Production Engineering Center, Crane, Indiana 47522, for a station lot number assignment.

1-3.4. NOMENCLATURE AND NUMBERING. A standard nomenclature and numbering system has been established in the Department of Defense and is mandatory for record purposes and ordering data. The markings on some chemical devices may differ from that shown in this manual. However, these devices are designated in accordance with official nomenclature as set forth in TW010-AA-ORD-010 (OD 12607). There is a different National Stock Number (NSN) for each item in supply as packed. The NSN are Federal Supply Class (FSC). The second part and last nine digits of the NSN are the National Item Identification Number (NIIN). Department of Defense Identification Code/ Navy Ammunition Logistic Code (DODIC/ NALC) is a four digit alphanumeric code used as a suffix to the NSN. The DODIC/NALC is used for Fleet reporting/requisitioning of ammunition and explosive supplies and to indicate the functional interchangeability of items (i.e., items having the same DODIC/NALC are functionally interchangeable). This manual lists all currently available NSN and DODIC/NALC for each item covered.

1-3.5. COLOR CODING. The base color of all chemical munitions is ocean gray. Colored bands or colored markings are stenciled on the body of the munition and on its container to identify the type of filler in the chemical munition. The color coding markings and systems are as follows:

1-3.5.1. Military Standard 709C. Chemical munitions presently being manufactured are marked in accordance with Military Standard 709C. This revised color coding system was adopted by the military in 1976. The markings include the name or agent symbol of the filler agent, see Figure 1-3.1.

1-3.5.2. Military Standard 709A. Chemical munition items manufactured from 1961 through 1976 were marked in accordance with Military Standard 709A, Figure 1-3.2, which differs from MIL-STD-709C mainly as to the number of colored bands and some of the colors used to identify the filler agents.

1-3.5.3. Five-Element Marking System. All chemical munition items manufactured before January 1961 follow the five-element marking system shown in Figure 1-3.3. A descriptive word such as gas, smoke, or incediary indicates the general nature of the filler agent.

1-3.5.4. Application. All chemical munition items manufactured before 1976 will retain their original color coding markings. Because of this, personnel handling chemical munitions must be familiar with all three color coding systems and markings.

1-4. DEFINITIONS OF GENERAL CHEMICAL TERMS

1-4.1. BINARY CHEMICAL MUNITIONS. Munitions designed to use two relatively nontoxic chemicals which combine during functioning of the weapon system to produce a toxic agent for release on target.

REVISED COLOR CODING SYSTEM (1976)

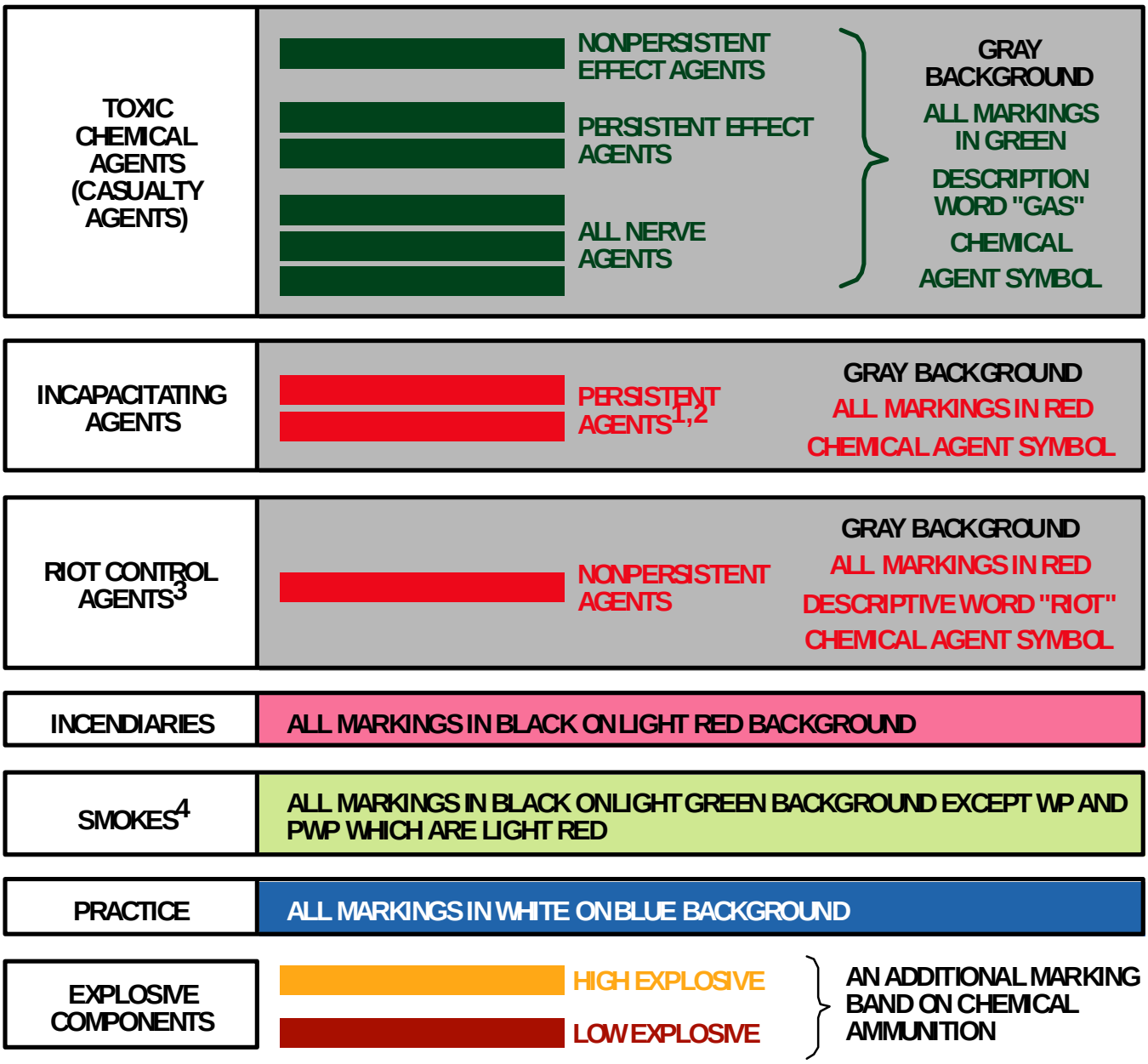
AGENT/FILLER	MARKING[1]/BACKGROUND/BAND COLOR	
TOXIC CHEMICAL AGENTS	ALL NERVE, BLISTER, BLOOD, CHOKING AGENTS	
	TOXIC BINARY	
INCAPACITATING AGENTS	B Z	
RIOT CONTROL AGENTS	ALL CS, CN D—SERIES	
INCENDIARY AGENTS [2]	ALL MARKINGS IN BLACK	
SCREENING AND SIGNALING SMOKES [2]	OTHER THAN WP, PWP	
	WP, PWP	
PRACTICE [2]	ALL MARKINGS IN WHITE	
EXPLOSIVE COMPONENTS (ADDITIONAL MARKING BANDS)		

1 MARKINGS INCLUDE NAME OR CHEMICAL AGENT SYMBOL
2 NO BAND INCLUDED

MIL-STD-709C

Figure 1-3.1. Revised Color Coding System

STANDARD COLOR CODING SYSTEM (NEW)



1 CURRENTLY, MUNITIONS FILLED WITH INCAPACITATING AGENTS ARE MARKED AS PERSISTENT AGENTS.

2 NO DESCRIPTIVE WORD IS ON INCAPACITATING AGENT FILLED MUNITIONS.

3 INSURE MUNITIONS CONTAINING CS2 FILL WILL BE MARKED WITH TWO RED BANDS TO DENOTE A PERSISTENT AGENT.

4 M18 COLORED SMOKE HAND GRENADES HAVE AN ALTERNATE GREEN (OD) BASE COLOR WITH LETTERING AND A 1-INCH BAND OF LIGHT GREEN TO SHOW PRIMARY USE.

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Figure 1-3.2. Standard Color Coding System

FIVE-ELEMENT MARKING SYSTEM (OLD)

BACKGROUND COLOR (cml munitions)	NO. OF BANDS (duration of effectiveness)	COLOR OF MARKINGS[1] (primary use)	CHEMICAL AGENT SYMBOL (exact filling)	DESCRIPTIVE WORD (general nature of agent on release)
		TOXIC CHEMICAL AGENTS (casualty agents)	GB, CG, CK	GAS
		TOXIC CHEMICAL AGENTS (casualty agents)	VX, HD, H, HT	GAS
		IRRITANT AGENTS (riot control agents)	CN, DM, CS, CN1, DM1, CS1	GAS
		INCENDIARIES	TH, NP, PT1, PTV	INCENDIARY
		SMOKES (screening and signaling)	HC, WP, PWP	SMOKE

[1] MARKINGS INCLUDE BANDS AND LETTERING.

Figure 1-3.3. Five-Element Marking System

1-4.2. CHEMICAL AGENT. A chemical compound intended for military use with lethal or incapacitating effects because of its chemical properties. Excluded are riot control agents, incediaries, smoke and flame-producing items, and individual disassociated components of chemical munitions.

1-4.3. CHEMICAL MUNITION. Munition containing a chemical filler that produces a toxic or irritating effect upon the body, a screening or signaling smoke, or an incediary or flame action.

1-4.4. DECONTAMINATION. The process of making any person, object, or area safe by absorbing, destroying, ventilating, making harmless, or removing chemical agents.

1-4.5. FLAME. Burning gas or vapor that causes lethal or incapacitating effects by means of direct burn wounds, depletion of oxygen, carbon monoxide poisoning, or heat, or a combination of these factors. Flame can function secondarily as an incediary.

1-4.6. INCAPACITATING AGENT. Chemical agent that produces temporary physical disability or temporary mental confusion, amnesia, or stupor.

1-4.7. INCENDIARY. Primarily an antimaterial compound that generates sufficient heat to cause destructive thermal degradation or destructive combustion of material.

1-4.8. INDUSTRIAL CHEMICAL. Chemicals developed or manufactured for use in industrial operations or research, by industry, government, or the academia. These chemicals are not primarily manufactured for specific purpose of producing human casualties or rendering equipment, facilities, or areas dangerous for use by man. Hydrogen cyanide (AC), cyanogen chloride (CK), and phosgene (CG) are considered industrial chemicals.

1-4.9. LETHAL CHEMICAL AGENT. Chemical agent that may be used effectively in field concentrations to produce death.

1-4.10. NONPERSISTENT AGENT. Nonpersistent agents are chemical agents which remain in effect, at the point of release, for less than 10 minutes.

1-4.11. PERSISTENT AGENT. Persistent agents are chemical agents which remain in effect, at the point of release, for 10 minutes or more.

1-4.12. RIOT CONTROL AGENT. Chemicals producing transient effects. The effect disappears in minutes when personnel are no longer exposed. Exposed persons rarely require medical treatment. Riot control agents are normally used by governments for domestic law enforcement purposes and are classified as “tear agents” or “lachrymators”.

1-4.13. SMOKE AGENT. A substance that, because of its chemical or physical properties, produces a screening or signaling smoke.

1-4.14. TRAINING AGENT. An agent used to train personnel to operating in a chemical environment.

1-5. HANDLING AND STORAGE

1-5.1. HAZARD CLASSIFICATIONS. Hazard classifications for chemical agents and munitions are governed by the Department of Defense (DoD) Ammunition and Explosive Standards (DoD 5154-4S, AR 385-64, and TM 9-1300-206). These standards provide the appropriate quantity distance hazard class, division, storage compatibility group, Department of Transportation (DOT) Class, and DOT marking of ammunition and explosives. This classification system is based on the United Nations Organization (UNO) classes for hazardous materials.

1-5.1.1. United Nations Organization (UNO) Classes. The Department of Defense (DoD) and the Department of Transportation (DOT) have adopted the UNO classes for classifying hazardous materials for handling, storage and shipment purposes. (See Table 1-1.)

Table 1-1. United Nations Organization (UNO) Classes

UNO Class Number	UNO Class Name
1	Explosives
2	Gases
3	Flammable and Combustible Agents
4	Flammable Solids
5	Oxidizers and Organic Peroxides
6	Poisons (Toxic)
7	Radioactive Materials
8	Corrosives

1-5.1.2. UNO Class 1, Explosives. The following chemical agents and munitions are classified UNO Class 1, Explosives:

1. Chemical munitions with explosive components.

2. Nontoxic (riot control agent filled) chemical munitions without explosive components.

1-5.1.3. UNO Class 6, Poisons (Toxic). The following chemical agents and munitions are classified UNO Class 6, Poisons (Toxic):

1. Toxic (lethal and incapacitating agent filled) chemical munitions without explosive components.

2. Toxic chemical agents in bulk containers.

1-5.2. CHEMICAL GROUPS. For purpose of storing and handling, chemical agents have been divided into chemical groups, as defined below, based on the action of the agent, the degree and type of hazard and the type of protection required. The same group designations are used for agents and chemical ammunition. The ammunition group is based on the ammunition chemical agent filler.

1-5.2.1. Chemical Group A. Group A includes highly toxic liquid agents which in either liquid or vapor form, may be absorbed through the respiratory tract, skin, or eyes (e.g., nerve agent, mustard). Exposure to Group A chemical agents may cause serious damage to body functions or death depending on the degree of exposure involved. Protection from these agents requires full coverage, impermeable cloth and protective masks. (See Table 1-2.)

Table 1-2. Group A Chemical Agents

Symbol	Name
GB	Sarin
VX	VX
H	Mustard
HD	Mustard (distilled)
HT	Mustard (T-mixture)
L	Lewisite
HN-1	Nitrogen mustard

1-5.2.2. Chemical Group B. Group B includes agents (gaseous, liquid, or solid) which are toxic or incapacitating by inhalation, ingestion or percutaneous absorption. Wearing of a suitable protective mask is required for the protection of personnel against inhalation of particles or smoke from burning agents. Since these agents will cause varying degrees of skin irritation, approved types of protective clothing (such as coveralls, gloves, etc.) shall be provided and worn. This group consists of choking agents, blood agents, riot control agents and screening smokes. Examples of Group B agents

are phosgene, CN, CN-DM, BZ, CS, and HC. (See Table 1-3.)

Table 1-3. Group B Chemical Agents

Symbol	Name
CS	0-Chlorobenzalmalonitrile
CS- 1	0-Chlorobenzalmalonitrile-silica aerogel
CS-2	0-Chlorobenzalmalonitrile-silica aerogel & water resistant coating
CN	Chloroacetophenone
CNS	Liquid lachrymator
CNB	Liquid lachrymator
DM	Diphenylaminechloroarsine (adamsite)
FM	Titanium Tetrachloride
FS	Sulfur trioxide chlorosulfonic acid mixture
CG	Phosgene
CL	Chlorine
AC	Hydrocyanic acid
CK	Cyanogen chloride
PS	Chloropicrin
DA	Diphenylchloroarsine
BZ	Bromobenzl
HC	Hexachloroethane

1-5.2.3. Chemical Group C. This group includes materials (WP and PWP) which are spontaneously combustible and for which special firefighting techniques and materials are required. Personal protection will be fire and heat resist ant items. Toxic fumes are a minimal hazard.

1-5.2.4. Chemical Group D. This group consists of readily flammable and incendiary materials (e.g., TH, TEA, TPA, NP, IM, PT-1) for which conventional firefighting methods are usually not effective. Fumes and combustion products are, in most instances, highly toxic when inhaled or upon contact with the skin. Personnel shall be equipped with full protective equipment when combatting fires involving the materials.

1-5.2.5. Chemical Group Listings. In addition to Table 1-2 and Table 1-3, the group classification of each chemical described in this manual (Chapters 4 and 5) is included in the description of that chemical.

1-5.3. HANDLING OF CHEMICAL MUNITIONS. Chemical munitions classified as lethal or incapacitating (Groups A and B) shall not be carried aboard ship unless specifically authorized by CNO. When such is authorized, Naval Ordnance Center (NAVORDCEN) will provide detailed instructions and personnel trained in handling them. Chemical lethal or incapacitating weapons may not be stowed with conventional explosives without specific approval of NAVORDCEN. Ships and shore activities which stow and handle lethal or incapacitating chemical weapons shall have a competent safety officer assigned who shall plan, coordinate, and supervise a safety program. Handling instructions, safety precautions, and emergency procedures shall be posted in all spaces where lethal or incapacitating munitions are stowed or handled. Safety watches shall be posted during all phases of handling in which the operator's view of the load or of obstructions is hampered. There shall be a pre-arranged evacuation plan in which all personnel are thoroughly drilled.

1-5.4. STORAGE OF CHEMICAL MUNITIONS

1-5.4.1. Compatibility. Chemical ammunition of two or more groups of fillers shall not be stored together except as allowed by NAVSEA SW020-AC-SAF-010/020/030 or upon specific authorization by NAVORDCEN. When practicable, chemical ammunition with different fillers of the same group should be stored in separate magazines to facilitate the detection, identification, segregation, and disposal of leaking containers. Where the number of suitable magazines does not permit segregation within

groups, ammunition of the same group may be stored together, regardless of the chemical filler. Whenever possible, each kind of ammunition (bombs, projectiles, and so forth) should be stored separately.

1-5.4.2. Storage Containers. Chemical munitions and their containers are designed and tested to ensure that they remain airtight. Most chemical weapons are handled and stowed in shipping and storage containers or overpacks which have been designed to ensure safe, secure delivery of the weapon from stockpile to target. Munitions of this type that do not require special containers are sufficiently rugged and/or overpacked to assure their safety during handling and shipping. Special precautions shall be taken to avoid damage to the shipping and storage containers and/or overpack. The container or overpack is a secondary safety barrier should the primary agent container fail.

1-5.4.3. Magazines. Chemical munitions shall be stored in magazines provided for in NAVSEA OP 5, Volume 1, Ammunition Ashore and NAVSEA OP 4, Ammunition Afloat.

1-5.5. REFERENCE DOCUMENTS. The following is a list of reference documents that provide additional information on handling, transportation, and storage of chemical agents and munitions:

1. OP 4, Ammunition Afloat

2. OP 5, Volume 1, Ammunition Ashore

3. NAVSEA SW020-AC-SAF-010/020/030 Transportation Storage Data for Ammunition, Explosives and Related Hazardous Materials

4. Bureau of Explosives Tariff No. BOE-6000, Hazardous Materials

5. Regulations of the Department of Transportation by Air, Rail, Highway, Water and Military Explosives by Water, Title 46 CFR Part 146 and Title 49 CFR Parts 171 through 179 and Part 397

6. Code of Federal Regulations Title 42, Part 73.25, Etiologic Agents

7 Agreements between the DoD and Department of Health, Education, and Welfare, and the Department of Agriculture

8. Official Air Transport Restricted Articles Tariff No. 6-D, ATB No. 37, CAB No. 82

9. NAVSUP Publication 505, Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft

1-6. DECONTAMINATION

Personnel and equipment contaminated with lethal chemical agents, no matter how slight, shall be subjected to proper decontamination procedures immediately. (See FM 3-5, NBC Decontamination.) Equipment contaminated with incapacitating agent shall be subjected to proper decontamination procedures as soon as practicable; however, exposed personnel shall be decontaminated immediately. Decontamination equipment for chemical operations (lethal, or incapacitating) should be set up before every handling operation. Personnel decontamination, including clothing is recommended for riot control agents or materials. Prior to entering a

stowage area, a check shall be made for contamination and, if necessary, decontamination measures shall be taken. Emergency decontaminations or detoxification procedures shall be established and decontamination points shall be located within the stowage or operational area. Such points shall be provided with an adequate supply of soap, detergent, water and other approved personnel and/or equipment decontamination facilities. Decontamination procedures are included for each chemical described in this manual. (See Chapters 4 and 5.)

CHAPTER 2

SAFETY PRECAUTIONS AND DISPOSAL INSTRUCTIONS

2-1. INTRODUCTION

This chapter contains safety precautions required in handling liquid and gaseous chemical agents in bulk quantities and certain specific types of chemical munitions. Disposal instruction for smoke and toxic chemical munitions are included. General handling and storage requirements are set forth in Section 1-5 of this manual. Specific handling and storage, decontamination, and first aid instructions are presented with the individual descriptions on chemical and riot agents as listed in Chapters 4 and 5.

2-1.1. WARNINGS AND CAUTIONS. Special warnings and cautions appearing under individual item descriptions in this manual shall be rigidly adhered to, as shall all special safety rules which may be set forth for individual items.

2-2. SAFETY REQUIREMENTS

2-2.1. GENERAL. All personnel engaged, either directly or indirectly, in operations in which ammunition, chemicals and/or other hazardous materials are involved shall be thoroughly trained in chemical safety. They shall be capable or recognizing hazardous situations and of taking prompt and effective corrective action. Thinking safety and working safely must become a firmly established habit when working with or in the vicinity of items which are potentially dangerous by reason of their explosive, flammable, or toxic characteristics.

2-3. SAFETY PRECAUTIONS

Complete understanding and strict observance of prescribed safety regulations are necessary to eliminate the unsafe acts and conditions which cause preventable accidents.

2-3.1. GENERAL SAFETY PRECAUTIONS. When handling chemical agents and munitions, observe the following general precautions:

1. Know and observe all federal, state and local laws and regulations which apply to the transportation, storage and usage of chemical munitions.

2. DO NOT allow unauthorized or unnecessary personnel to be present when chemicals are being handled or used.

3. Any requirement specifying the use of personnel protective clothing and/or equipment is considered a mandatory safety regulation which must be enforced and observed.

4. Know the location of all protective equipment and first aid supplies. Know how to administer first aid to yourself and to other personnel.

5. All gas masks and protective equipment shall be individually fitted and marked with the name of the user and shall be inspected at least once a week to assure their availability and serviceability.

NOTE

Only the person for whom the equipment was fitted shall wear the equipment.

6. The Navy Environmental Health Center (BuMed) should be contacted for data on protective clothing and equipment required for hazards or toxic exposures. (See OP 3199 for hazards and toxic exposures).

7. Contact lenses shall not be worn in any area where chemical munitions are handled and used. Prescription mask optical inserts may be obtained through local Medical Departments.

8. DO NOT carry chemicals or chemical components in pockets or elsewhere on the body.

9. DO NOT ingest any chemical agent or materials.

10. Personnel shall not eat, drink, chew, bring food to or store food in any area where chemical agents are handled or stored.

11. DO NOT permit smoking, matches or other sources of fire or flame within 100 feet of an area in which chemicals are being handled or used.

12. Visibly damaged, dented, or corroded chemical items must not be used. They must be carefully segregated for disposition by qualified Explosive Ordnance Disposal personnel.

13. Under no circumstances shall chemical munitions be disassembled or tampered with.

14. In all handling and storage operations, utmost care must be exercised to avoid damage that might cause accidental ignition.

15. Chemical munitions shall be kept away from all fires and excessively high temperatures.

16. Chemical munitions must not be dropped, rolled, thrown, or otherwise handled in a rough or careless manner.

17. DO NOT expose chemical munitions to prolonged exposure to the direct rays of the sun. Such exposure increases sensitivity and deterioration and may result in gas leakage due to increased vapor pressure inside munition/container.

18. Handle chemical packages and containers only with authorized equipment.

19. DO NOT remove chemical munitions from their hermetically sealed containers until immediately before use.

20. DO NOT use pull rings and safety pins to lift or handle chemical devices.

21. DO NOT abandon any chemical agent or munition. Any chemical agents or munitions found away from normal storage area should be marked and Base Security or Explosive Ordnance Disposal personnel should be notified IMMEDIATELY.

22. DO NOT leave chemicals, empty cartridges, boxes, liners, or other materials used for packing chemical munitions lying around where children or unauthorized personnel or livestock can get them. Fatal or serious accidents can result from such careless practice.

23. Ensure that all unused munitions are returned to their proper packing containers and the containers sealed and closed after use.

24. Wait 30 minutes after ignition time before approaching a misfire.

2-3.2. RIOT CONTROL GRENADES. When using riot control grenades as described in Chapter 6, observe the following precautions:

1. Always positively identify grenade action, whether burning type or bursting type before attempting to use.

2. DO NOT pull the fuze ring when lifting or handling grenades.

WARNING

NEVER PICK UP A RIOT CONTROL GRENADE IF DROPPED AFTER REMOVAL OF SAFETY PIN. MOVE IMMEDIATELY TO SAFE AREA.

3. After removing the safety pin, hold the fuze lever (or arming sleeve) firmly in place until the grenade is thrown, tossed, or placed in position. Always throw the grenade as soon as the pin is pulled.

4. Always throw bursting grenades well beyond their normal bursting radius.

5. Because burning-type grenades will flash occasionally and cause personnel injury, throw so as to function at least 30 feet from friendly personnel.

6. In throwing grenades, avoid hitting obstacles which can change course of grenade or cause it to bounce back.

7. DO NOT stand directly downwind from heavy concentrations of agent from CN, CS, CS1, CN1, DM1 or burning CN-DM riot hand grenade even though equipped with a protective mask.

8. DO NOT strike the top of the fuze with a hard object. A blow may ignite the fuze.

9. DO NOT attempt to launch the grenade from a rifle with service or blank ammunition. Use only the special grenade cartridges provided for this purpose.

10. Throw riot grenades from a position upwind of the rioters.

11. Wear a protective mask constantly when DM or DM1 agents are present in the atmosphere, pulling it away from the chin only during periods of actual vomiting.

12. DO NOT remove CN-DM grenades from their sealed metal can until shortly before use. Exposure to rain and humidity may cause a misfire. Stow burning-type grenades in a cool, dry place.

13. Observe 30-minute waiting period prior to approaching dud. Have duds destroyed in place by Explosive Ordnance Disposal personnel.

14. When using riot control grenades for training, keep equipment for fighting brush fires handy since grenades may start such fires.

15. Refer to appropriate rifle operator manuals for prescribed rifle launcher/cartridge combinations to launch grenades fitted with adapters.

2-3.3. RIOT CONTROL DISPERSERS. When using riot control dispersers as described in Chapter 7, observe the following precautions:

1. When filling or operating the M3 and M5 dispersers, personnel must wear a suitable protective mask and approved protective clothing such as coveralls and gloves.

2. Handle filled M3 and M5 dispersers with extreme care. These units contain pressurized tanks charged with 2100 psi compressed air.

3. DO NOT destroy or puncture the pressurized dispersers.

4. DO NOT expose dispersers to temperatures above 130°F. When exposed to excessive heat, the disperser could explode.

5. The M32 and M36 dispersers are never to be carried in pockets of clothing. Use only the provided carrying case when transporting dispersers on the body.

2-3.4. CARTRIDGES AND PROJECTILES. When using chemical and riot control cartridges and projectiles as described in Chapter 8, observe the following precautions.

1. The use of oil or grease on cartridges and projectiles is dangerous and prohibited.

2. Cartridges should not be polished, although corrosion, moisture, or dirt should be wiped off.

3. Detonator, fuze, and booster cavities, and fuze threads shall be kept free of all foreign material except for a light film of specified lubricating preservative.

4. Fuzes, detonators, and boosters are loaded with explosives which are sensitive to shock, heat, and friction and shall be handled with extreme care at all times.

5. No attempt shall be made to disassemble any fuze, cartridge, projectile or component thereof, unless specifically authorized in applicable Army manuals or by NAVORDCEN.

6. DF, when exposed to air or water, becomes highly acidic, causing it to be very corrosive. It also emits vapors harmful to the human body. Personnel handling DF shall wear protective mask and acid protective gloves and clothing.

7. OPA is a highly flammable liquid and emits harmful vapors that will affect the human body. Personnel handling OPA shall wear protective mask and acid protective gloves and clothing.

2-3.5. CHEMICAL MINES. When using chemical mines as described in Chapter 9, observe the following precautions:

1. Mines must be handled with care at all times. The explosive elements in fuzes, primers, detonators, and boosters are particularly sensitive to mechanical shock, friction, static electricity and high temperature.

2. Mines and components should be protected against moisture. The moisture-resistant seal on the packing containers shall not be broken until the mines are to be used or inspected.

3. Safety pins, safety forks (clips), and other safety devices are designed to prevent accidental initiation of the mine while being handled. These safety devices should be left in place until just prior to arming the mine.

WARNING

A PROTECTIVE MASK AND PROTECTIVE CLOTHING MUST BE WORN WHEN PREPARING AND LAYING CHEMICAL MINES.

4. Before removing (picking up) mines, safety devices shall be replaced, that is, the mines shall be properly disarmed.

WARNING

A PROTECTIVE MASK AND PROTECTIVE CLOTHING MUST BE WORN WHEN PREPARING AND LAYING CHEMICAL MINES.

5. Personnel involved in handling chemical mines must have appropriate first aid materials on hand for the chemical involved, i.e., atropine, 2-Pam Chloride, etc.

2-3.6. BOMBS AND CLUSTERS. When using chemical bombs and clusters as described in Chapter 10, observe the following precautions:

1. Protective masks, gloves and clothing shall be used whenever chemical bombs are to be handled.

2. DO NOT permit inexperienced personnel to handle chemical bombs except under the direct supervision of trained personnel.

3. DO NOT permit personnel handling chemical bombs to work alone or in locations where assistance is not readily available.

4. DO NOT unpack bombs, clusters, or components until they are ready for use or inspection.

5. DO NOT assemble fuzes, igniters, bursters, or other explosive components to bombs or clusters until they are ready to be used.

6. Work upwind from chemical bombs when possible.

2-3.6.1. Bomb Fuzes. Chemical bomb fuzes contain high explosives elements which are sensitive to heat and shock. The explosive elements deteriorate when exposed to moisture and dirt. To protect personnel from accidentally activating fuzes and to prevent damage to the fuzes, the following precautions must be observed:

1. DO NOT unseal moistureproof fuze containers until the fuzes are to be installed in a bomb or cluster.

2. Protect fuzes from excessive heat. DO NOT store them in direct sun light.

3. Protect both packed and unpacked fuzes against shock. DO NOT drop, tumble, drag, or throw containers of fuzes or the fuzes themselves.

4. DO NOT pack or unpack fuzes within 100 feet of other explosives.

5. When unpacking a fuze, examine it carefully to insure that sealing wires and safety pins are intact; that safety blocks, striker stops, and arming pins are in place; and that the arming stem (if present) is not unscrewed. Immediately notify Explosive Ordnance Disposal personnel if fuze does not pass inspection.

6. DO NOT remove safety pins or sealing wires until the arming wire is in place in the fuze.

7. DO NOT bend or distort the arming-vane assembly.

8. DO NOT use a primer-detonator other than the one authorized for use with the fuze.

9. Replace safety pin and seal wires in unused fuzes. Pack the fuzes in containers.

10. DO NOT attempt to disassemble a fuze.

11. When an authorized modification is made to a fuze, mark both the fuze and the container so as to show clearly the nature of the modification.

2-3.7. SPRAY TANKS. When using chemical spray tanks as described in Chapter 11, observe the following precautions:

1. Personnel shall wear protective masks, gloves, and clothing in all filling and handling operations.

2. Spray tanks shall not be filled until close to operational flight times.

3. In filling operations, any spillage must be decontaminated and washed off the equipment immediately.

4. Spray tanks shall not be used as a storage container.

5. Aircraft should never land with full tanks, in case of an abortive mission, the contents must be discharged in a safe area.

2-3.8. BULK CONTAINERS. When using chemical bulk containers as described in Chapter 12, observe the following precautions:

1. Conduct filling transfer operations downwind from personnel and equipment.

2. Personnel must be thoroughly familiar with the characteristics of the chemical being handled and the equipment being used.

3. First aid supplies including agent antidote must be available for instant use prior to commencing operations. A sufficient quantity of applicable decontaminant and decontaminating equipment must be on hand in order to decontaminate entire container of agent if necessary.

4. Personnel shall wear protective masks, gloves, and clothing in all filling and handling operations.

WARNING

CONTAINERS FILLED WITH TOXIC AGENTS MUST NOT BE DIRECTLY TO THE ATMOSPHERE, BUT MUST BE PROPERLY FILTERED THROUGH AN APPROPRIATE VENT-EQUIPPED CANISTER.

2-3.9. FILLING EQUIPMENT. When using chemical filling equipment as described in Chapter 13, observe the following precautions:

1. When possible conduct filling transfer operations out-of-doors and downwind from personnel and equipment.

2. Adequate ventilation including fans and blowers must be provided when filling transfer operations must be in an indoor area.

3. First aid supplies and equipment shall be available for instant use.

4. Personnel must be thoroughly familiar with the characteristics of the chemical being handled and equipment being used.

5. Personnel shall wear protective masks, gloves, and clothing in all filling and handling operations.

2-3.10. TRAINING DEVICES. When using chemical training devices as described in Chapter 14, observe the following precautions:

1. Observe all applicable safety precautions during training with training devices and inert materials, to promote safe operating procedures for use with live items.

2-4. DISPOSAL INSTRUCTIONS.

2-4.1 GENERAL. This section provides information and procedures necessary for the safe disposal of chemical munitions, explosive charges, ammunition, and incendiaries. See NAVSEA OP 5, Ammunition Ashore for additional information. The disposal of ammunition and explosives may be required because they have become unserviceable due to age, deterioration, damage, obsolescence, overstock, or lack of identity. It is the policy of NAVORDCEN to dispose of these materials using the most economical method consistent with established safety and environmental standards. When arranging the safe, effective, expeditious and economical disposal of ammunition and explosives, consideration must be given to demilitarization of materials that can be safely and ecomomically reused or sold. Materials that cannot be safely and economically salvaged shall be safely disposed of or destroyed in accordance with the specifications described in this manual and OP 5.

NOTE

Expended hardware and residual products associated with functioned demolition items shall be processed through local Defense Reutilization and Marketing Office (DRMO) for reclamation and/or sale, in accordance with DoD Instruction 4160.21-M-1 (Defense Demilitarization Manual) and OP 5 (Sale, Salvage, and Disposition of inert material).

2-4.2 AUTHORIZATION FOR DISPOSAL

The requirements for routing demilitarization and disposal of ammunition and explosives are provided in SPCCINST 8010.12 (series) and NAVSEAINST 4570.1 (series). Disposition instructions for material under technical direction of the Marine Corps will be requested from MARCORPSYSCOM (AM). Disposition instructions for material under technical control of NAVORDCEN will be requested from the IMSD. Disposal operations must comply with all applicable local, state and federal requirements for disposal and decontamination operations. Policy, responsibility and procedures for release of hazardous or nonhazardous, large or small quantities of ammunition, explosives and hazardous materials for demilitarization/disposal are contained in NAVSEAINST 4570.1 (series). The procedures outlined in this paragraph are not meant to prohibit routine disposal of ammunition and explosives by any activity in accordance with the specific provisions set forth in this manual and OP 5.

NOTE

All disposal sites, such as burning sites, grounds, burn furnaces, incinerators and detonation sites/areas are considered hazardous waste treatment facilities. In the United States, they will be included on the activity hazardous waste permit acording to Title 40 CFR Parts 260-265. Overseas activities must comply with hosy nation regulations as determined by the status of forces agreements.

2-4.3 APPROVED PROCEDURES FOR DISPOSAL

Explosive ordnance disposal personnel shall use rendered safe procedures developed by the Explosive Ordnance Disposal Technical Division (NAVORDTECHDIV), Indian Head, MD., for emergency disposal of ammunition or explosives. Standard Operating Procedures (SOPs), developed per NAVSEA OP 5 (paragraph 2-1.1), shall be used by all personnel conducting routine disposal operations of ammunition or explosives. These procedures shall be reviewed by the cognizant EOD group commander or Commanding Officer of subordinate mobile and training units and approved by the CO of the activity where the routine disposal is being conducted.

CHAPTER 3

REPORTING ACCIDENTS AND INCIDENTS

3-1. GENERAL REQUIREMENTS

All mishaps, accidents, incidents, and unsatisfactory performance, i.e., malfunctions, involving chemical agents and munitions shall be reported as required by OPNAVINST 5102.1B, Mishap Investigation and Reporting. U.S. Marine Corps activities are exempted if reports are submitted in accordance with USMC Technical Instruction TI-8010-15/1A.

3-1.1. DEFINITIONS. The principal terms of concern in this chapter are defined and interpreted as follows:

3-1.1.1. Chemical Agent. A chemical substance which is intended for use in military operations to kill, seriously injure or incapacitate people through its chemical properties. Excluded from considerations are riot control agents, chemical herbicides, smoke and flame (JCS Publication 1).

3-1.1.2. Chemical Mishap. Any unplanned or unexpected event causing personnel injury, occupational illness, death, or material loss or damage or an explosion of any kind whether damage occurs or not.

3-1.1.3. Chemical Agent Accident. Any occurrence involving a chemical agent which, in the opinion of a medically trained authority, did result in a disabling injury or, did or will, result in $10,000 or more damage to property from contamination.

3-1.1.4. Chemical Agent Incident. Any occurrence involving chemical agents and munitions which creates a potentially hazardous situation. Incidents include but are not necessarily limited to:

1. Human errors in processing, assembling, testing, loading, storing, transporting, handling, using, or disposing of chemical agents and munitions.

2. Unusual or unexpected occurrences, unnatural phenomena, unfavorable environments (e.g., RADHAZ), or instances of equipment failure which may damage or affect the safety and reliability of chemical agents and munitions.

3. Loss or abandonment of chemical agents and munitions resulting in potential hazard to untrained personnel who may find the item so lost or abandoned.

3-1.1.5. Malfunction. The term "Malfunction" applies when chemical agents and munitions are intentionally actuated and fail to function in the manner for which designed. Malfunctions may be either major or minor.

1. Catastrophic Malfunction. A catastrophic malfunction is a malfunction resulting in fatality (ies), severe injury (ies), or major equipment damage.

2. Major Malfunctions. A major malfunction is a failure which results in, or is potentially capable of resulting in personnel injury and/or material casualty.

3. Minor Malfunction. A minor malfunction is a failure which does not result in injury

or casualty and for which the potential for injury or material casualty is remote. (Duds, prematures, etc.).

3-1.1.6. Dangerously Defective Items. Chemical munitions which, on visual examination or local test, are found to be capable of resulting in an accident or a malfunction. Examples: ruptures of outer containers, leaking chemical fillers, protruding primers, partially armed fuzes, etc.

3-2. DISCUSSION

All U.S. Military chemical munitions and equipment are designed with as high a degree of safety and reliability as can be humanly foreseen. Prior to release for service use, tests are conducted at all stages of development, fleet evaluation, and production. After availability in service, tests continue for safety and reliability to determine effects of aging in storage. As in any accident-prevention program, in order to improve safety and reliability of chemical munitions, auxiliary equipment, and pertinent instructions, causes of accidents, incidents, and malfunctions must be rapidly and accurately determined, and appropriate corrective action must be taken immediately.

3-3. ACTION

All ships and stations experiencing mishaps accidents, incidents, or malfunctions involving chemical munitions, as these several terms are defined herein, shall:

1. Discontinue Use of the Item. Discontinue use of the item involved pending local inspection, interrogation, and assessment of probable cause. Depending on the degree of damage or casualties (accidents), the degree of potential hazard (incidents), the ability to attribute causes with some assurance, and operational necessity such as acceptance of calculated risk in combat emergency, usage may be resumed. Severe damage, casualties, potential hazard, inability to determine cause, and other factors prevailing should govern the decision to discontinue local use of the entire type of chemical munition or to suspend the specific lot involved, pending a complete technical evaluation and/or an on-site investigation by technically trained personnel.

2. Report All Occurrences. Report all occurrences to Crane Division, Naval Surface Warfare Center, Code PM4, Crane, Indiana and Naval Ammunition Logistics Center (NALC) Mechanicsburg, Pennsylvania. To insure that reports are complete and concise, the format set forth in OPNAVINST 5102.1B shall be used.

3. Collect All Available Evidence. Because chemical accidents and major malfunctions are usually characterized by the destruction or loss of the offending item, the difficulty in positive determination of cause is magnified. All fragments and remains of the item should be collected for examination and tests. Photographs of damage to equipment and to the area of occurrence, if practicable, are desirable. There have been cases in which minor malfunctions or incidents have resulted in the unnecessary disposal of the ordnance item involved. In most cases, the hazard associated with an incident or minor malfunction is at the instant of occurrence or immediately thereafter. Accordingly, after an approved interval has passed, a misfire or minor malfunction should be suitably tagged, set aside, and returned to the nearest issuing activity ashore for investigation or tests or for such disposition as may be directed by NAVSURFWARCENDIV Crane (PM4) or NALC Mechanicsburg. However, nothing in this paragraph is to be construed as prohibiting the immediate disposal of any item which, in the judgment of the Commanding Officer, constitutes a hazard.

NOTE

If it is determined to take disposal action, photographs of the item should be taken provided safety is not compromised.

4. Actions For Investigations. NAVSEAINST 8025.1D details actions for investigations of 2T cognizant material managed by NAVSURFWARCENDIV Crane, Ammunition Program Office (PM4). Action responsibilities are assigned for PM4, Design Agent (DA) activities, the Inventory Control Point (ICP), and In-Service Engineering Agent (ISEA) as listed in NAVSEAINST 5400.57A and Surveillance Coordinating Center (SCC) as listed in NAVSEAINST 3967.2. Mishaps involving 2T cognizant ammunition developed by another service shall be assigned to the developing service for investigation per DoD 5160.65-M.

3-4. Responsibility of Ammunition Program Office, NAVSURFWARCENDIV Crane (PM4)

As program manager for Navy conventional ammunition and based on an analysis of the mishap circumstances, comments and recommendations from the DA(s), SCC, ISEA or factors of supply and Fleet readiness, Crane (PM4) shall:

1. Carry out an Emergency Reaction Plan as outlined in NAVSEAINST 8025.1D to respond to a catastrophic mishap.

2. Review U.S. Army, U.S. Marine Corps and U.S. Air Force reclassifications affecting Navy stocks and direct NALC Mechanicsburg to include reclassifications in the U.S. Navy Notices of Ammunition Reclassification (NARs) when required.

3. Review and investigate all reported mishaps.

4. Tell the reporting activity to release the ammunition type, lot strata or individual lot from local suspension with a recommendation for continued use or;

5. Direct NALC Mechanicsburg to withdraw the lot, lot strata or type permanently from service use without an investigation or;

6. Direct NALC Mechanicsburg to reclassify the lot, lot strata or type to a proper condition code pending an investigation.

7. Assign a Naval Sea Systems Command Surface Ammunition Malfunction Control (SAMC) number on mishaps which warrant full investigation into cause. All activities will use this control number in related correspondence.

8. Coordinate SAMC investigation with the ISEA, DA(s) and SCC.

9. Direct and coordinate the development and preparation of a Malfunction Investigation Plan (MIP) with the ISEA, DA(s) and SCC.

10. Approve the overall MIP for use and send MIP to the proper ISEA, DA(s) and SCC for support.

11. Fund ISEA, DA(s) and SCC for support.

12. Coordinate the development and preparation of a final malfunction investigation report with the ISEA, DA(s) and SCC.

13. Take appropriate action based on analysis of reports and recommendations.

3-5. RESPONSIBILITY OF NALC MECHANICSBURG

As Inventory Control Point (ICP) for Navy conventional ammunition, NALC Mechanicsburg shall:

1. Ensure PM4, ISEA, DA(s) and SCC are aware of all mishaps reported per OPNAVINST 5102.1B.

2. Issue NARs per SPCCINST 8010.12D to change condition code of the item under investigation as directed by PM4.

3. Arrange for shipment of test samples and related items with MILSTRIP and shipping data as requested by DA. Provide copies to PM4, ISEA, DA(s) and test activities.

4. Send disposition instructions to activities that hold suspended lots and that have sent NAVSEA Form 8012/2 (Rev 2-81), Ammunition Disposition Request and Authorization (ADRA) to NALC Mechanicsburg.

5. Keep a permanent file of all ammunition reclassifications.

6. Send reclassification of U.S. Navy common items to other user services.

7. Include U.S. Army reclassifications in the U.S. Navy NARs only when approved by PM4.

8. Send a list of all quantities of reclassified ammunition resulting from NARs quarterly to PM4 with a copy to the ISEA and SCC.

3-6. RESPONSIBILITY OF NAVSURFWARCENDIV CRANE (CODE 40) AS IN-SERVICE ENGINEERING AGENT (ISEA)

Crane Division, Naval Surface Warfare Center, Code 40, has been assigned ISEA for explosive demolition materials. As such, NAVSURFWARCENDIV Crane (Code 40) is responsible for action as follows:

1. Evaluate initial reports of catastrophic ccurrences following NAVSEAINST 8025.1D.

2. Review mishap reports. Give recommendations on reclassification and the need for investigation to PM4 when requested.

3. Coordinate with the PM4, ICP, SCC, DA(s) and other activities when a full investigation into causes is assigned by PM4.

4. Upon direction by PM4, develop a MIP with the DA(s) and SCC and send it to PM 4 for approval.

5. Upon direction by PM4, Monitor DA(s) or SCC tests defined in the MIP to include reviewing test procedures and test data.

6. Develop, execute and manage an automated data processing system to track and cross reference all mishaps by DoD code, NAR number, SAMC number, lot number and category, lead investigator and status.

7. Send progress reports every 60 days to SEA 66 and PM4 on MIP. When investigation exceeds six months, send monthly reports until completed.

8. Summarize investigations in a Malfunction Investigation Status Report to be published semi-annually or as directed by PM4 with information copies to DA(s) and SCC.

9. Keep a data base of all completed SAMC files for retrieval and further use.

3-7. MESSAGE FORMAT

Reports are to be submitted in accordance with the format described in OPNAVINST 5102.1B. Information copy of reporting message should be sent to NAVSURFWARCENDIV Crane (Code 40).

CHAPTER 4

CHEMICAL AGENTS

4-1. INTRODUCTION

This chapter provides information on the characteristics and properties of chemical agents (lethal and incapacitating) used in munitions, dispersers, bombs, and spray tanks as described in the succeeding chapters (See NAVMED P-5041 for additional information.)

4-1.1. GENERAL. Chemical agents are highly toxic agents which, in either liquid or vapor form, can be absorbed through the respiratory tract, skin, or eyes or ingested. Exposure to chemical agents can cause serious damage to body functions or death depending on the degree of exposure involved. Protection from these agents requires that full coverage, impermeable protective clothing and a protective mask be worn.

Table 4-1. Chemical Agent

Chemical Agent/ Composition and Symbol	Disposal Method	Decontaminant	First Aid	Characteristics	State at 20°C (68°F)	Physiological Action
Phosgene (CG)	Vent	None needed in field; aeration in closed spaces	Fresh air; keep warm and dry	Odor of green corn, new-mown hay or grass	Colorless gas	Choking
Diphosgene (DP)					Colorless liquid	
Tabun (GA)	1. Neutralize 2. Burn	1. Caustic soda 2. DS-2 3. Sodium carbonate 4. STB 5. Hot soapy water	Atropine M258A1 decontaminating kit Artificial respiration in severe cases	Faintly fruity odor, none when pure	Colorless to brown liquid	Anticholinesterase (nerve agent)
Sarin (GB)				Almost no odor in pure state	Colorless liquid	
Soman (GD)				Fruity odor with impurities, odor of camphor		
VX		1. HTH-HTB 2 2. DS-2 3. STB 4. Bleach		Odorless amber-colored liquid		
Hydrogen cyanide (AC)	Detonate or vent[1]	1. DS-2 2. Caustic soda		Odor similar to bitter almonds	Colorless gas liquid	Affects blood
Cyanogen chloride (CK)	Vent			Irritating properties so great, odor can go unnoticed	Colorless gas	
Arsine (SA)			Fresh air; medical attention, keep warm, quiet	Mild garlic-like odor		
Distilled mustard (HD)	1. Neutralize 2. Burn	1. HTH-HTB 2. DS-2 3. STB	M258A1 decontamination kit	Garlic-like odor	Colorless to pale yellow liquid	Blistering
Nitrogen mustard (HN1) (HN2) (HN3)				HN1 – faintly fishy or musty odor; HN2 – soft soap or fruity odor;HN3 – colorless when pure	Dark liquid	
Mustard-T mixture (HT)		1. Bleach 2. DS-2		Odor similar to HD	Clear yellowish liquid	

1 Up to 25 pounds, detonate or vent; larger quantities, controlled venting.
* Micropulverized
** CSI plus 1% hexalmethyldiscilzane

Table 4-1. Chemical Agent (Continued)

Chemical Agent/ Composition and Symbol	Disposal Method	Decontaminant	First Aid	Characteristics	State at 20°C (68°F)	Physiological Action
Lewisite (L)	Neutralize (residue is poisonous arsenical compound)	1. HTH-HTB 2. DS-2 3. STB 4. Caustic soda	M258A1 decontaminating kit	Geranium-like odor	Dark oily liquid	Blistering
Phenyldichloroarsine (PD)				Also acts as vomiting agent. No odor	Colorless liquid	
Ethyldichloroarsine (ED)				Fruity, but biting and irritating odor		
Methyldichloroarsine (MD)				Odorless		
Phosgene Oxime (CX)	Burn	Physically remove with water DS-2	Water	Disagreeable, penetrating odor; produces immediate pain	Colorless solid or liquid	
Diphenylchloroarsine (DA)	1. Neutralize 2. Burn (arsenical compounds will remain)	None in field	Fresh air; keep warm and quiet	No pronounced odor	White to brown solid	Vomiting
Adamsite (DM) (DM1*)					Yellow to green solid	
Diphenylcyanoarsine (DC)				Odor similar to garlic and bitter almonds	White to pink solid	
Chloroacetophenone (CN) (CN1*)	1. Neutralize 2. Burn	1. Caustic soda 2. Personnel aerate		Fragrant odor similar to apple blossoms	Solid	Tear
Chloroacetophenone in chloroform (CNC)				Odor like chloroform	Liquid	
Chloroacetophenone and chloropicrin in chloroform (CNS)	1. Neutralize 2. Burn	1. Caustic soda 2. Personnel aerate	Fresh air, keep warm and quiet	Odor like flypaper	Liquid	Lacrimator (tear)
Chloroacetophenone in benzene and carbon tetrachloride (CNB)				Odor like benzene		
Bromobenzylcyanide (CA)				Odor like soured fruit		
o-Chlorobenzamalonitrile[1] (CS) (CS1*) (CS2**)		1. DS-2 2. Personnel aerate and flush areas with water		Pepper-like odor	Fine powder	Tear - may burn skin in high concentrations
BZ (BZ)	10% caustic solution mixed 1 to 1 with alcohol. Wait 24 hours, then burn	10% caustic solution mixed 1 to 1 with alcohol	None; constant medical observation	----------	Fine powder	Mental/ physical incapacitator

1 Up to 25 pounds, detonate or vent; larger quantities, controlled venting.
* Micropulverized
** CSI plus 1% hexalmethyldiscilzane

4-2. NERVE AGENTS

Nerve agents are lethal chemical agents that are highly toxic and rapidly effective. They are organic chemicals which are liquid at ambient temperatures. The liquid, vapor, or aerosol of these agents may be absorbed through the skin and eyes; the vapor or aerosol through the respiratory tract, if inhaled; and the liquid through the gastrointestinal tract, if ingested. These agents impair the normal functioning of the nervous system, as manifested first by a series of local symptoms, the most usual being abnormal contraction of the pupils of the eyes, and then progressing to paralysis and death. There are two kinds of nerve agents:

1. G-Agents. The G-Agents are odorless and nonpersistent, with the hazard being primarily from the vapor. GB is the standard agent in the subgroup.

2. V-Agents. V-agents are odorless and persistent, with the hazard being primarily from contact with the liquid, although a vapor hazard does exist. VX is the standard agent in this subgroup.

4-2.1. GA, TABUN

Action on metals	None
Boiling point	464°F at 29.9 in Hg
Chemical name	Dimethylaminoethoxy-cyanophosphine
Chemical storage group	A
Decomposition temperature	238°F
Formula	$(CH_3)_2N(C_2H_5O)CNPO$
Melting point	-58°F
Odor	Faintly fruity; none when pure
Persistency	Dependent on weather and type of munitions. Heavily splashed liquid persists 1 to 2 days under average weather conditions.
Rate of action	Very rapid
Rate of detoxification	Slight but definite
Stability in storage	Stable in steel containers at ambient temperature

4-2.1.1. Intended Use. Tabun (GA) is a quick-acting casualty agent which acts on the sympathetic nervous system.

4-2.1.2. Description. GA is a colorless to brownish liquid giving a colorless vapor. Individuals poisoned by GA display approximately the same sequence of symptoms regardless of whether or not the agent has been inhaled, absorbed, or ingested. These symptoms, in normal order of appearance, are: running nose; tightness of chest; dimness of vision and pinpointing of the pupils; difficulty in breathing; drooling; excessive sweating; nausea and vomiting; cramps; involuntary defecation and urination; twitching, jerking and staggering; and headache, confusion, drowsiness, coma, and convulsions. These symptoms are followed by cessation of breathing and death. The number and severity of symptoms are dependent on the dosage and rate of entry. Vapor penetrates the skin readily; however, symptoms appear much slower from skin dosage than from respiratory dosage. Although skin absorption of sufficient amount may cause death in 1 to 2 minutes, death may be delayed for 1 to 2 hours. Lethal respiratory dosages kill in 1 to 10 minutes, and liquid in the eye kills nearly as rapidly.

4-2.1.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as Group A Chemical Ammunition for handling and storage purposes. Impermeable protective clothing must be worn when handling a nerve agent since its vapor readily penetrates the skin.

When filling storage containers, sufficient void space must be left to allow for expansion of the agent. One-ton containers are filled to a maximum of 170 gallons (total capacity 190 gallons), which allows about a 10 percent void.

Materials can be decontaminated with DS-2, bleach slurry, dilute alkali solutions, or hot soapy water. In confined areas, steam, ammonia, or hot soapy water is effective.

4-2.1.4. Decontamination. For first aid, personnel should flush the affected area with a stream of water and wash with hot, soapy water. Contaminated clothing should be carefully removed to avoid self-contamination.

4-2.1.5. Shipping Containers. GA is packed in one-ton D bulk containers and 55-gallon drums. Similarly, 55-gallon drums are filled with 50 gallons of liquid.

4-2.2. GB, SARIN

Action on metals	Slightly corrosive to steel
Boiling point	296.6°F at 29.9 in. Hg
Chemical name	Methylisopropoxyfluoro-phosphine oxide
Chemical storage group	A
Decomposition temperature	Very high
Formula	$CH_3(C_3H_7O)FOP$
Melting point	-70.6°F
Odor	Almost none in pure form
Persistency	Moderately persistent when dispersed as large droplets; nonpersistent as a vapor.
Rate of action	Very rapid
Rate of detoxification	Low detoxification rate; essentially cumulative
Stability in storage	Fairly stable in steel containers at 149°F. Stability improves with increasing purity.

4-2.2.1. Intended Use. Sarin (GB) is a quick acting, casualty-producing nerve agent with very high eye toxicity. It is used as a filling in bombs, rockets, and artillery projectiles.

4-2.2.2. Description. GB is an odorless, colorless liquid when pure. Individuals poisoned by GB display approximately the same sequence of symptoms regardless of whether or not the agent has been inhaled, absorbed, or ingested. These symptoms, in normal order of appearance, are: running nose; tightness of chest; dimness of vision and pinpointing of the pupils; difficulty in breathing; drooling; excessive sweating; nausea and vomiting; cramps; involuntary defecation and urination; twitching, jerking and staggering; and headache, confusion, drowsiness, coma, and convulsions. These symptoms are followed by cessation of breathing and death. The number and severity of symptoms are dependent on the dosage and rate of entry. Its skin toxicity is low except where the skin is broken. Symptoms appear much slower from skin dosage than from respiratory dosage. Lethal respiratory dosages kill in 1 to 10 minutes, and liquid in the eye kills nearly as rapidly. Although skin absorption of a sufficient amount may cause death in 1 to 2 minutes, death may be delayed for 1 to 2 hours.

After an attack, the time at which the area no longer presents a significant hazard to unprotected troops may vary from a few minutes to a few days depending on such factors as climate temperature and scale of the attack. In general, an area attacked by GB can be traversed by troops with negligible risk shortly after the attack if protective masks are worn.

4-2.2.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. Impermeable protective clothing must be worn when handling this nerve agent since its vapor readily penetrates the skin.

When filling storage containers, sufficient void space must be left to allow for expansion of the agent. One-tone containers are filled to a maximum of 170 gallons (total capacity is 190 gallons), which allows about 10 percent void. Similarly, 55 gallon drums are filled with 50 gallons of liquid.

4-2.2.4. Decontamination. For first aid, personnel should flush the affected area with a stream of water and wash with hot, soapy water. Contaminated clothing should be carefully removed to avoid self-contamination.

Atropine and 2-Pam Chloride must be administered immediately upon exposure to GB vapor. The atropine should be injected into a muscle. If the victim has stopped breathing, artificial respiration (not mouth-to-mouth resuscitation) must be administered. An oxygen breathing apparatus should also be used.

Materials can be decontaminated with DS-2, bleach slurry, dilute alkali solutions, or hot soapy water. In confined areas, steam, ammonia, or hot soapy water is effective.

4-2.2.5. Shipping Containers. GB is packed in one-ton type D bulk containers and 55-gallon drums.

4-2.2.6. Identification Data. GB is listed under Specification MIL-C-10758C, NSN 1365-00-293-9239, and DODIC/NALC K725.

4-2.3. GD, SOMAN

Action on metals	Slightly corrosive to metals
Boiling point	332.6°F
Chemical name	Methylpinacolyloxyfluorophosphine oxide
Chemical storage group	A
Decomposition temperature	Not available
Formula	$CH_3(C_6H_{12}O)FOP$
Melting point	-94°F
Odor	Fruity; odor of camphor with impurities
Persistency	Depends on munitions used and weather conditions; under average conditions, heavily splashed liquid persists 1 to 2 days
Rate of action	Very rapid
Rate of detoxification	Low; essentially cumulative
Stability in storage	Less stable than GA and GB

4-2.3.1. Intended Use. Soman (GD) is a quick-acting casualty agent which acts on the sympathetic nervous system.

4-2.3.2. Description. Individuals poisoned by GD display approximately the same sequence of symptoms regardless of whether or not the agent has been inhaled, absorbed, or ingested. These symptoms, in normal order of appearance, are: running nose; tightness of chest; dimness of vision and pinpointing of the pupils; difficulty in breathing; drooling; excessive sweating; nausea and vomiting; cramps; involuntary defecation and urination; twitching, jerking and staggering; and headache, confusion, drowsiness, coma, and convulsions. These symptoms are followed by cessation of breathing and death. The number and severity of symptoms are dependent on the dosage and rate of entry. Vapor penetrates the skin readily; however, symptoms appear much slower from skin dosage than from respiratory dosage. Although skin absorption of sufficient amount may cause death in 1 to 2 minutes, death may be delayed for 1 to 2 hours. Lethal respiratory dosages kill in 1 to 10 minutes, and liquid in the eye kills nearly as rapidly.

4-2.3.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. Impermeable protective clothing must be worn when handling this nerve agent since its vapor readily penetrates the skin.

When filling storage containers, sufficient void space must be left to allow for expansion of the agent. One-ton containers are filled to a maximum of 170 gallons (total capacity 190 gallons), which allows about a 10 percent void. Similarly, 55-gallon drums are filled with 50 gallons of liquid.

4-2.3.4. Decontamination. For first aid, personnel should flush the affected area with a stream of water and wash with hot, soapy water. Contaminated clothing should be carefully removed to avoid self-contamination.

Materials can be decontaminated with DS-2, bleach slurry, dilute alkali solutions, or hot

soapy water. In confined areas, steam, ammonia, or hot soapy water is effective.

4-2.3.6. Shipping Containers. GD is packed in one-ton D hulk containers and 55-gallon drums.

4-2.4. VX, PERSISTENT

Action on metals	Slightly corrosive to steel
Boiling point	Similar to GB
Chemical name	-----
Chemical storage group	A
Decomposition temperature	Similar to GB
Formula	-----
Melting point	Similar to GB
Odor	Odorless
Persistency	Considerably longer than GB
Rate of action	Rapid (3 to 10 minutes)
Rate of detoxification	Low; essentially cumulative
Stability in storage	Similar to GB

4-2.4.1. Intended Use. Persistent VX is used as a quick-acting casualty agent. This agent is used in chemical projectiles, land mines and spray tanks.

4-2.4.2. Description. VX is a nerve agent similar to GB, but of lower volatility. Because of this low volatility, the vapor effect is limited, but the persistency is increased. Areas can be contaminated for several days.

The physiological effects produced by this agent are convulsions, paralysis, and respiratory failure. Its toxicity to the eyes and skin is very high. The rate of action by inhalation is 3 to 10 minutes, and 30 minutes to 24 hours when absorbed by the skin.

VX is more difficult to vaporize and aerosolize than GB. Winds in excess of 8 m.p.h. are unfavorable for the employment of chemical munitions and may require a prohibitive expenditure to achieve desired results. Winds below 5 m.p.h. may fluctuate widely in speed and direction, and therefore impose difficulties in assuring the safety of friendly forces, who must use protective clothing and equipment until the area has been decontaminated, or until sufficient time has elapsed to permit dissipation.

Field protective masks and permeable (impregnated) protective clothing are proof against VX vapor; permeable and impermeable clothing provide protection against the droplets.

4-2.4.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes.

4-2.4.4. Decontamination. For personnel decontamination, VX may be effectively removed from the skin by use of a protective ointment of 5 percent solution of sodium hypochlorite (household bleach) in water. Prompt decontamination of skin is imperative; decontamination undertaken within 1 minute after contamination is twice as effective as it would be if delayed 5 minutes. To decontaminate by means of showering, the body should be first flushed with copious quantities of cold water, then washed with plenty of soapy, warm water.

Surfaces contaminated with VX can be decontaminated with DS2, 10-percent HTH solution, bleach slurry, 30- to 35-percent solution of sodium hypochlorite, or the M280 Decon Kit, Individual Equipment.

4-2.4.5. Shipping Containers. VX is packed in one-ton D bulk containers and 55-gallon drums.

4-2.4.6. Identification Data. VX is listed under NSN 1365-00-541-7209 and DODIC/NALC K732.

4-3. BLISTER AGENTS

Blister agents (Vesicants) are used for casualty effect. These agents affect the eyes and lungs and blister the skin. Mustard is recognized by a distinctive odor and has a fairly high duration of effectiveness under normal conditions. Other blister agents have been developed which are odorless and vary in duration of effectiveness.

Most blister agents are insidious in action; there is little or no pain at the time of exposure except from lewisite (L) and phosgene oxime (CX) which causes immediate pain on contact. The development of casualties is somewhat delayed. CX produces a wheal (similar to a bee sting) rather than a water blister which the other blister agents produce. Protection from blister agents is extremely difficult since they attack any part of the body which comes in contact with the liquid or vapor.

4-3.1. CX, PHOSGENE OXIME

Action on metals	-----
Boiling point	128.3°F
Chemical name	Dichloroformoxime
Chemical storage group	A
Decomposition temperature	Decomposes slowly at normal temperatures
Formula	Cl_2CNOH
Melting point	102.2° – 104°F
Odor	Sharp, penetrating
Persistency	-----
Rate of action	Immediate effects upon contact
Rate of detoxification	-----
Stability in storage	Decomposes slowly

4-3.1.1. Intended Use. Phosgene Oxime (CX) is a powerful blister agent which produces violent irritation to the mucous membranes of the eyes and nose.

4-3.1.2. Description. CX produces immediate pain which varies from a mild prickling sensation to that of a severe bee sting. After contacting the skin, the affect area turns white within 30 seconds and is surrounded by a red ring. Swelling occurs in about 30 minutes. The whitened area turns a brownish color in about 24 hours, with a scab forming in about a week. Healing may require about 3 weeks, although in some cases it may take up to 2 months. Itching may be present throughout this time.

4-3.1.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes.

4-3.1.4. Decontamination. Due to its rapid reaction with the skin, decontamination will not be entirely effective after pain has developed. Nevertheless, decontamination should be accomplished as quickly as possible by flushing the area with large amounts of water to remove any agent which has not yet reacted with the skin.

4-3.1.5. Shipping Containers. CX is stored in one-ton type D bulk containers.

4-3.2. H, LEVINSTEIN MUSTARD

Action on metals	No action
Boiling point	422.6°F at 29.9 in. Hg
Chemical name	Dichloro-diethylsulfide
Chemical storage group	A
Decomposition temperature	300.2°F – 350.6°F
Formula	$(ClCH_2CH_2)_2S$
Melting point	55.4°F – 57.2°F
Odor	Garlic-like
Persistency	7 days in cold weather, 1-2 days in warm weather
Rate of action	4-6 hours
Rate of detoxification	3-6 months
Stability in storage	Stable in metal containers

4-3.2.1. Intended Use. Levinstein Mustard (H) will produce highly irritating effects to the eyes, skin, and lungs.

4-3.2.2. Description. H contains approximately 30% sulfur impurities which gives it a pronounced odor. Its properties are essentially the same as those of distilled mustard, HD, which is produced after H has been purified by washing and vacuum distillation.

4-3.2.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. Because of impurities which cause it to deteriorate, H is not as stable in storage as HD. When containers of mustard are stored, the valves on each container should be in horizontal alignment. This will prevent sludge from clogging the lower eduction tube.

4-3.2.4. Decontamination. Surfaces which are contaminated with H can be decontaminated with DS-2 and bleach slurry or dry mix (depending on the surface).

CAUTION

WHEN DRY STB (SUPERTROPICAL BLEACH) COMES IN CONTACT WITH MUSTARD, SUFFICIENT HEAT IS USUALLY GENERATED TO PRODUCE A FIRE.

4-3.2.5. Shipping Containers. H is stored in one-ton type D bulk containers and 55-gallon drums.

4-3.3. HD, DISTILLED MUSTARD

Action on metals	No action
Boiling point	442.4°F
Chemical name	Dicloroethylsulfide
Chemical storage group	A
Decomposition temperature	300.2° to 350.6°F
Formula	$(ClCH_2CH_2)_2S$
Melting point	57.2°F
Odor	Garlic-like
Persistency	7 days or more in cold weather, 1 to 2 days in warm weather
Rate of action	4 to 6 hours, longer in some cases
Rate of detoxification	3 days – 3 to 6 months, depending on severity
Stability in storage	Stable in metal containers below 250°F

4-3.3.1. Intended Use. Distilled Mustard (HD) is a powerful blister agent which is highly irritating to the eyes, skin, and lungs. It is used more for its incapacitating effects than for its lethal effects. Due to the slow rate of action, its use should be limited to situations where such a delay is acceptable. This agent may be used to contaminate terrain and material, thereby contaminating troops which come into contact with these surfaces. The principal means of disseminating HD are by bombs, artillery projectiles, land mines, and spray tanks on aircraft.

4-3.3.2. Description. Symptoms of HD poisoning usually appear in 4 to 6 hours, although symptoms have been observed up to 24 hours. The physiological effects produced by this agent are inflammation of the eyes, redness and blistering of the skin, and inflammation of the nose, throat, and lungs. Skin and lung effects can persist for 3 months and eye effects can persist from 2 weeks to 6 months. Exposure to even a small concentration of HD is capable of causing severe burns which appear several hours later. As a liquid, its ability to contaminate is effective for a longer period of time than for a vapor.

4-3.3.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. HD is stable in metal containers below 250°F and has no action on metals. It is usually a liquid in temperate climates. Personnel should use caution when handling these containers. Exposure to vapors from spilled HD causes minor symptoms such as eye irritation. Repeated exposure to such vapors may irritate the lungs, causing a chronic cough and pain in the chest area. Leakage of HD during storage can usually be detected by its odor, which resembles that of garlic. Leakage can also be detected by detector paper or crayon, or by the chemical agent detector kit.

4-3.3.4. Decontamination. Material contaminated with HD should be washed with DS-2 solution, or bleach slurry consisting of half supertropical bleach and half water. A dry mix may be made with two shovelfuls of dry earth. The M280 Decon Kit, Individual Equipment may be used to decontaminate personal equipment.

Personnel can be decontaminated with the M258A1 Skin Decon Kit. The skin area must first be washed with water. The M258A1 Skin Decon Kit cannot be used in the eyes.

For first aid, pinch the blot on the skin, flush with water, apply the M258A1 Skin Decon Kit, wipe dry, and apply more ointment to the affected area. For liquid HD agent in the eyes, flush with water from a canteen while holding lids open and apply the M258A1 Skin Decon Kit, to face.

For further treatment, analgesics, antibiotics, and local atropine must be applied to the eyes. Skin symptoms require local dressings and systemic antibiotics; respiratory tract symptoms require antibiotics. Sedatives are required for gastrointestinal symptoms, and intravenous fluids and transfusions for shock.

CAUTION

WHEN DRY STB (SUPERTROPICAL BLEACH) COMES IN CONTACT WITH MUSTARD, SUFFICIENT HEAT IS USUALLY GENERATED TO PRODUCE A FIRE.

4-3.3.5. Shipping Containers. 170 ± 3 gallons of HD are stored in one-ton containers conforming to MIL-C-3250.

4-3.3.6. Identification Data. HD is listed under Specification MIL-M-12051, NSN 1365-00-277-3040, and DODIC/NALC K655.

4-3.4. HL, LEWISITE MUSTARD

Action on metals	Little or none if dry
Boiling point	Less than 374°F
Chemical name	None, refer to components
Chemical storage group	A
Decomposition temperature	Greater than 212°F
Formula	None, refer to components
Melting point	6.8°F
Odor	Garlic-like
Persistency	Dependent on the weather and the munitions used
Rate of action	Produces immediate stinging of skin and redness within 30 minutes. Blistering begins in about 13 hours.
Rate of detoxification	Not detoxified
Stability in storage	Satisfactory in lacquered steel containers

*The above properties are based on a mixture consisting of 63% Lewisite and 37% distilled mustard by weight. This is the mixture which has the lowest freezing point (the eutectic mixture).

4-3.4.1. Intended Use. Lewisite Mustard (HL) is used as a delayed-action casualty agent. It is a mixture of distilled mustard (HD) and Lewisite (L) which results in a low-freezing mixture for use in cold weather operations or as a high-altitude spray.

4-3.4.2. Description. Skin which has come into contact with HL appears red in a short time. This is followed by blistering which usually covers the entire area of reddened skin. Respiratory lesions produced from inhaling the vapors are similar to those produced by mustard. However, in the most severe cases, fluids which have built-up in the lungs may pass into the thoracic cavity of the body. Liquids on the skin or inhaled vapor may affect capillary permeability, permitting the loss of fluid from the blood stream. This will result in blood thickening, followed by shock and death. Liquid HL that contacts the eyes is severely damaging.

4-3.4.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. Stability in storage is satisfactory when in lacquered steel containers.

4-3.4.4. Decontamination. HL may be decontaminated with bleach, fire, DS-2, caustic soda, or the M258A1 Skin Decon Kit.

4-3.4.5. Shipping Containers. HL is stored in one-ton type D bulk containers.

4-3.5. HN1, NITROGEN MUSTARD

Action on metals	None
Boiling point	185°F at 0.39 in. Hg
Chemical name	2,2' dicloro-triethylamine
Chemical storage group	A
Decomposition temperature	Decomposes before boiling point is reached
Formula	$(ClCH_2CN_2)_2NC_2H_5$
Melting point	-29.2°F
Odor	Fishy or musty
Persistency	Depends on munitions used and the weather
Rate of action	Somewhat shorter than HD. Delayed 12 hours or more.
Rate of detoxification	Not detoxified – cumulative
Stability in storage	Adequate for use in munitions

4-3.5.1. Intended Use. Nitrogen Mustard (HNl) is used as a delayed-action casualty agent. HN1 is used in projectiles, land mines, and spray tanks.

4-3.5.2. Description. This agent is very irritating to the eyes in low concentrations. This irritation appears in a shorter time than that for HD. Higher concentrations are required to produce incapacitating effects through skin absorption. Exposure to strong vapors or liquid HN1 can produce itching and irritation of the skin, with blisters forming later. Effects on the respiratory tract include nose and throat irritation. Bronchopneumonia may appear after 24 hours. Ingestion or absorption through the skin can retard blood-formation and injure body tissue. Severe diarrhea accompanied by blood loss may occur. Ingestion of 2 to 6 milligrams produces nausea and vomiting.

4-3.5.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. HN1 storage capabilities are adequate for use in munitions.

4-3.5.4. Decontamination. Bleach, fire, or DS-2 can be used for decontamination.

4-3.5.5. Shipping Containers. HN1 is stored in one-ton type D bulk containers.

4-3.6. HN2, NITROGEN MUSTARD

Action on metals	None
Boiling point	167°F at 0.59 in. Hg
Chemical name	2,2' dichloro-diethylmethylamine
Chemical storage group	A
Decomposition temperature	Decomposition before boiling point is reached.
Formula	$(ClCH_2CH_2)_2NCH_3$
Melting point	-76°F
Odor	Like soft soap in diluted form, fruity in high concentrations
Persistency	Weather, somewhat shorter than HD
Rate of action	Skin effects delayed 12 hours or longer
Rate of detoxification	Not detoxified
Stability in storage	Not stable

4-3.6.1. Intended Use. Nitrogen Mustard (HN2) is used as a delayed-action casualty agent, however, it is highly unstable and not considered as a useful chemical agent.

4-3.6.2. Description. HN2 has the greatest blistering capability of the nitrogen mustards in vapor form but is intermediate as a liquid blistering agent. Toxic eye effects are produced more rapidly than by HD. Effects produced on the skin by this agent are delayed 12 hours or longer. It is very irritating to the eyes in low concentrations. Higher concentrations are required to produce incapacitating effects through skin absorption. Exposure to strong vapors or liquid HN2 can produce itching and irritation of the skin, with blisters forming later. Effects on the respiratory tract include nose and throat irritation. Bronchopneumonia may appear after 24 hours. Ingestion of absorption through the skin can retard blood formation and injure body tissue. Severe diarrhea accompanied by blood loss may occur. Ingestion of 2 to 6 milligrams produces nausea and vomiting.

4-3.6.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. This agent is highly unstable in storage.

4-3.6.4. Decontamination. Bleach, fire, M258A1 Skin Decon Kit, or DS-2 can be used as decontaminants.

4-3.6.5. Shipping Containers. HN2 is stored in one-ton type D bulk containers.

4-3.7. HN3, NITROGEN MUSTARD

Action on metals	None if HN3 is dry
Boiling point	278.6° to 280.4°C at 0.59 in. Hg
Chemical name	2,2', 2"-trichlorotriethylamine
Chemical storage group	A
Decomposition temperature	relatively high, it decomposes before the boiling point reached at atmospheric pressure.
Formula	$(ClCH_2CH_2)_3N$
Melting point	24.8°F
Odor	None when pure
Persistency	7 days or more in cold weather, 1-2 days in warm weather.
Rate of action	Most symptoms delayed 4 to 6 hours, but in some cases eye irritation and photophosia develop immediately.
Rate of detoxification	Not detoxified – cumulative
Stability in Storage	This agent darkens and produces a crystalline solid in storage.

4-3.7.1. Intended Use. Nitrogen Mustard (HN3) is used as delayed-action casualty agent.

4-3.7.2. Description. This agent is very irritating to the eyes in low concentration. This irritation appears in a shorter time than that for HD. Higher concentrations are required to produce incapacitating effects through skin absorption. Exposure to strong vapors or liquid HN3 can produce itching and irritation of the skin, with blisters forming later. Effects on the respiratory tract include nose and throat irritation. Bronchopneumonia may appear after 24 hours. Ingestion or absorption through the skin can retard blood formation and injure body tissue. Severe diarrhea accompanied by blood loss may occur. Ingestion of 2 to 6 milligrams produces nausea and vomiting.

4-3.7.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. HN3 darkens and deposits a crystalline solid in storage.

4-3.7.4. Decontamination. Bleach, fire, M258A1 Skin Decon Kit, or DS-2 are effective decontaminants.

4-3.7.5. Shipping Containers. HN3 is stored in one-ton type D bulk containers.

4-3.8. HT, DISTILLED MUSTARD AND T-MIXTURE

Action on metals	Similar to HD
Boiling point	Similar to HD
Chemical name	-----
Chemical storage group	A
Decomposition temperature	Similar to HD
Formula	-----
Melting point	Lower than HD
Odor	Garlic-like
Persistency	Longer than HD
Rate of action	Similar to HD
Rate of detoxification	Similar to HD
Stability in storage	Stable in steel containers

4-3.8.1. Intended Use. Distilled mustard and T-mixture (HT) is a strong blister agent which is highly irritating to the eyes, skin, and lungs. It is used as a delayed-action casualty agent.

4-3.8.2. Description. HT is a mixture of 60 percent HD and 40 percent T, a sulfur and chlorine compound similar in structure to HD. The properties of HT are essentially the same as those of HD. It does, however, have a longer duration of effectiveness, a lower freezing point, and is more stable than HD. It is toxic when inhaled, but its low volatility makes it difficult to obtain effective vapor concentrations in the field.

4-3.8.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes.

4-3.8.4. Decontamination. Bleach, fire, M258A1 Skin Decon Kit, or DS-2 are effective decontaminants.

4-3.8.5. Shipping Containers. HT is stored in one-ton type D bulk containers.

4-3.8.6. Identification Data. HT is listed under NSN 1365-00-277-3041 and DODIC/NALC K665.

4-3.9. L, LEWISITE

Action on metals	None if L is dry
Boiling point	374°F at 29.9 in. Hg
Chemical name	Dichloro (2-chlorovinyl arsine)
Chemical storage group	A
Decomposition temperature	Above 212°F
Formula	$C_2H_2AsCl_1$
Melting point	32.18°F
Odor	Geranium-like; very little odor when pure
Persistency	Similar to HD
Rate of action	Rapid
Rate of detoxification	The body does not detoxify L
Stability in Storage	Stable in steel or glass containers.

4-3.9.1. Intended Use. Lewisite (L) is a powerful blister agent which is highly irritating to the eyes, skin, and lungs. This agent can also be used as a poison gas.

4-3.9.2. Description. In order of severity and appearance of symptoms, L acts as a blister agent, a toxic lung irritant, and, when absorbed in the tissues, a poison to the bodily system. As a liquid, it causes an immediate burning sensation in the eyes and permanent loss of sight if not decontaminated within one minute. L produces an immediate and painful stinging sensation to the skin; reddening of the skin starts within 30 minutes. Blisters do not appear until after approximately 13 hours. In addition, this agent can act as a poison, producing a build-up of fluid in the lungs, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure. If L vapors are inhaled in high concentrations, it may be fatal in as little as 10 minutes.

4-3.9.3. Handllng and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes.

4-3.9.4. Decontamination. L can be decontaminated with bleach, fire, DS-2, or caustic soda.

4-3.9.5. Shipping Containers. L is stored in one-ton type D bulk containers.

4-3.10. ED, ETHYLDICHLOROARSINE

Action on metals	None on steel; attacks brass at 122°F; destructive to rubber and plastics
Boiling point	312.8°F
Chemical name	Ethyldichloroarsine
Chemical storage group	A
Decomposition temperature	Stable to boiling point
Formula	$C_2H_5AsCl_2$
Melting point	-85°F
Odor	Fruity, but biting and irritating
Persistency	Evaporates about as fast as water. Short duration under wet conditions.
Rate of action	Irritating effect on nose and throat is intolerable after 1 minute at moderate concentrations; blisters appear in less than 12 hours.
Rate of detoxification	Sublethal amounts are detoxified rapidly as with other arsenicals.
Stability in storage	Stable in steel

4-3.10.1. Intended Use. Ethyldichloroarsine (ED) is used as a delayed-action casualty agent. The absorption of either vapor or liquid through the skin can be fatal if in sufficient amounts.

4-3.10.2. Description. ED irritates the respiratory tract and will produce lung injury if the exposure time is sufficient. Vapor from this agent is irritating to the eyes and the liquid can produce severe eye injury. Absorption of either the vapor or liquid through the skin can be fatal if in sufficient amounts. Blistering is produced from prolonged contact with either the liquid or vapor.

4-3.10.3. Handing and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as Group A Chemical Ammunition for handling and storage purposes.

4-3.10.4. Decontamination. ED can be decontaminated with bleach, DS-2, STB, or caustic soda.

4-3.10.5. Shipping Containers. ED is stored in steel containers.

4-3.11. MD, METHYLDICHLOROARSINE

Action on metals	None on steel
Boiling point	271.4°F
Chemical name	Methyldichloroarsine
Chemical storage group	A
Decomposition temperature	Stable to boiling point
Formula	$CH_3A_sCl_2$
Melting point	-44.5°F
Odor	None
Persistency	Relatively short; evaporates much faster than water.
Rate of action	Immediate irritation of eyes and nose; blistering effect delayed several hours.
Rate of detoxification	Detoxified at an appreciable rate
Stability in storage	Stable in steel containers

4-3.11.1. Intended Use. Methyldichloroarsine (MD) is used as a delayed-action casualty agent. The absorption of either vapor or liquid through the skin can be fatal if in sufficient amounts.

4-3.11.2. Description. MD irritates the respiratory tract and will produce lung injury if the exposure time is sufficient. Vapor from this agent is irritating to the eyes and the liquid can produce severe eye injury. Absorption of either the vapor or liquid through the skin can be fatal if in sufficient amounts. Blistering is produced from prolonged contact with either the liquid or vapor.

4-3.11.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes.

4-3.11.4. Shipping Containers. MD is stored in steel containers.

4-3.12. PD, PHENYLDICHLOROARSINE

Action on metals	None
Boiling point	489.9° – 495.7°F
Chemical name	Phenyldichloroarsine
Chemical storage group	A
Decomposition temperature	Stable to boiling point
Formula	$C_6H_5AsCl_2$
Melting point	3.2°F
Odor	None
Persistency	Depends on munitions used and the weather; short duration when wet.
Rate of action	Immediate effect on eyes; effects on skin delayed 1/2 to 1 hour.
Rate of detoxification	No specific information, but, as with related arsenicals, it is probably detoxified rapidly in sub-lethal dosages.
Stability in Storage	Very stable

4-3.12.1. Intended Use. Phenyldichloroarsine (PD) is used as a delayed-action casualty agent.

4-3.12.2. Description. Although PD is classed here as a blister agent, it also acts as a vomiting agent. On bare skin, it is a strong blistering agent, however, it may be decomposed immediately by wet clothing. This agent has immediate effects on the eyes, but its effects on skin are delayed 1/2 to 1 hour.

4-3.12.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group A Chemical Ammunition for handling and storage purposes. PD is very stable in storage.

4-3.12.4. Shipping Containers. PD is stored in steel containers.

4-4. BLOOD AGENTS

Blood agents are absorbed into the body primarily by breathing. They affect bodily functions through action on the enzyme cytochrome-oxidase, thus preventing the normal transfer of oxygen from the blood to body tissue. Blood agents have little or no use at the present time, but may be available in some munitions.

4-4.1. AC, HYDROGEN CYANIDE

Action on metals	Little or none
Boiling point	78.08°F
Chemical name	Hydrogen cyanide
Chemical storage group	B
Decomposition temperature	Above 149.9°F
Formula	H C N
Melting point	7.88°F
Odor	Similar to peach kernels or bitter almonds
Persistency	Short, it is highly volatile and in the gaseous state it is lighter than air.
Rate of action	Very rapid; death occurs within 15 minutes of a lethal dosage.
Rate of detoxification	Rapidly detoxified by body if concentration is weak.
Stability in storage	Unstable except when very pure. It forms an explosive polymer after prolonged storage which can be stabilized by addition of small amounts of phosphoric acid or sulphur dioxide.

N O T E

Although reclassified as an "industrial chemical", information on AC is included in this manual because of the possibility of foreign usage.

4 4.1.1. Intended Use. Hydrogen Cyanide (AC) is used as a quick-acting casualty agent. AC gas is ignited about 50 percent of the time when it is disseminated from an ordinary artillery shell, but is suitable for use in the 4.2-inch mortar shell, bombs, rockets, and grenades.

4-4.1.2. Description. AC is a gas which dissolves in water and acts as a very weak acid. It is made by treating a cyanide with sulfuric acid and is commercially useful as a fumigant and rat poison. This agent prevents the normal transfer of oxygen from the blood to body tissue, resulting in death from respiratory failure. Prior to death, a significant increase in breathing may be observed. In high concentrations, the amount inhaled in a few breaths may be sufficient to cause immediate death without obvious symptoms. In most cases, death usually occurs within 15 minutes of a lethal dosage. Exposure to lower concentrations of AC can cause headache, dizziness, nausea, unsteadiness, and a feeling of suffocation. There is rarely any resulting disability from exposures which are not fatal.

4-4.1.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group B Chemical Ammunition for handling and storage purposes. This agent is unstable except when very pure. After prolonged storage, it forms an explosive polymer which can be stabilized by addition of small amounts of phosphoric acid or sulphur dioxide. AC is a dangerous explosive hazard when exposed to heat or flame.

4-4.1.4. Decontamination. No decontamination procedures are required under field conditions. Individuals exposed to AC should put on protective masks immediately as soon as the presence of AC is suspected.

4-4.1.5. Shipping Containers. AC is packaged in type A steel containers.

4-4.1.6. Identification Data. This item is listed under NSN 1365-00-277-3052 and DODIC/NALC K595.

4-4.2. CK, CYANOGEN CHLORIDE

Action on metals	Attacks steel, iron, and silver very slowly. No effect on lead.
Boiling point	56.84°F
Chemical name	Cyanogen chloride
Chemical storage group	B
Decomposition temperature	Above 212°F, it may explode at a certain point of deterioration.
Formula	CNCl
Melting point	21.2°F
Odor	Resembles peach kernels; however, irritating properties are so great that odor can go unnoticed
Persistency	Short; vapor may persist in jungle or forest for some time under suitable weather conditions.
Rate of action	Immediate to several minutes.
Rate of detoxification	Incapacitation is usually brief, but residual injury to the central nervous system may persist for weeks or become permanent.
Stability in storage	Stable at 149°F for 30 days. It tends to undergo condensation or polymerization in storage to form a solid compound, cyanuric chloride ($C_3N_3Cl_3$). Impurities promote polymerization which may occur with explosive violence.

N O T E

Although reclassified as an "industrial chemical", information on CK is included in this manual because of the possibility of foreign use.

4-4.2.1. Intended Use. Cyanogen Chloride (CK) is used as a quick-acting casualty agent. It will penetrate a protective mask canister or filter element more readily than most chemical agents; however, a very high concentration is required. CK will break down filters that contain the element Chromium VI in approximately 30 minutes.

4-4.2.2. Description. CK is a colorless, heavy, highly-volatile liquid which forms a vapor heavier than air. This agent interferes with the utilization of oxygen by the body tissues. It also irritates the eyes even in low concentrations, and is an intense irritant of the lungs, causing an excessive accumulation of fluid which produces a choking effect. The breathing rate slows, and death is preceded by convulsions and respiratory arrest. The common symptoms are lacrimation, irritation of the eyes, nose, and respiratory tract; coughing, choking, nausea, headache, giddiness, coma, and convulsions.

Incapacitation is usually brief, and recovery is prompt. Residual injury of the central nervous system may persist for weeks, and some of the damage may be permanent.

4-4.2.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group B Chemical Ammunition for handling and storage

purposes. This agent tends to undergo condensation or polymerization in storage to form a solid compound, cyanuric chloride ($C_3N_3Cl_3$). Impurities promote polymerization which may occur with explosive violence.

4-4.2.4. Decontamination. No decontamination of material exposed to CK vapor is needed. For material contaminated with CK liquid, DS-2 or sodium hydroxide solution can be used.

4-4.2.5. Shipping Containers. CK is packaged in type A steel containers.

4-4.2.6. Identification Data. CK is listed under NSN 1365-00-277-3053 and DODIC/NALC K545.

4-4.3. SA, ARSINE

Action on metals	Reacts slowly with copper, brass, and nickel. May also decompose from contact with other metals.
Boiling point	-80.5°F
Chemical name	Arsine or arsenic trihydride
Chemical storage group	B
Decomposition temperature	536°F
Formula	AsH_3
Melting point	-178.6°F
Odor	Mild garlic-like odor
Persistency	Short
Rate of action	Effects are delayed from 2 hours to as much as 11 days.
Rate of detoxification	Not rapid enough to be of importance.
Stability in storage	Not stable in uncoated metal containers. Metals accelerate the decomposition of SA.

4-4.3.1. Intended Use. Arsine (SA) is used as a delayed-action casualty agent.

4-4.3.2. Description. SA interferes with functioning of the blood, specifically, the hemoglobin of the red blood cells. Indications of poisoning usually develop within several hours of exposure. Headache, dizziness, nausea and vomiting, abdominal pain, and weakness are early signs. In severe cases, this may be followed by tea-colored or bloody urine. Occasionally, the renal tubules may be plugged by debris, resulting in suppression of urine. Jaundice and tenderness over the liver may appear about the same time. In fatal cases, the patient may develop delirium, followed by coma and death.

Because of its high volatility and relatively low latent heat of vaporization, SA is one of the most rapidly dispersing chemical agents. This agent, however, ignites very easily and cannot be used in shells.

4-4.3.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group B Chemical Ammunition for handling and storage purposes. Exposure to light should be avoided since light causes SA to decompose rapidly.

4-4.3.4. Decontamination. None required.

4-4.3.5. Shipping Containers. SA is packaged in type A steel containers.

4-5. CHOKING AGENTS

Choking agents are lethal agents in the form of gases or vapors which attack the respiratory tract. Some of the agents irritate the nose, pharynx, and upper respiratory tract and produce pulmonary edema, all of which contribute to the sensation of choking. The immediate effect is likely to be coughing, choking, and possibly nausea. The symptoms may be delayed for several hours.

4-5.1. CG, PHOSGENE

Action on metals	None when CG is dry; acidic and corrosive when it is moist.
Boiling point	46.76°F at 29.9 in. Hg
Chemical name	Carbonyl chloride
Chemical storage group	B
Decomposition temperature	1472°F
Formula	$COCl_2$
Melting point	-180.4°F (also given as -197.97°F)
Odor	New-mown hay or grass; green corn.
Persistency	Short, although vapor may persist for some time in low places under calm winds and stable atmospheric conditions.
Rate of action	Delayed 3 hours or more if exposure is light; immediate symptoms may follow exposure to high concentrations.
Rate of detoxification	Not detoxified; cumulative
Stability in Storage	Stable in steel containers if CG is dry.

4-5.1.1. Intended Use. Phosgene (CG) is used as a delayed-action casuality agent, although immediate symptoms can develop from exposure to high concentrations.

4-5.1.2. Description. CG exerts its effect solely on the lungs, and results in damage to the capillaries. It causes a watery fluid to seep into the air sacs. If a lethal dosage was received, these sacs become so flooded that air is excluded, and the victim dies from a lack of oxygen (dry land drowning). Most deaths occur within 24 hours. If the dosage received was not lethal, and with proper treatment, the fluid will be reabsorbed and the victim recovers. The severity of the poisoning cannot be determined from the immediate symptoms since the full effect is not usually apparent for 3 or 4 hours after exposure.

4-5.1.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

4-5.1.4. Decontamination. Material contacted by CG vapor is decontaminated with DS-2 or water, followed by an alkali solution.

4-5.1.5. Shipping Containers. CG is packaged in steel containers and drums.

4-5.1.6. Identification Data. CG is listed under Specification MIL-P-10455, NSN 1365-00-277-3038, and DODIC/NALC K685.

4-5.2. DP, DIPHOSGENE

Action on metals	Metals catalyze the conversion to CG
Boiling point	260.6° to 262.4°F
Chemical name	Trichloromethyl chlorofurmate
Chemical storage group	B
Decomposition temperature	573.8° to 663.8°F
Formula	$C1COOC1_3$
Melting point	-70.6°F
Odor	New-mown hay or grass; green corn
Persistency	Short, although vapor may persist for some time in low places under calm winds and stable atmospheric conditions
Rate of action	Delayed 3 hours or more if exposure is light; immediate symptoms may follow exposure to high concentrations.
Rate of detoxification	Not detoxified; cumulative
Stability in Storage	Unstable because of conversion to CG.

4-5.2.1. Intended Use. Diphosgene (DP) is used as a delayed- or immediate-action casualty agent, depending on the dosage rate.

4-5.2.2. Description. This agent is converted to CG in the body, therefore, the physiological effects are the same for both agents. It exerts its effect solely on the lungs, and results in damage to the capillaries. It causes a watery fluid to seep into the air sacs. If a lethal dosage was received, these sacs become so flooded that air is excluded, and the victim dies from a lack of oxygen. Most deaths occur within 24 hours. If the dosage received was not lethal, and with proper treatments, the fluid will be reabsorbed and the victim recovers. The severity of the poisoning cannot be determined from the immediate symptom since the full effect is not usually apparent for 3 or 4 hours after exposure.

4-5.2.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical is designated as a Group B Chemical Ammunition for handling and storage purposes.

4-5.2.4. Decontamination. Material contacted by DP vapor is decontaminated with DS-2 or water, followed by an alkali solution.

4-5.2.5. Shipping Containers. DP is packaged in steel containers and drums.

4-6. BINARY (INTERMEDIATE) AGENTS

Binary intermediate agents are relatively nontoxic chemicals which combine during functioning of a weapon system to produce a toxic chemical agent.

4-6.1. DF, DIFLUOROMETHYLPHOSPINE

4-6.1.1. Intended Use. Difluoromethylphosphine (DF) is a binary intermediate agent that is relatively nontoxic. DF combines with binary intermediate agent OPA (paragraph 4-6.2) during weapon functioning to produce the toxic chemical agent (GB2). DF, when exposed to air or water, becomes highly acidic, causing it to be very corrosive. It also emits vapors harmful to the human body. Personnel handling DF shall wear protective mask and acid protective gloves and clothing.

4-6.1.2. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This binary intermediate agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

4-6.1.3. Identification Data. DF is listed under Specification MIL-C-51427.

4-6.2. OPA, ISOPROPYL ALCOHOL-ISOPROPYLAMINE

4-6.2.1. Intended Use. Isopropyl Alcohol-Isopropylamine (OPA) is a binary intermediate agent that is relatively nontoxic. OPA combines with binary intermediate agent DF (paragraph 4-6.1) during weapon functioning to produce the toxic chemical agent (GB2). OPA vapors/liquid can irritate eyes, nose, throat, and skin. Personnel should avoid breathing OPA vapors and avoid OPA liquid contact with skin. Personnel handling OPA shall wear protective mask and acid protective gloves and clothing.

4-6.2.2. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This binary intermediate agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

4-6.2.3. Identification Data. OPA is listed Specification MIL-C-51428.

4-7. INCAPACITATING AGENTS

Incapacitating chemical agents are capable of producing physiological or mental effects that prevent exposed personnel from performing their primary military duties for a significant period of time; there is complete recovery from these effects.

4-7.1. BZ, AGENT

4-7.1.1. Intended Use. BZ is a delayed-acting chemical agent which produces temporary incapacitation. It is used in burning mixtures which aerosolize the agent.

4-7.1.2. Description. BZ, which is white or off-white in color, is packed in munitions in a micropulverized form. This agent is a very potent psychoactive compound which produces mental and physical incapacitation when inhaled. Its primary effects are on the brain, producing giddiness, disorientation, hallucination, and drowsiness. Physiological effects include dry, flushed skin, increased heartbeat, urinary retention and constipation, headache, and a general slowing of mental and physical activities. Symptoms become evident 30 to 60 minutes after exposure, with the most severe incapacitation occurring in 4 to 8 hours. These effects may last 3 or 4 days if untreated. The persistency of BZ in aerosol form is about 10 minutes. In micropulverized form, its duration can be indefinite in dry areas.

4-7.1.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This chemical agent is designated as a Group B Chemical Ammunition for handling and storage purposes. Since this agent is packed in munitions in micropulverized form, any leakages which should occur will cause the suspension of particles in the air. Inhalation of these particles will produce the same effects and symptoms as the aerosol.

4-7.1.4. Decontamination. Decontamination of personnel can be accomplished by washing contaminated parts with soap and water. Flush eyes with clear water only. Clothing and equipment should be shaken or brushed and thoroughly washed. Hypochlorite or alcohol caustic solutions are suitable decontaminants for BZ on materiel. BZ can be removed by scrubbing, pressure hosing, or drenching the surface with a detergent-wetting solution followed by hosing with clear water.

Because a person exposed to BZ cannot sweat, the danger of heat stroke is the primary concern in first aid. Excessive clothing should be removed if the environmental temperature is above 70°F and the victim moved to fresh air. To prevent him from injuring himself or others as symptoms develop, restrictive care must be provided. Individuals who cannot stand must be lifted to a litter and strapped in. Individuals who are ambulatory must be regarded as potentially belligerent and should be separated from each other, confined, and closely observed before and during medical treatment.

The drug physostigmine salicylate is highly effective in treating BZ victims if administered approximately 4 hours following exposure. Only medical personnel should administer the drug, however, and treatment does not shorten duration of BZ intoxication. Premature discontinuation of therapy will result in relapse.

4-7.1.5. Shipping Containers. BZ is packaged in 60-pound steel drums.

4-7.1.6. Identification Data. BZ is listed under NSN 1365-00-857-0434.

CHAPTER 5

RIOT CONTROL AGENTS

5-1. INTRODUCTION

This chapter provides information on the characteristics and properties of riot control agents used in munitions, grenades, and dispersers as described in the succeeding chapters (See NAVMED P-5041 for additional information).

5-1.1. GENERAL. Riot control agents are gaseous, liquid, or solid chemical agents which produce transient effects. The effects disappear in minutes after personnel are no longer exposed. Exposed persons rarely require medical treatment. Riot control agents are normally used by governments for domestic law enforcement purposes and are classified as “tear agents” or “lachrymators”. Wearing a protective mask is required to protect personnel against inhalation of vapors, particles, or smoke from the burning agents. Since these agents will cause varying degrees of skin irritation, personnel must wear approved types of protective clothing such as coveralls and gloves when handling riot control agents.

Table 5-1. Riot Control Agents

Chemical Name	Paragraph	Boiling Point	Melting Point	Decomposition Temperature	Flash Point
DA, Diphenyl-chloroarsine	5-2.1	631.4°F	111.2°F	572°F	662°F
DC, Diphenyl-cyanoarsine	5-2.2	415.4°F	87.8°F	572°F (25% decomp)	Low
DM, Adamsite	5-2.3	770°F	383°F	Above boiling point	None when dry
CN, Chloroacetophenone	5-3.1	471.2°F to 473°F	129.2°F	Stable to boiling point	High enough not to interfere with military use
CN1, Chloro-acetophenone-Aerogel	5-3.2	458.6°F	68°F to 69.8°F	–	–
CS, Ortho-Chlorobenzyl-Malonitrile	5-3.3	590°F to 599°F	199.4°F to 203°F	Not Available	–
CS1-Ortho-Chlorobenzyl-Malonitril-Silica Aerogel	5-3.4	–	–	–	–
CS2-Ortho-Chlorobenzyl-Malonitrile-Silica Aerogel	5-3.5	–	–	–	–

5-2. VOMITING AGENTS

Vomiting agents (Sternutators) are normally solids which, when heated, vaporize and then condense to form toxic aerosols. They produce a strong, pepper-like irritation of the nose and eyes and lachrymation. They cause coughing, sneezing, nausea, vomiting, and a feeling of malaise. Onset of symptoms occurs within a few minutes of exposure. Exposure to high concentrations in confined spaces may result in severe pulmonary injury and possible death. However, in the event of exposure to field concentrations of agents, the symptoms disappear in 20 minutes to 2 hours.

5-2.1. DA, DIPHENYLCHLOROARSINE

Action on metals	None when dry
Boiling point	631.4°F
Chemical name	Diphenylchloroarsine
Chemical storage group	B
Decomposition temperature	572°F
Formula	$(C_6H_5)_2AsCl$
Melting point	111.2°F
Odor	No pronounced odor
Persistency	Less than 10 minutes
Rate of action	Very rapid; within 2 or 3 minutes after 1 minute of exposure.
Rate of detoxification	Mild incapacitating dosages are detoxified completely within 1 to 2 hours.
Stability in storage	Stable when pure

5-2.1.1. Intended Use. Diphenylchloroarsine (DA) is used as a riot control agent.

5-2.1.2. Description. Minute concentrations of the agent cause irritation to the nose and throat. Longer exposures causes tightness of the chest, headaches, sneezing, coughing, intense nausea, and weakness. From exposure to moderate concentrations of DA, the effects last about 30 minutes after leaving the contaminated area. At higher concentrations, the effects may last up to several hours. The irritation and discomfort produced by this gas are so intense that intolerable concentrations are reached long before it becomes life-threatening. Continued use of the protective mask is the only protection necessary against DA.

5-2.1.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This riot control agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

5-2.1.4. Decontamination. Protective masks should be worn as long as the gas is present in the atmosphere. It is first detected by symptoms of headache and nausea. Only during periods of actual vomiting should the mask be pulled away from the chin.

5-2.1.5. Shipping Containers. DP is packaged in steel containers.

5-2.2. DC, DIPHENYLCYANOARSINE

Action on metals	None
Boiling point	415.4°F
Chemical name	Diphenylcyanoarsine
Chemical storage group	B
Decomposition temperature	About 25% decomposed at 572°F
Formula	$(C_6H_5)_2AsCN$
Melting point	87.8°F
Odor	Similar to a mixture of garlic and bitter almonds
Persistency	Less than 10 minutes
Rate of action	Very rapid. High concentrations are intolerable in about 30 seconds.
Rate of detoxification	Rapid in small amounts. Incapacitating dosages lose their effect after about 1 hour.
Stability in storage	Stable at all ordinary temperatures.

5-2.2.1. Intended Use. Diphenylcyanoarsine (DC) is used as a riot control agent.

5-2.2.2. Description. Minute concentrations of this agent cause irritation to the nose and throat. Longer exposures causes tightness in the chest, headaches, sneezing, coughing, intense nausea, and weakness. From exposure to moderate concentrations of DC, the effects last about 30 minutes after leaving the contaminated area. At higher concentrations, the effects may last up to several hours. The irritation and discomfort produced by this gas are so intense that intolerable concentrations are reached long before it becomes life-threatening. Continued use of the protective mask is the only protection necessary against DC.

5-2.2.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This riot control agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

5-2.2.4. Decontamination. Protective masks should be worn as long as the gas is present in the atmosphere. It is first detected by symptoms of headache and nausea. Only during periods of actual vomiting should the mask be pulled away from the chin.

5-2.2.5. Shipping Containers. DC is packaged in steel containers.

5-2.3. DM, ADAMSITE

Action on metals	Corrodes iron, bronze, and brass
Boiling point	770°F
Chemical name	Diphenylaminochloroarsine
Chemical storage group	B
Decomposition temperature	Above boiling point
Formula	$NH(C_6H_4)_2AsCl$
Melting point	383°F
Odor	No pronounced odor
Persistency	Less than 10 minutes
Rate of action	Very rapid. Only about 1 minute is required for temporary incapacitation at concentration of 22 mg/m^3.
Rate of detoxification	Rapid in small amounts. Incapacitating dosages lose their effect after about 30 minutes.
Stability in storage	Stable when pure.

5-2.3.1. Intended Use. Adamsite (DM) is used as a riot control agent. DM is usually found combined with CN in a burning type grenade.

5-2.3.2. Description. DM is a vomiting gas classed as a nonpersistent agent. Composed of yellow or green crystals in its solid, pure state, DM is converted by heat into vapor which forms a yellow smoke. It has no identifying odor. Minute concentrations of this agent cause irritation to the nose and throat. Longer exposure causes tightness of the chest, headaches, sneezing, coughing, intense nausea, and weakness. From exposure to moderate concentrations of DM, the effects last about 30 minutes after leaving the contaminated area. At higher concentrations, the effects may last up to 3 hours. The irritation and discomfort produced by this gas are so intense that intolerable concentrations are reached long before it becomes life-threatening. Continued use of the protective mask is the only protection necessary against DM .

5-2.3.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This riot control agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

5-2.3.4. Decontamination. Protective masks should be worn as long as the gas is present in the atmosphere. It is first detected by symptoms of headache and nausea. Only during periods of actual vomiting should the mask be pulled away from the chin. If the situation permits, the outer clothing should be removed and aired, and the skin washed with soap and water. If symptoms persist, water may be used to rinse the nose and throat. In extreme cases, the victim must be kept quiet until the symptoms have passed.

5-2.3.5. Shipping Containers. DM is packaged in steel containers.

5-3. TEAR AGENTS

Tear agents or gases (Lachrymators) may be either liquids or extremely fine powders. Some of the solid agents are compounded into pyrotechnic mixtures for thermal dissemination. The tear agents cause flow of tears and irritation of the skin. Since there is small likelihood of tear agents producing casualties, they are used rarely except for training and riot control.

5-3.1. CN, CHLOROACETOPHENONE

Action on metals	Slight
Boiling point	471.2°F – 473°F
Chemical name	Chloroacetophenone
Chemical storage group	B
Decomposition temperature	Stable to boiling point
Formula	$C_6H_5COCH_2Cl$
Melting point	129.2°F
Odor	Fragrant; similar to apple blossoms
Persistency	Nonpersistent
Rate of action	Rapid; practically instantaneous
Rate of detoxification	Rapid; effects disappear in a few hours
Stability in storage	Stable

5-3.1.1. Intended Use. Chloroacetophenone (CN) is used primarily for riot and mob control. CN forces personnel to don masks or take gas preventive measures. It has a little more than nuisance value in war due to the effectiveness of the modern protective mask. CN is the principal ingredient in MACE.

5-3.1.2. Description. CN and its allied tear gases produce acute pain in the eyes, profuse tears, and spasms of the eyelids. The effects wear off quickly and there is usually no permanent damage. The victim may find his vision temporarily obscured. CN is also an irritant to the upper respiratory passages. In high concentrations, CN is also irritating to the skin, causing burning and itching sensations, particularly on moist parts of the body. The effects are similar to sunburn. They are, however, entirely harmless and disappear in a few hours.

5-3.1.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This riot control agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

5-3.1.4. Decontamination. Contaminated surfaces should be washed with hot sodium carbonate, sodium hydroxide, or soapy water solution.

For first aid, personnel should be moved to fresh air and face toward the wind with eyes open. If any CN should remain in the eye, it should be washed out with water or saline solution. A 1/4-percent solution of sodium sulfite, if available, is more effective in dissolving and neutralizing CN. The eyes should not be rubbed or bandaged. Dermatitis and superficial skin burns may be treated with Calamine Lotion for symptomatic relief. The treatment of deeper burns is the same as for thermal burns of like severity.

5-3.1.5. Shipping Containers. CN is packaged in 4-pound metal containers and 450-pound metal drums.

5-3.1.6. Identification Data. CN is listed under Specification MIL-C-10338, NSN 1365-00-038-5194, and DODIC/NALC K510.

5-3.2. CN1, CHLOROACETOPHENONE – AEROGEL

Action on metals	Slight
Boiling point	458.6°F
Chemical name	Chloroacetophenone – aerogel
Chemical storage group	B
Decomposition temperature	-----
Formula	-----
Melting point	68° – 69.8°F
Odor	Fragrant; similar to apple blossoms
Persistency	Nonpersistent
Rate of action	Rapid
Rate of detoxification	Rapid
Stability in storage	Stable

5-3.2.1. Intended Use. Chloroacetophenone – aerogel (CN1) is used primarily for riot and mob control. CN1 forces personnel to don masks or take gas preventive measures. CN1 has little more than nuisance value in war due to the effectiveness of the modern protective mask.

5-3.2.2. Description. CN1 is basically the same as CN except CN1 contains aerogel which prevents massing. CN1 and its allied tear gases produce acute pain in the eyes, profuse tears, and spasms of the eyelids. The effects wear off quickly and there is usually no permanent damage. The victim may find his vision temporarily obscured. CN1 is also an irritant to the upper respiratory passages. In high concentrations, CN1 is irritating to the skin, causing burning and itching sensations, particularly on moist parts of the body. The effects are similar to sunburn. They are, however, entirely harmless and disappear in a few hours.

5-3.2.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This riot control agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

5-3.2.4. Decontamination. Contaminated surfaces should be washed with hot sodium carbonate, sodium hydroxide, or soapy water solution.

For first aid, personnel should be moved to fresh air and faced toward the wind with eyes open. If any CN1 should remain in the eye, it should be washed out with water or saline solution. A 1/4-percent solution of sodium sulfite, if available, is more effective in dissolving and neutralizing CN1. The eyes should not be rubbed or bandaged. Dermatitis and superficial skin burns may be treated with Calamine Lotion for symptomatic relief. The treatment of deeper burns is the same as for thermal burns of like severity.

5-3.2.5. Shipping Containers. CN1 is packaged in 4-pound metal containers and 450-pound metal drums.

5-3.3. CS, ORTHO-CHLOROBENZALMALONONITRILE

Action on metals	Very slight action on steel
Boiling point	590° to 599°F
Chemical name	O-Chlorobenzalmalononitrile
Chemical storage group	B
Decomposition temperature	Not available
Formula	$ClC_6H_4CHC(CN)_2$
Melting point	199.4° to 203°F
Odor	Pepper-like
Persistency	Short
Rate of action	Rapid
Rate of detoxification	Rapid; incapacitating dosages lose their effects in 5 to 10 minutes
Stability in storage	Stable

5-3.3.1. Intended Use. O-chlorobenzalmalononitrile (CS) is a training and riot control agent ten times more powerful than CN. This agent is used as a filling for burning-type grenades and capsules.

5-3.3.2. Description. CS is a white crystalline powder which produces extreme burning of the eyes; coughing, difficulty in breathing, and chest tightness; involuntary closing of the eyes; stinging sensation on moist areas of the skin; running nose; and dizziness or swimming of the head. Heavy concentrations will also cause nausea and vomiting. The agent takes effect in 20 to 60 seconds, and incapacitation endures from 2 to 5 minutes after removal to a clear atmosphere. The severe irritation of the eyes and respiratory system requires medical treatment. Experiments have shown that troops simulating rioters disperse even faster after a second exposure to CS than they did on the first encounter.

CS, while more potent than CN, is at the same time less toxic and far safer to use in training. CS also attacks its victims more quickly than CN, and even experienced troops may be incapacitated before they can put on protective masks.

5-3.3.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This riot control agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

5-3.3.4. Decontamination. If the eyes come in contact with this agent, they must be thoroughly irrigated with water or a 1/4-percent solution of sodium sulfite and the victim promptly sent to the dispensary for further treatment. The eyes must not be rubbed. If personnel have been exposed to CS, they should be moved into the fresh air. The skin should be immediately flushed with water and the victim sent to the dispensary for medical treatment. Area decontamination is not required since CS is nonpersistent.

5-3.3.5. Shipping Containers. This agent is packed in a polyethylene bag inside a 55-gallon steel drum.

5-3.3.6. Identification Data. CS is listed under Specification MIL-C-51015, NSN 1365-00-690-8656, and DODIC/NALC K765.

5-3.4. CS1, ORTHO-CHLOROBENZALMALONONITRILE – SILICA AEROGEL

Action on metals	Very slight action on steel
Boiling point	-----
Chemical name	Ortho-chlorobenzalmalononitrile – silica aerogel
Chemical storage group	B
Decomposition temperature	-----
Formula	-----
Melting point	-----
Odor	Pepper-like
Persistency	Short
Rate of action	Rapid
Rate of detoxification	Rapid
Stability in storage	Stable

5-3.4.1. Intended Use. O-chlorobenzalmalononitrile – silica aerogel (CS1) is used as a training and riot control agent. It is used as a filling for bursting-type grenades and in all bulk irritant agent dispensers.

5-3.4.2. Description. CS1 is a mixture of 95-percent CS and 5-percent silica aerogel. This agent produces extreme burning of the eyes; coughing, difficulty in breathing, and chest tightening; involuntary closing of the eyes; stinging sensations on moist areas of the skin; running nose; and dizziness or swimming of the head. Heavy concentrations will also cause nausea and vomiting. The agent takes effect in 20 to 60 seconds, and incapacitation endures from 2 to 5 minutes after removal to a clear atmosphere. The severe irritation of the eyes and respiratory system requires medical treatment.

CS1, while more potent than CN, is at the same time less toxic and far safer to use in training. CS1 also attacks its victims more quickly than CN, and even experienced troops may be incapacitated before they can put on protective masks.

5-3.4.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This riot control agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

5-3.4.4. Decontamination. If the eyes come in contact with this agent, they must be thoroughly irrigated with water or a 1/4-percent solution of sodium sulfite and the victim promptly sent to the dispensary for further treatment. The eyes must not be rubbed. If personnel have been exposed to CS1, they should be moved into the fresh air. The skin should be immediately flushed with water and the victim sent to the dispensary for medical treatment. Area decontamination is not required since CS1 is nonpersistent.

5-3.4.5. Shipping Containers. This agent is packaged in a 3-1/2 gallon polyethylene jeepo bottle-type container, with 5 containers per wooden box.

5-3.4.6. Identification Data. CS1 is listed under Specification MIL-C-50009, NSN 1365-00-026-1914, and DODIC/NALC K768.

5-3.5. CS2, ORTHO-CHLOROBENZALMALONONITRILE – SILICA AEROGEL AND WATER RESISTANT COATING

Action on metals	Very slight action on metal
Boiling point	-----
Chemical name	O-Chlorobenzalmalononitrile – silica aerogel and water resistant coating
Chemical storage group	B
Decomposition temperature	-----
Formula	-----
Melting point	-----
Odor	Pepper-like
Persistency	Greater than CS
Rate of action	Rapid
Rate of detoxification	Rapid
Stability in storage	Stable

5-3.5.1. Intended Use. O-chlorobenzalmalononitrile – silica aerogel and water resistant coating (CS2) is used as a training and riot control agent.

5-3.5.2. Description. CS2 is modified CS1 treated with liquid silicone, resulting in increased fluidity and persistency. This agent produces extreme burning of the eyes; coughing, difficulty in breathing, and chest tightness; involuntary closing of the eyes; stinging sensations on moist areas of the skin; running nose; and dizziness or swimming of the head. Heavy concentrations will also cause nausea and vomiting. The agent takes effect in 20 to 60 seconds, and incapacitation endures from 2 to 5 minutes after removal to a clear atmosphere. The severe irritation of the eyes and respiratory system requires medical treatment.

5-3.5.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical agents as set forth in Section 1-5 of this manual apply to this item. This riot control agent is designated as a Group B Chemical Ammunition for handling and storage purposes.

5-3.5.4. Decontamination. If the eyes come in contact with this agent, they must be thoroughly irrigated with water or a 1/4-percent solution of sodium sulfite and the victim promptly sent to the dispensary for further treatment. The eyes must not be rubbed. If personnel have been exposed to CS2, they should be moved into the fresh air. The skin should be immediately flushed with water and the victims sent to the dispensary for medical treatment.

5-3.5.5. Shipping Containers. This agent is packaged in 3-1/2 gallon polyethylene jeepo bottle-type containers, with 5 containers per wooden box.

5-3.5.6. Identification Data. CS2 is listed under NSN 1365-00-935-6016 and DODIC/NALC K766.

CHAPTER 6

RIOT CONTROL GRENADES AND ASSOCIATED EQUIPMENT

6-1. INTRODUCTION

This chapter contains general and technical information on riot control grenades, grenade fuzes, and grenade projection adapters.

6-1.1. GENERAL. Riot control hand grenades are used for casualty, harassing, or riot control purposes. They may be used in training exercises to simulate casualty agents and to test the fit and effectiveness of protective masks.

The effects of weather on the functioning of riot control hand grenades must be considered prior to their use. Winds must be considered so that they will carry the vapors in the desired direction and, at the same time, care must be taken to protect friendly troops and installations. Rain generally lessens the effect of riot control grenades since it washes vapors from the air and dampens combustible material.

The manner of throwing hand grenades is relatively unimportant. Personnel should use the throwing motion with which they are most successful. Accuracy and distance are usually the primary objectives. Some grenades are rifle projected. Refer to appropriate rifle operator manuals for more information on this subject.

Table 6-1. Riot Control Grenades and Associated Equipment

Item	Paragraph	Agent	Agent Weight
Grenade, Hand, Riot, CN-DM, M6	6-2.1	CN-DM	10.0 ounces
Grenade, Hand, Riot, CN, M7	6-2.2	CN	12.0 ounces
Grenade, Hand, Riot, CN, M7A1	6-2.3	CN	12.0 ounces
Grenade, Hand, Riot, CS, M7A1	6-2.4	CS	9.5 ounces
Grenade, Hand, Riot, CS, M7A2	6-2.5	CS capsules	3.1 ounces
Grenade, Hand, Riot, CS, M7A3	6-2.5	CS capsules	3.1 ounces
Grenade, Hand, Riot, CS, M47	6-2.6	CS	7.0
Grenade, Hand, Riot, CS, M54	6-2.7	CS pellets	4.2 ounces
Grenade, Hand, Riot, CN1, M25A1	6-3.1	CN1	3.3 ounces
Grenade, Hand, Riot, CN1, M26A2	6-3.2	CN1	3.2 ounces

Table 6-1. Riot Control Grenades and Associated Equipment – Continued

Item	Paragraph	Agent	Agent Weight
Grenade, Hand, Riot, CS1, M25A2	6-3.3	CS1	3.2 ounces
Fuze Grenade, Hand, M201	6-4.1	---	---
Fuze Grenade, Hand, M201A1	6-4.1	---	---
Fuze Grenade, Hand, M226	6-4.2	---	---
Fuze Grenade, Hand, M227	6-4.3	---	---
Adapter, Projection, Grenade, M2	6-5.1	---	---
Adapter, Projection, Grenade, M2A1	6-5.1	---	---

6-2. BURNING GRENADES

6-2.1. GRENADE, HAND, RIOT, CN-DM, M6

6-2.1.1. Intended Use. The M6 CN-DM Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This grenade can also be used for training purposes.

6-2.1.2. Description. This grenade, Figure 6-2.1, is a cylindrical metal container approximately 2.5 inches in diameter, 4.5 inches high, and weighs 1.0 pound. The body of the grenade has eighteen emission holes, three rows of six holes each. The emission holes are covered with adhesive tape to protect the filler from moisture. The grenade contains approximately 10 ounces of CN-DM filler and EC smokeless powder. A starter mixture is contained in a zinc or plastic cup attached inside the grenade. The M201 or M201A1 Hand Grenade Fuze (paragraph 6-4.1) is threaded into a fuze adapter in the top of the grenade. The fuze safety lever is held in an unarmed position by a safety cotter pin which is attached to a pull ring. The container is painted gray with red markings. A single red band is used to indicate a nonpersistent riot control agent filler.

6-2.1.3. Functional Description. This grenade can be hand launched or can be rifle projected with the M2 or M2A1 Grenade Projection Adapter (see Section 6-5). In hand launching, the fuze safety lever must be held firmly against the grenade body while the safety cotter pin is removed and until the grenade is thrown. The grenade should be thrown at least 30 feet from all friendly personnel. Release of the fuze safety lever allows the striker to hit the primer which ignites the 0.7 to 2.0 second delay element in the fuze. At the end of the delay, the ignition mixture in the fuze is ignited, and this, in turn, ignites the starter mixture which ignites the main filler. The gases generated by the burning filler blow off the tape coverings from the emission holes. The CN-DM vapors are emitted in the form of a smoke for approximately 90 seconds.

6-2.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-2.1.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-2.1.6. Shipping Containers. This grenade is packaged in individually sealed metal or fiberboard containers, 16 containers to a wooden box. A filled box weighs approximately 33 pounds.

6-2.1.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 290 grams.

6-2.1.8. Identification Data. The M6 grenade is listed under Drawing 13-22-3 and DODIC/NALC G905. NSN 1330-00-310-2653 with M201 Fuze and NSN 1330-00-219-8579 with M201A1 Fuze.

6-2.1.9. General Data. The following table provides general data on the M6 grenade:

Body Length	4.5 inches
Diameter	2.5 inches
Weight	1.0 pound
Burning Time	30 to 60 seconds
Filler Agent	CN, DM, EC smokeless powder
Filler Weight	10.0 ounces
Fuze	M101 or M201A1
Fuze Delay	2.0 seconds
Fuze Type	Igniting

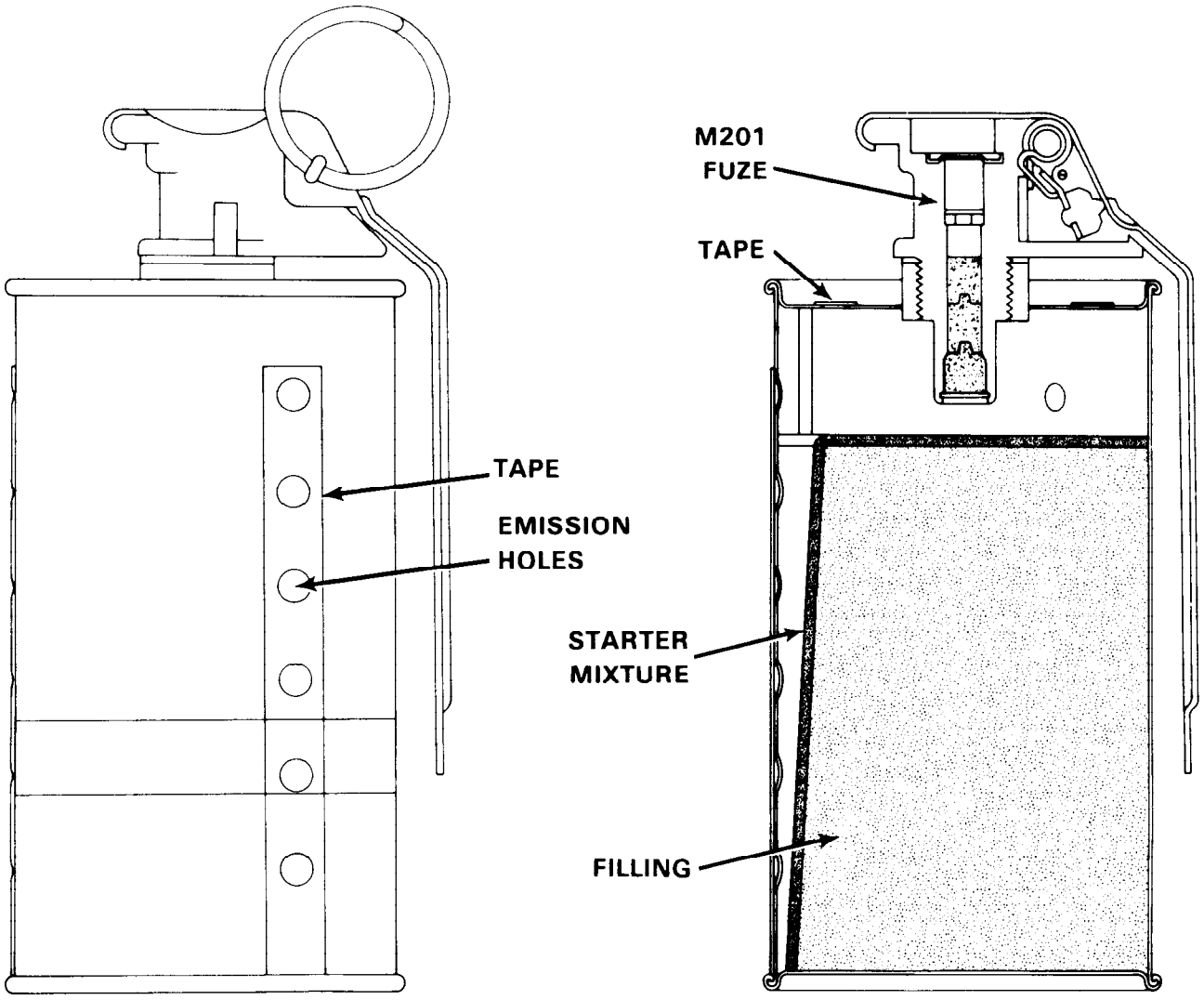


Figure 6-2.1. M6 CN-DM Riot Hand Grenade

6-2.2. GRENADE, HAND, RIOT, CN, M7

6-2.2.1. Intended Use. The M7 CN Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This grenade can also be used for training purposes.

6-2.2.2. Description. This grenade, Figure 6-2.2, is a cylindrical metal container approximately 2.5 inches in diameter, 4.5 inches high, and weighs 1.06 pounds. The body of the grenade has eighteen emission holes, three rows of six holes each. The emission holes are covered with adhesive tape to protect the filler from moisture. The grenade contains approximately 12 ounces of CN filler that is compressed into the grenade body to leave a tapered channel through the filler. The top of the filler and the center channel are coated with a starter mixture to ensure even burning. The M201 or M201A1 Fuze (paragraph 6-4.1) is threaded into a fuze adapter in the top of the grenade. The fuze safety lever is held in an unarmed position by a safety cotter pin which is attached to a pull ring. The container is painted gray with red markings. A single band is used to indicate a nonpersistent riot control agent filler.

6-2.2.3. Functional Description. This grenade can be hand launched or can be rifle projected with the M2 or M2A1 Grenade Projection Adapter (See Section 6-5). In hand launching, the fuze safety lever must be held firmly against the grenade body while the safety cotter pin is removed and until the grenade is thrown. The grenade should be thrown at least 30 feet from all friendly personnel. Release of the fuze safety lever allows the striker to hit the primer which ignites the 0.7 to 2.0 second delay element in the fuze. At the end of the delay, the ignition mixture in the fuze is ignited, and this, in turn ignites the starter mixture which ignites the main filler. The gases generated by the burning filler blow off the tape coverings from the emission holes. The CN vapors are emitted in the form of a smoke for approximately 20 to 60 seconds.

6-2.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-2.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-2.2.6. Shipping Containers. This grenade is packaged in individually sealed metal or fiberboard containers, 16 containers to a wooden box. A filled box weighs approximately 35 pounds.

6-2.2.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 347 grams.

6-2.2.8. Identification Data. The M7 grenade is listed under Drawing 13-21-3 and DODIC/NALC G960. NSN 1330-00-529-8452 with M201 Fuze and NSN 1330-00-871-3697 with M201A1 Fuze.

6-2.2.9. General Data. The following table provides general data on the M7 grenade:

Body Length	4.5 inches
Diameter	2.5 inches
Weight	1.06 pounds
Burning Time	20 to 60 seconds
Filler Agent	C N
Filler Weight	12.0 ounces
Fuze	M201 or M201A1
Fuze Delay	2.0 seconds
Fuze Type	Igniting

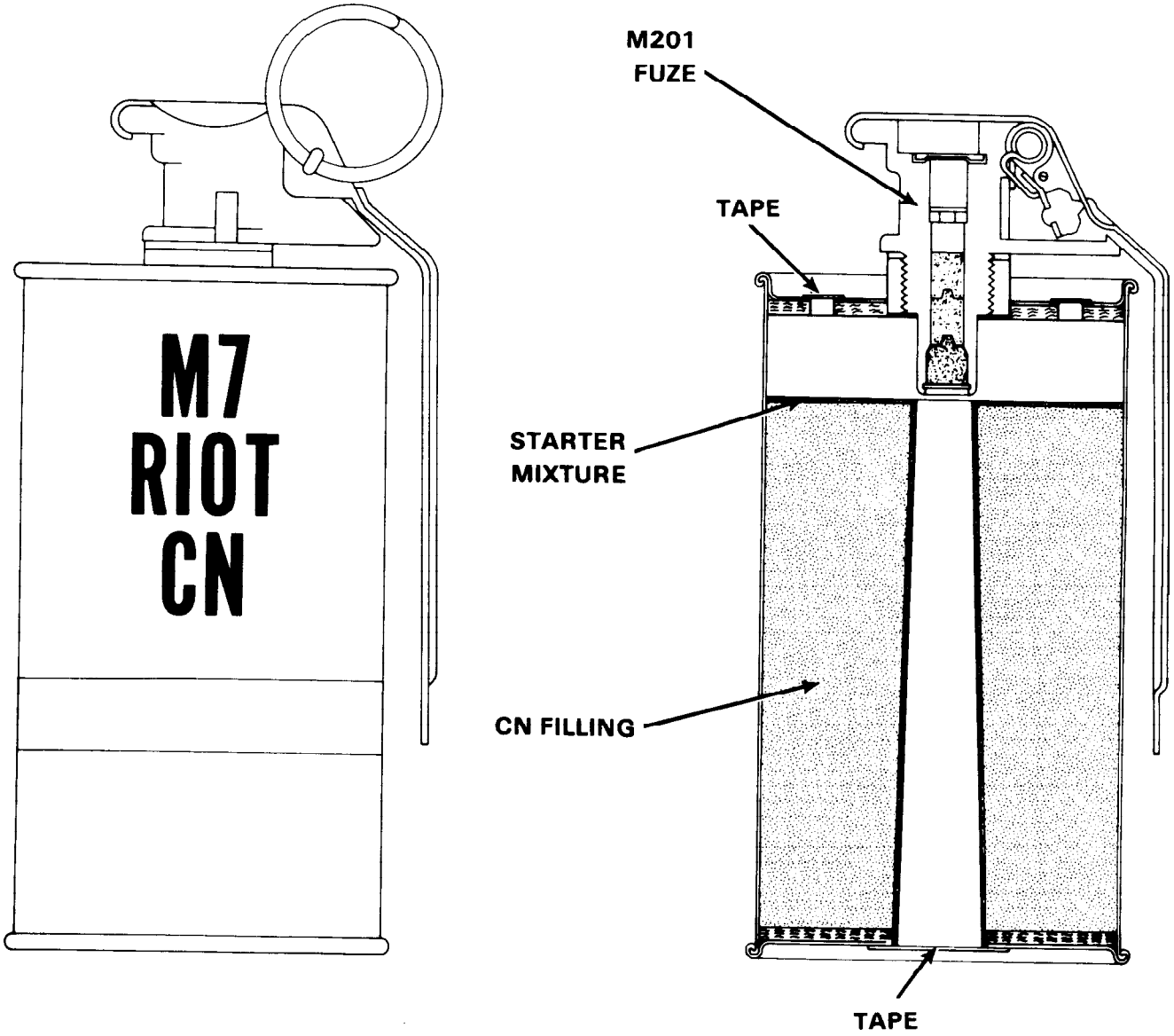


Figure 6-2.2. M7 CN Riot Hand Grenade

6-2.3. GRENADE, HAND, RIOT, CN, M7A1

6-2.3.1. Intended Use. The M7A1 CN Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This grenade can also be used for training purposes.

6-2.3.2. Description. This grenade, Figure 6-2.3, is a cylindrical metal container approximately 2.5 inches in diameter, 4.5 inches high, and weighs 1.16 pounds. Four emissions holes are located in the top of the grenade and one in the bottom. The emission holes are covered with adhesive tape to protect the filler from moisture. The grenade contains approximately 12 ounces of CN filler that is compressed into the grenade body to leave a tapered channel through the filler. The top of the filler and the center channel are coated with a starter mixture to ensure even burning. The M201A1 Fuze (paragraph 6-4.1) is threaded into a fuze adapter in the top of the grenade. The fuze safety lever is held in an unarmed position by a safety cotter pin which is attached to a pull ring. The container is painted gray with red markings. A single band is used to indicate a nonpersistent riot control agent filler.

6-2.3.3. Functional Description. This grenade can be hand launched or can be rifle projected with the M2 or M2A1 Grenade Projection Adapter (see Section 6-5). In hand launching, the fuze safety lever must be held firmly against the grenade body while the safety cotter pin is removed and until the grenade is thrown. The grenade should be thrown at least 30 feet from all friendly personnel. Release of the fuze safety lever allows the striker to hit the primer which ignites the 0.7 to 2.0 second delay element in the fuze. At the end of the delay, the ignition mixture in the fuze is ignited, and this, in turn ignites the starter mixture which ignites the main filler. The gases generated by the burning filler blow off the tape coverings from the emission holes. The CN vapors are emitted in the form of a smoke for approximately 20 to 60 seconds.

6-2.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-2.3.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-2.3.6. Shipping Containers. This grenade is packaged in individually sealed metal or fiberboard containers, 16 containers to a wooden box. A filled box weighs approximately 35 pounds.

6-2.3.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 347 grams.

6-2.3.8. Identification Data. The M7A1 grenade is listed under Drawing 13-21-7, NSN 1330-00-219-8577 and DODIC/NALC G960.

6-2.3.9. General Data. The following table provides general data on the M7A1 grenade:

Body Length	4.5 inches
Diameter	2.5 inches
Weight	1.16 pounds
Burning Time	20 to 60 seconds
Filler Agent	C N
Filler Weight	12.0 ounces
Fuze	M201A1
Fuze Delay	2.0 seconds
Fuze Type	Igniting

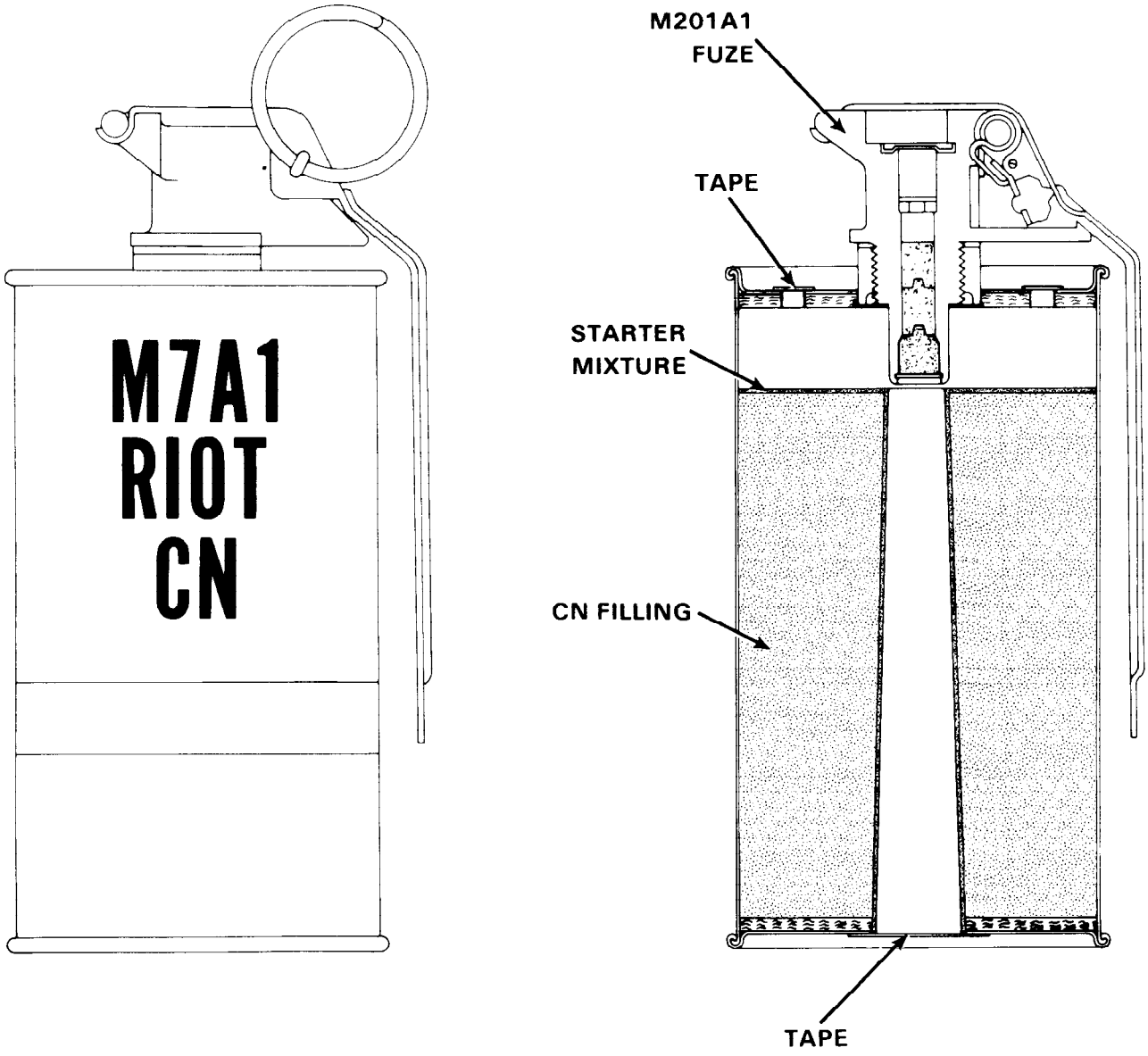


Figure 6-2.3. M7A1 CN Riot Hand Grenade

6-2.4. GRENADE, HAND, RIOT CS, M7A1

6-2.4.1. Intended Use. The M7A1 CS Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This grenade can also be used for training purposes.

6-2.4.2. Description. This grenade, Figure 6-2.4, is a cylindrical metal container approximately 2.5 inches in diameter, 4.5 inches high, and weighs 1.0 pound. Four emission holes are located in the top of the grenade and one in the bottom. The emission holes are covered with adhesive tape to protect the filler from moisture. The grenade contains approximately 9.5 ounces of CS filler that is compressed into the grenade body to leave a tapered channel through the filler. The top of the filler and the center channel are coated with a starter mixture to ensure even burning. The M201A1 Fuze (paragraph 6-4.1) is threaded into a fuze adapter in the top of the grenade. The fuze safety lever is held in an unarmed position by a safety cotter pin which attached to a pull ring. The container is painted gray with red markings. A single band is used to indicate a nonpersistent riot control agent filler.

6-2.4.3. Functional Description. This grenade can be hand launched or can be rifle projected with the M2 or M2A1 Grenade Projection Adapter (See Section 6-5). In hand launching, the fuze safety lever must be held firmly against the grenade body while the safety cotter pin is removed and until the grenade is thrown. The grenade should be thrown at least 30 feet from all friendly personnel. Release of the fuze safety lever allows the striker to hit the primer which ignites the 0.7 to 2.0 second delay element in the fuze. At the end of the delay, the ignition mixture in the fuze is ignited, and this, in turn, ignites the starter mixture which ignites the main filler. The gases generated by the burning filler blow off the tape coverings from the emission holes. The CS vapors are emitted in the form of a smoke for approximately 15 to 30 seconds.

6-2.4.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-2.4.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-2.4.6. Shipping Containers. This grenade is packaged in individually sealed metal or fiberboard containers, 16 containers to a wooden box. A filled box weighs approximately 30 pounds.

6-2.4.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 276 grams.

6-2.4.8. Identification Data. This grenade is listed under Drawing D13-21-6, NSN 1330-00-646-0011, and DODIC/NALC G962.

6-2.4.9. General Data. The following table provides general data on the M7A1 grenade:

Body Length	4.5 inches
Diameter	2.5 inches
Weight	1.0 pound
Burning Time	20 to 60 seconds
Filler Agent	CS
Filler Weight	9.5 ounces
Fuze	M201 or M201A1
Fuze Delay	2.0 seconds
Fuze Type	Igniting

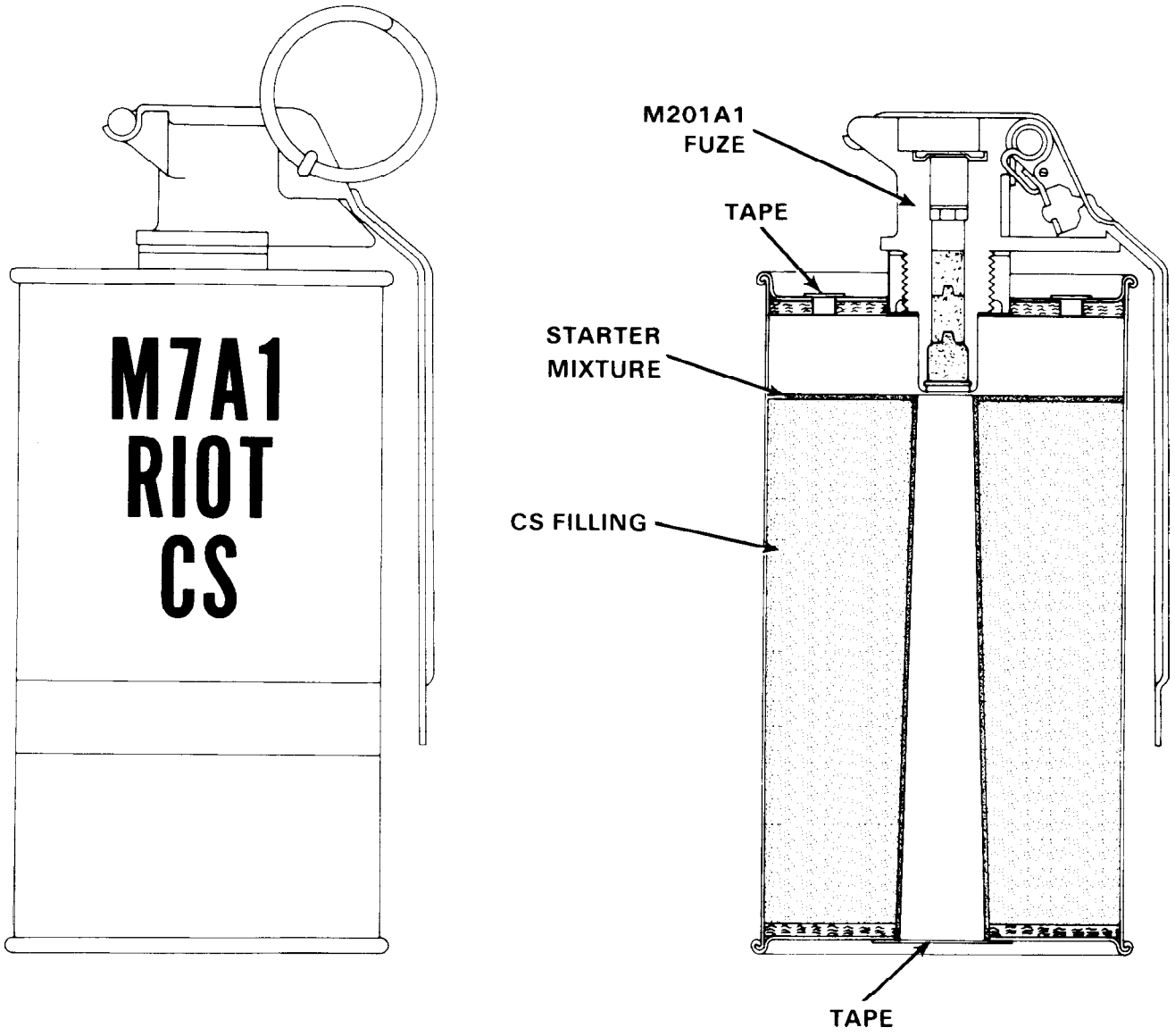


Figure 6-2.4. M7A1 CS Riot Hand Grenade

6-2.5. GRENADE, HAND, RIOT, CS, M7A2 AND M7A3

6-2.5.1. Intended Use. The M7A2 and M7A3 CS Riot Hand Grenades are used for the control of riots, mobs, and other disturbances. These grenades can also be used for training purposes.

6-2.5.2. Description. These grenades, Figure 6-2.5, are a cylindrical metal container approximately 2.5 inches in diameter, 4.5 inches high, and weighs 1.0 pound. There are three emission holes in the top of the grenades and one in the bottom. These emission holes are covered with pressure sensitive tape to protect the filling from moisture. These grenades contain approximately 150 grams of burning mixture (fuel) and approximately 115 grams of encapsulated agent, which comprises 97 grams of powered CS agent in gelatin capsules. The filling is compressed into the grenade bodies to leave a tapered channel through the filling. The top surface of the filling and the tapered walls of the hole are coated with a starter mixture to ensure ignition of the fuel and even burning of the CS agent. The M201A1 Fuze (paragraph 6 4.1) is threaded into a fuze adapter in the top of the grenade. The fuze safety lever is held in an unarmed position by a safety cotter pin which is attached to a pull ring. These grenades are painted gray with red markings. A single band is used to indicate a nonpersistent riot control agent filler. The M7A2 differs from the M7A3 grenade only in the way in which the filling is manufactured.

6-2.5.3. Functional Description. These grenades can be hand launched or can be rifle projected with the M2 or M2A1 Grenade Projection Adapter (See Section 6-5). In hand launching, the fuze safety lever must be held firmly against the grenade body while the safety cotter pin is removed and until the grenade is thrown. The grenade should be thrown at least 30 feet from all friendly personnel. Release of the fuze safety lever allows the striker to hit the primer which ignites the 0.7 to 2.0 second delay element in the fuze. At the end of the delay, the ignition mixture in the fuze is ignited, and this, in turn ignites the starter mixture which ignites the fuel CS capsules. The gases generated by the burning fuel blow off the tape coverings from the emission holes. The CS vapors are emitted in the form of a smoke for approximately 15 to 30 seconds.

6-2.5.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. These grenades are designated as a Group B Chemical Ammunition for handling and storage purposes.

6-2.5.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to these grenades.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-2.5.6. Shipping Containers. These grenades are packaged in individually sealed metal or fiberboard containers, 16 containers to a wooden box. A filled box weighs approximately 30 pounds.

6-2.5.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of these grenades is approximately 276 grams.

6-2.5.8. Identification Data. The M7A2 is listed under Drawing 13-22-29, NSN 1330-00-799-8816, and DODIC/NALC G963. The M7A3 is listed under Drawing 13-22-35, NSN 1330-00-966-0802, and DODIC/NALC G963.

6-2.6.9. General Data. The following table provides general data on these grenades:

Body Length	4.5 inches
Diameter	2.5 inches
Weight	1.0 pound
Burning Time	15 to 30 seconds
Filler Agent	CS capsules
Filler Weight	3.1 ounces
Fuze	M201A1
Fuze Delay	2.0 seconds
Fuze Type	Igniting

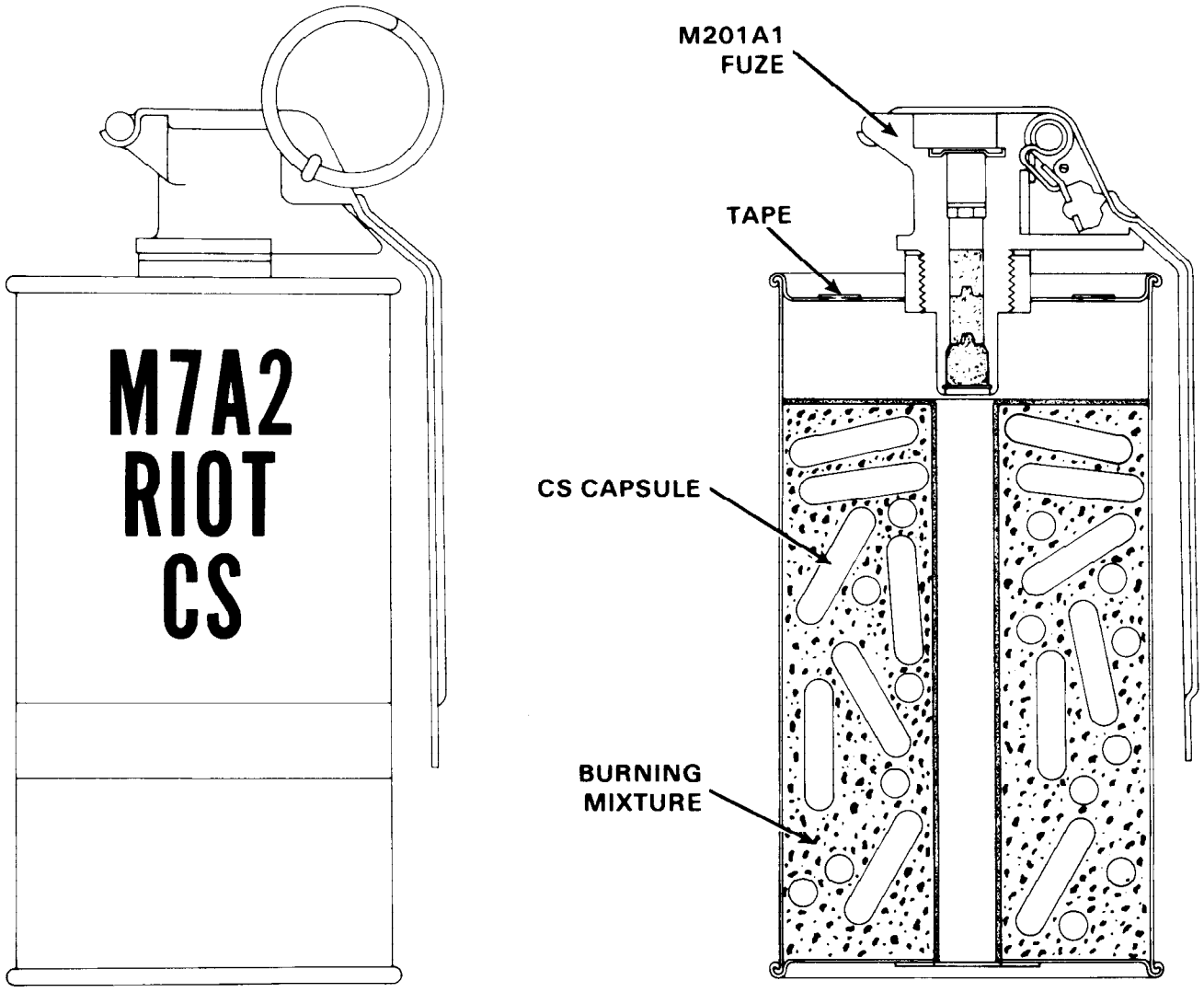


Figure 6-2.5. M7A2 and M7A3 CS Riot Hand Grenade

6-2.6. GRENADE, HAND, RIOT, CS, M47

6-2.6.1. Intended Use. The M47 CS Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This grenade can also be used for training purposes.

6-2.6.2. Description. This grenade, Figure 6-2.6, consists of a spherical rubber body approximately 3.5 inches in diameter, 14 ounces in weight, and containing 7.0 ounces of granulated CS mixture. One emission hole is located on the bottom of the grenade body. The emission hole is covered with pressure sensitive tape to protect the filling from moisture. Grenade Fuze M227 (paragraph 6-4.3) is threaded into the top of the grenade body. The grenade fuze is restrained from functioning by the safety cotter pin, sliding safety latch and safety lever. The grenade is painted gray with red markings and a single red band to indicate a nonpersistent riot control agent filler.

6-2.6.3. Functional Description. The fuze safety lever must be held firmly against the grenade body while the safety cotter pin is removed and until the grenade is thrown. Removal of the safety cotter pin allows the safety latch to slide along the safety lever and free it. The grenade should be thrown at least 30 feet from all friendly personnel. When the grenade is thrown, the lever is released, allowing the arming pin spring to expand, forcing the arming pin and safety lever from the grenade body. Ejection of the arming pin releases the firing pin, allowing firing pin spring to drive the firing pin into the primer and initiate the ignition train. The primer ignites the first-fire mixture, which flashes and ignites the delay mixture. This, in turn, ignites the ignition mixture which ignites the granulated CS mixture. When the CS mixture is ignited and starts burning, pressure builds up and opens the tape covering the emission hole. (This pressure also forces release of CS vapors from the grenade for 8-20 seconds; at CS the time jet action causes the grenade to move quickly and erratically along the ground.)

6-2.6.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-2.6.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

WARNING

WAIT 30 MINUTES BEFORE APPROACHING A SUSPECTED DUD-FIRED GRENADE. DETERIORATION OR DAMPNESS MAY PROLONG BURNING OF THE PYROTECHNIC DELAY.

6-2.6.6. Shipping Containers. This grenade is packaged one per sealed metal or fiberboard container.

6-2.6.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 400 grams.

6-2.6.8. Identification Data. This grenade is listed under Drawing D13-25-70, NSN 1330-00-477-6704, and DODIC/NALC G922.

6-2.6.9. General Data. The following table provides general data on the M47 grenade:

Diameter (Spherical)	3.5 inches
Weight	14.0 ounces
Burning Time	8 to 20 seconds
Filler Agent	C S
Filler Weight	7.0 ounces
Fuze	M227
Fuze Delay	2.0 seconds
Fuze Type	Igniting

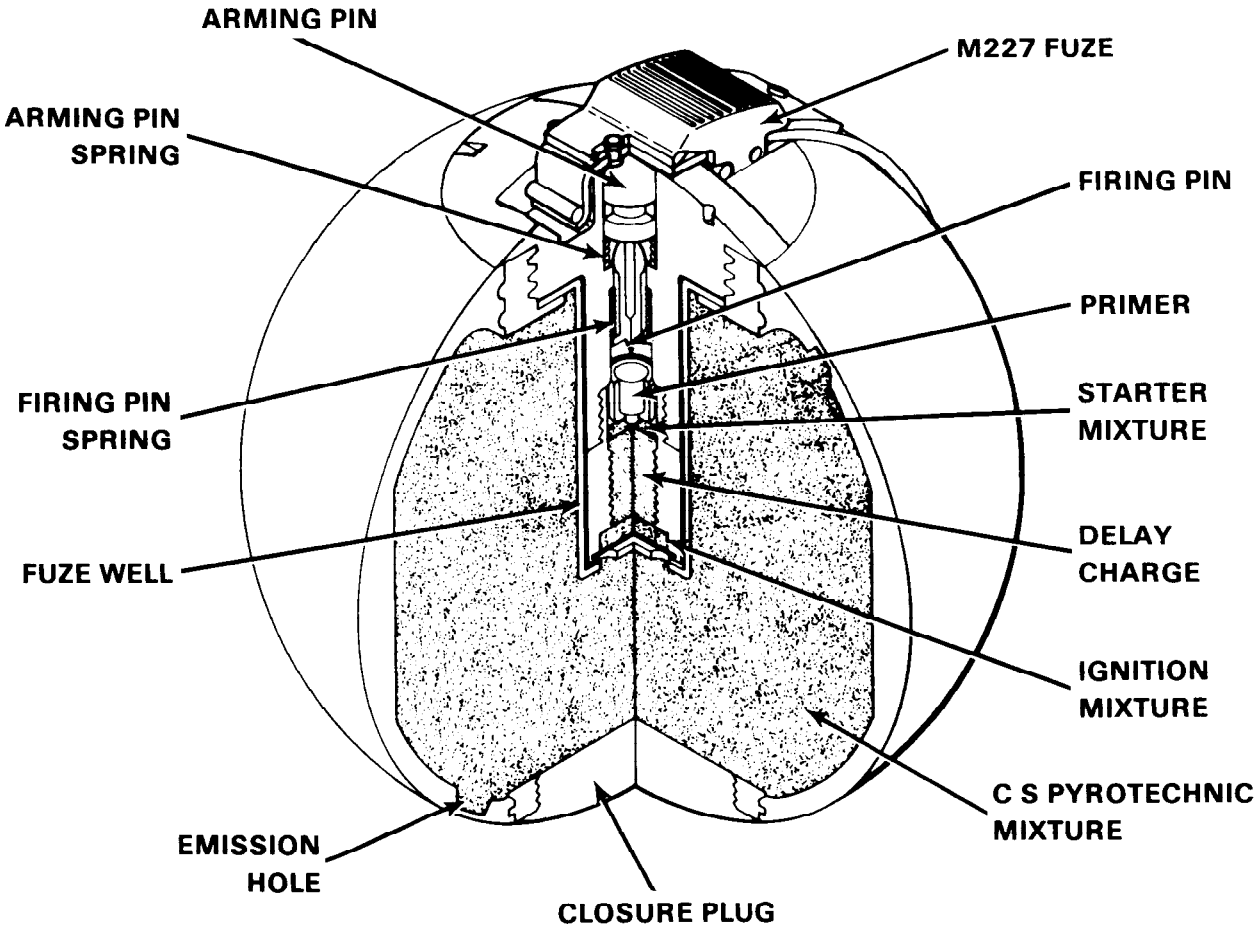


Figure 6-2.6. M47 CS Riot Hand Grenade

6-2.7. GRENADE, HAND, RIOT, CS, M54

6-2.7.1. Intended Use. The M54 CS Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This grenade can also be used for training purposes.

6-2.7.2. Description. This grenade, Figure 6-2.7, is a cylindrical metal container approximately 2.5 inches in diameter, 5.75 inches high and weighs 1.0 pound. Three emission holes are located in the top of the grenade and one in the bottom. The emission holes are covered with pressure sensitive tape to protect the filling from moisture. The grenade contains approximately 4.2 ounces of CS pellets and fuel mixture. The sides of the flash hole and the top of the filler are coated with a starter mixture. The M226 Fuze (paragraph 6-4.2) is threaded into the top of the grenade body. The fuze safety lever is held in an unarmed position by a safety cotter pin which is attached to a pull ring. The container is painted grey with red markings and one single red band to indicate a nonpersistent riot control agent filler.

6-2.7.3. Functional Description. The fuze safety lever must be held firmly against the grenade body while the safety cotter pin is removed and until the grenade is thrown. The grenade should be thrown at least 30 feet from all friendly personnel. Release of the fuze safety lever allows the striker to hit the primer which ignites the 8.0 to 12.0 second delay element in the fuze. At the end of the delay, the ignition mixture in the fuze is ignited, and this, in turn ignites the starter mixture which ignites the CS and fuel mixture. The gases generated by the burning CS and fuel mixture blow off the tape coverings from the emission holes. The CS vapors are emitted in the form of smoke for approximately 15 to 35 seconds.

6-2.7.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-2.7.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-2.7.6. Shipping Containers. This grenade is packaged in individually sealed metal or fiberboard containers, 16 containers to a wooden box. A filled box weighs approximately 36 pounds.

6-2.7.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 126 grams.

6-2.7.8. Identification Data. This grenade is listed under Drawing D13-22-45; NSN 1330-00-089-7258, and DODIC/NALC G923.

6-2.7.9. General Data. The following table provides general data on the M54 grenade:

Body Length	5.75 inches
Diameter	2.50 inches
Weight	1.0 pound
Burning Time	15 to 35 seconds
Filler Agent	CS pellets
Filler Weight	4.2 ounces
Fuze	M226
Fuze Delay	8 to 12 seconds
Fuze Type	Igniting

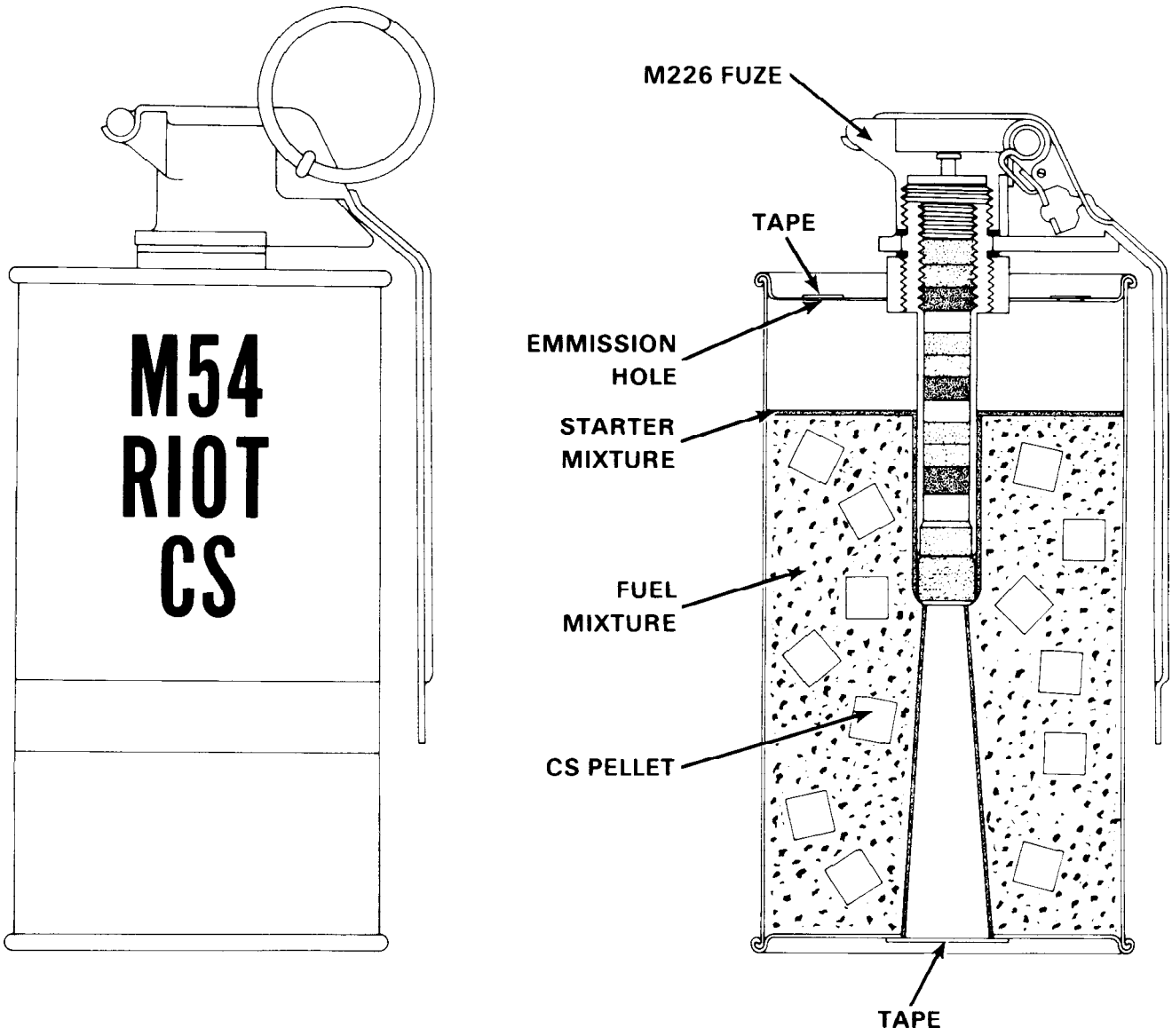


Figure 6-2.7. M54 CS Riot Hand Grenade

6-3. BURSTING GRENADES

6-3.1. GRENADE, HAND, RIOT, CN1, M25A1

6-3.1.1. Intended Use. The M25A1 CN1 Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This bursting type grenade can be used to simulate casualty agents during training exercises.

6-3.1.2. Description. This grenade, Figure 6-3.1, consists of a spherical plastic body approximately 2.96 inches in diameter, weighs 0.47 pound, and is equipped with an integral firing mechanism. Its weight, size, and shape allows easy handling and projection. Two phenolic plastic halves are cemented together to form the grenade body. Internal center sleeves, integral with the halves, form a tubular opening which houses the firing mechanism. The firing mechanism consists of the following:

1. Fuze Assembly. The fuze assembly contains the primer, delay element, and detonator.

2. Slider. The slider houses the attached fuze assembly inside its lower end and a hole in the upper end receives the safety pin.

3. Safety Balls. Two safety balls are fitted into a groove around the slider and hold it in an unarmed position until forced into recesses by action of the firing spring after the arming sleeve is expelled.

4. Firing Pin. The firing pin is formed on the inner side of the closure plug in the base of the grenade.

5. Firing Spring. The firing spring fits over the slider and is compressed between the projections on the slider and the upper end of the lower half sleeve.

6. Arming Spring. The arming spring is compressed inside the arming sleeve.

7. Arming Sleeve. The arming sleeve is located in the upper channel and extends approximately .31 inches above the grenade.

8. Safety Pin. The safety pin with pull ring extends through the holes in the arming sleeve and slider.

The grenade contains approximately 3.3 ounces of CN1 agent filler. The CN1 filling is loaded through an opening on the side of the grenade and closed with a filling plug. The grenade is painted gray with red markings and a single red band to indicate a nonpersistent riot control agent.

6-3.1.3. Functional Description. The arming sleeve must be held firmly in place, with the thumb or index finger, while the safety pin is removed and until the grenade is thrown. The grenade should be thrown at least 30 feet from all friendly personnel. For maximum effect, aim the throw so the grenade bursts 3 or 4 feet above the ground and upwind in the immediate vicinity of the target.

After the safety pin is withdrawn and the grenade is thrown, the arming sleeve is expelled by the compressed arming spring. This action permits the two safety balls to recede into the grooves, releasing the slider, which is driven by the firing spring against the firing pin and initiates the primer. The fuze provides a delay of 1.4 to 3.0 seconds before detonation. Upon detonation the plastic grenade body is shattered and micropulverized CN1 is dispersed in a cloud that travels with the wind. The radius of the burst is approximately 5 yards.

6-3.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-3.1.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-3.1.6. Shipping Containers. This grenade is packaged in individually sealed metal or fiberboard containers, 50 containers to a wooden box. A filled box weighs approximately 60 pounds.

6-3.1.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 96 grams.

6-3.1.8. Identification Data. This grenade is listed under Drawing D13-26-70; NSN 1330-00-219-8578, and DODIC/NALC G927.

6-3.1.9. General Data. The following table provides general data on the M25A1 grenade:

Diameter (Spherical)	2.96 inches
Weight	0.47 pound
Bursting Radius	5.0 yards
Filler Agent	CN1
Filler Weight	3.3 ounces
Fuze	Integral
Fuze Delay	1.4 to 3.0 seconds
Fuze Type	Igniting

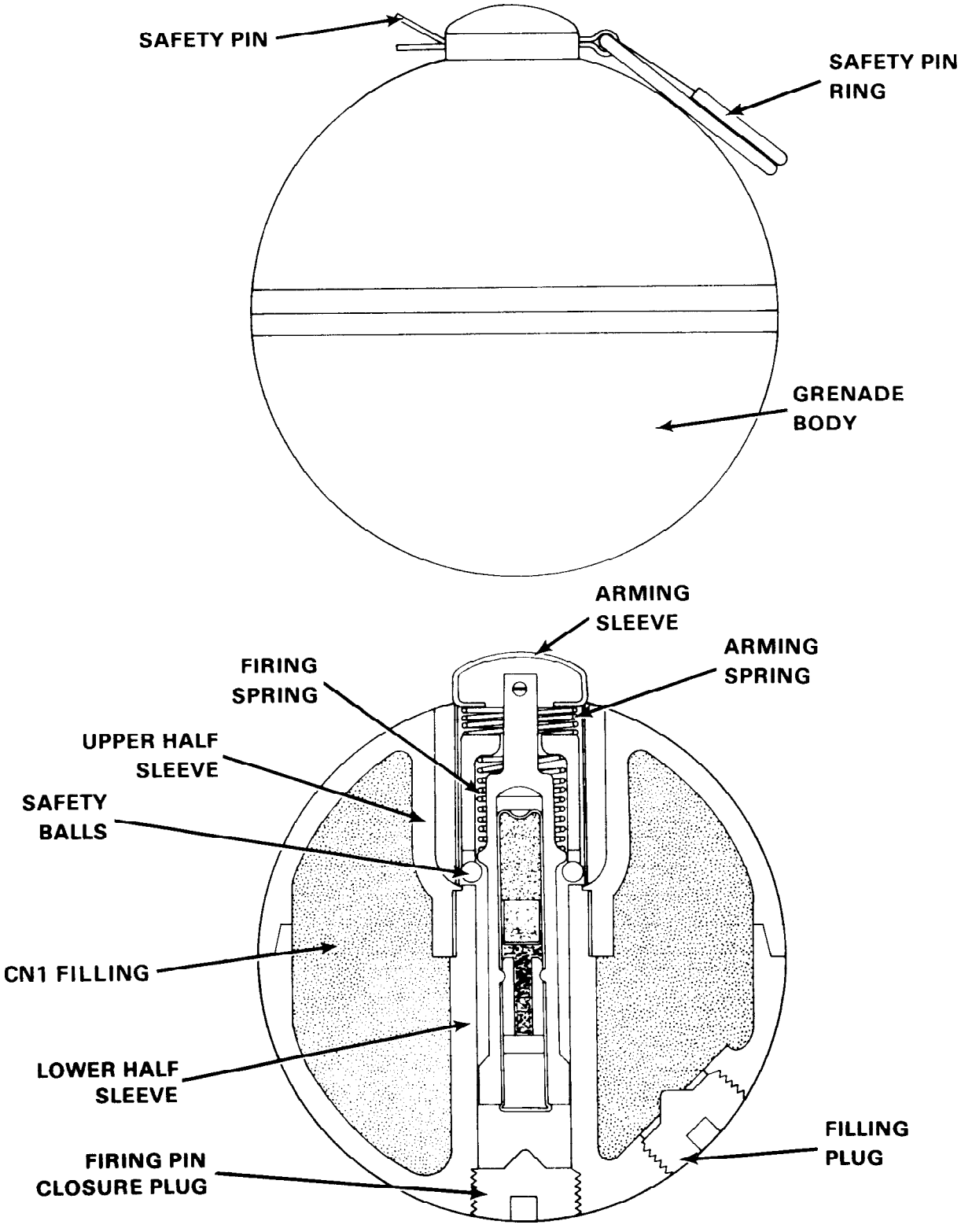


Figure 6-3.1. M25A1 CN1 Riot Hand Grenade

6-3.2. GRENADE, HAND, RIOT, CN1, M25A2

6-3.2.1. Intended Use. The M25A2 CN1 Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This bursting type grenade can also be used to simulate casualty agents during training exercises.

6-3.2.2. Description. This grenade, Figure 6-3.2, consists of a spherical plastic body approximately 2.93 inches in diameter, 0.47 pound in weight, and is provided with an integral fuze assembly. Two phenolic plastic halves are cemented together to form the grenade body. Internal center sleeves, integral with the halves, form a tubular opening which houses the fuze assembly. The fuze assembly consists of an arming sleeve, arming pin, firing spring, slider assembly, and firing pin. The slider assembly contains a primer, pyrotechnic delay column, and a detonator. The grenade is assembled with a safety pin and pull ring. The grenade contains approximately 3.2 ounces of CN1 agent filler. The CN1 filling is loaded through an opening on the side of the grenade and closed with a filling plug. The grenade is painted gray with red markings and a single red band to indicate a nonpersistent riot control agent.

6-3.2.3. Functional Description. The arming sleeve must be held firmly in place, with the thumb or index finger, while the safety pin is removed and until the grenade is thrown. The safety pin locks the arming sleeve to the grenade body through the slider assembly. It also retains the arming pin in a horizontal position. When the safety pin is removed, the arming sleeve is freed to separate from the grenade body. The slider assembly is released and is driven against the firing pin. The firing pin initiates the primer in the end of the slider. The primer initiates the delay column which burns for 1.4 to 3.0 seconds before initiating the detonator. The detonator shatters the grenade body, dispersing the agent. The grenade should be thrown at least 30 feet from all friendly personnel. For maximum effect, aim the throw so the grenade bursts 3 or 4 feet above the ground and upwind in the immediate vicinity of the target.

6-3.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-3.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-3.2.6. Shipping Containers. This grenade is packaged in individually sealed metal or fiberboard containers, 50 containers to a wooden box. A filled box weighs approximately 60 pounds.

6-3.2.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 96 grams.

6-3.2.8. Identification Data. This grenade is listed under Drawing D13-25-55, NSN 1330-00-682-4645, and DODIC/NALC G924.

6-3.2.9. General Data. The following table provides general data on the M25A2 grenade:

Diameter (Spherical)	2.93 inches
Weight	0.47 pound
Bursting Radius	5.0 yards
Filler Agent	CN1
Filler Weight	3.2 ounces
Fuze	Integral
Fuze Delay	1.4 to 3.0 seconds
Fuze Type	Igniting

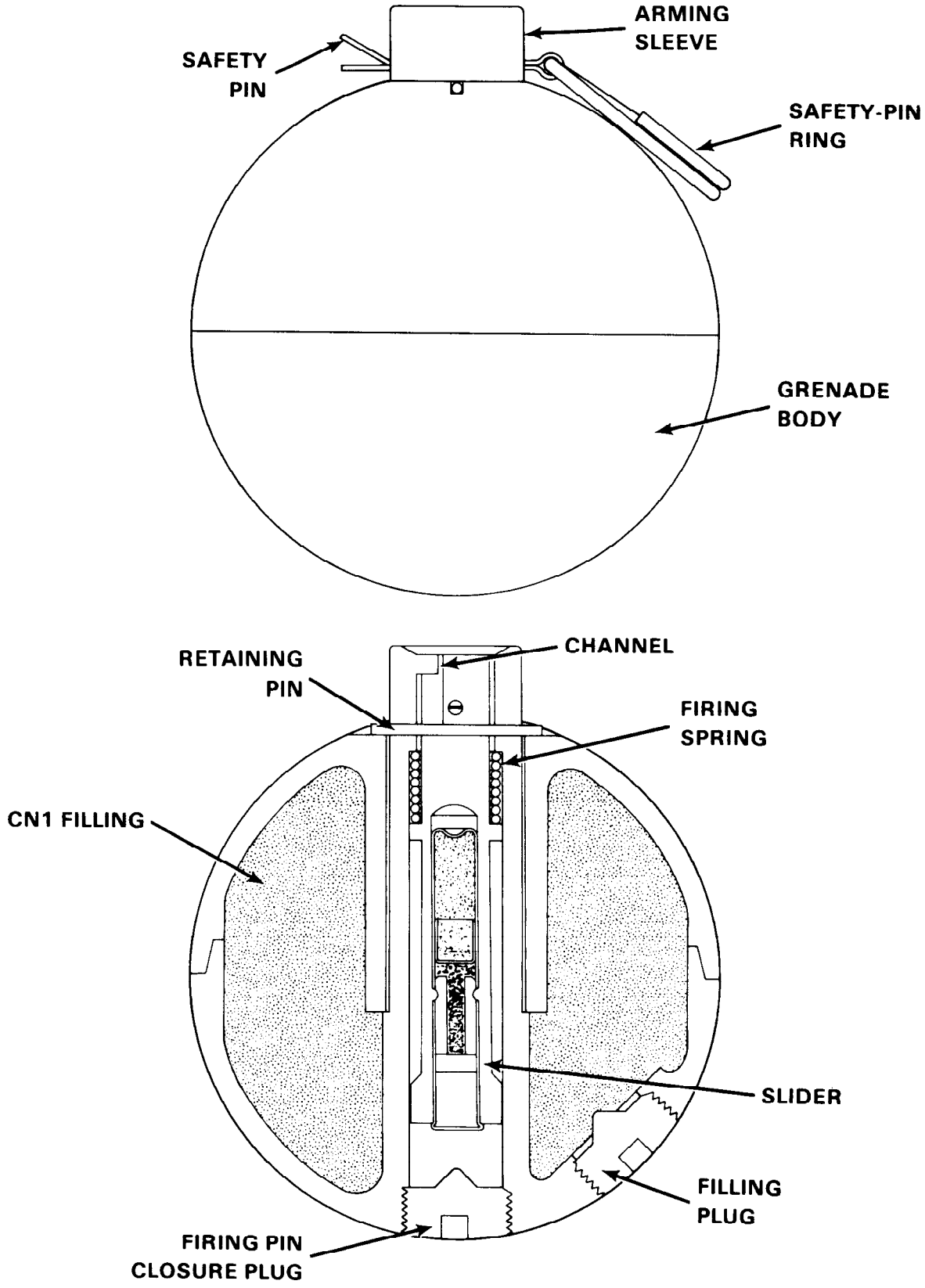


Figure 6-3.2. M25A2 CN1 Riot Hand Grenade

6-3.3. GRENADE, HAND, RIOT, CS1, M25A2

6-3.3.1. Intended Use. The M25A2 CS1 Riot Hand Grenade is used for the control of riots, mobs, and other disturbances. This bursting type of grenade can also be used to simulate casualty agents during training exercises.

6-3.3.2. Description. This grenade, Figure 6-3.3, consists of a spherical plastic body approximately 2.93 inches in diameter, 0.47 pound in weight, and is provided with an integral fuze assembly. Two phenolic plastic halves are cemented together to form the grenade body. Internal center sleeves, integral with the halves, form a tubular opening which houses the fuze assembly. The fuze assembly consists of an arming sleeve, arming pin, firing spring, slider assembly, and firing pin. The slider assembly contains a primer, pyrotechnic delay column, and a detonator. The grenade is assembled with a safety pin and pull ring. The grenade contains approximately 3.2 ounces of CS1 agent filler. The CS1 filling is loaded through an opening on the side of the grenade and closed with a filling plug. The grenade is painted gray with red markings and a single red band to indicate a nonpersistent riot control agent.

6-3.3.3. Functional Description. The arming sleeve must be held firmly in place, with the thumb or index finger, while the safety pin is removed and until the grenade is thrown. The safety pin locks the arming sleeve to the grenade body through the slider assembly. It also retains the arming pin in a horizontal position. When the safety pin is removed, the arming sleeve is freed to separate from the grenade body. The slider assembly is released and is driven against the firing pin. The firing pin initiates the primer in the end of the slider. The primer initiates the delay column which burns for 1.4 to 3.0 seconds before initiating the detonator. The detonator shatters the grenade body, dispersing the agent. The grenade should be thrown at least 30 feet from all friendly personnel. For maximum effect, aim the throw so the grenade bursts 3 or 4 feet above the ground and upwind in the immediate vicinity of the target.

6-3.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This grenade is designated as a Group B Chemical Ammunition for handling and storage purposes.

6-3.3.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this grenade.

WARNING

DO NOT STAND DIRECTLY DOWNWIND FROM BURNING GRENADES EVEN IF EQUIPPED WITH A PROTECTIVE MASK.

6-3.3.6. Shipping Containers. This grenade is packaged in individually sealed metal or fiberboard containers, 50 containers to a wooden box. A filled box weighs approximately 60 pounds.

6-3.3.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components of this grenade is approximately 96 grams.

6-3.3.8. Identification Data. This grenade is listed under Drawing D13-25-55, NSN 1330-00-645-6211, and DODIC/NALC G924.

6-3.3.9. General Data. The following table provides general data on the M25A2 grenade:

Diameter (Spherical)	2.93 inches
Weight	0.47 pound
Bursting Radius	5.0 yards
Filler Agent	CS1
Filler Weight	3.2 ounces
Fuze	Integral
Fuze Delay	1.4 to 3.0 seconds
Fuze Type	Igniting

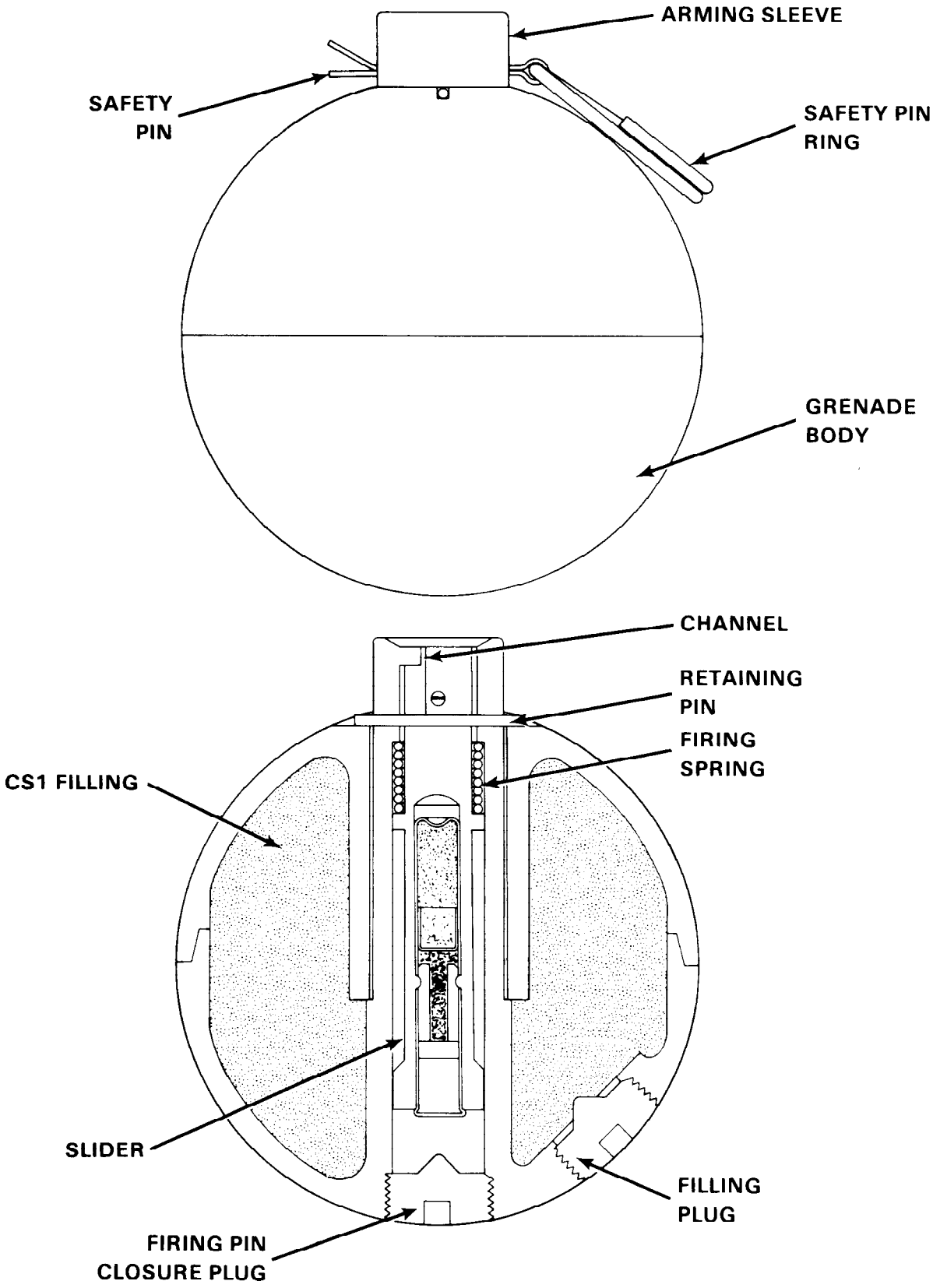


Figure 6-3.3. M25A2 CS1 Riot Hand Grenade

6-4. GRENADE FUZES

6-4.1. FUZE, GRENADE, HAND, M201 AND M201A1

6-4.1.1. Intended Use. The M201 and M201A1 Hand Grenade Fuzes are issued assembled to various burning type hand grenades. These fuzes are designed so the explosive of one unit will not cause mass ignition.

6-4.1.2. Description. These fuzes, Figure 6-4.1, consist of a body striker, safety lever, and safety pin to which is attached a pull ring. The cylindrical body, which is threaded for assembly to the grenade, contains, a 2 second delay element, and an ignition cup filled with ignition mixture. The safety lever, held in place by the safety pin, extends over the top of the fuze. The safety lever prevents movement of the spring-loaded striker. These two fuzes are identical except for the safety lever and attaching feature designs.

6-4.1.3. Functional Description. Removal of the safety pin releases the safety lever. This permits the striker to pivot on its hinge pin and strike the primer. The primer explodes, igniting the delay element, which takes approximately 2 seconds to burn through to the ignition mixture. The ignition mixture burns through the cup and ignites the grenade starter mixture, which in turn ignites the main filling.

6-4.1.4. Handling and Storage. OP 5, Volume 1, Ammunition Ashore, provides information on safe handling and storage of these fuzes.

6-4.1.5. Maintenance. These fuzes are subject to deterioration. Frequent inspections are necessary to insure serviceability. Fuzes shall not be removed from grenades and replaced without approval of the Naval Sea Systems Command.

6-4.1.6. Safety Precautions. The general safety precautions contained in Chapter 2 and OP 5 apply to these fuzes.

6-4.1.7. Shipping Containers. These fuzes are packaged one per fiberboard box with 70 per wooden box.

6-4.1.8. Explosive/Chemical Weight. The aggregate weight of the principle explosive and/or chemical components of the fuze is approximately 18 grams.

6-4.1.9. Identification Data. The M201A1 Fuze is listed under Drawing D13-10-22, NSN 1330-00-293-9516, and DODIC/NALC G874.

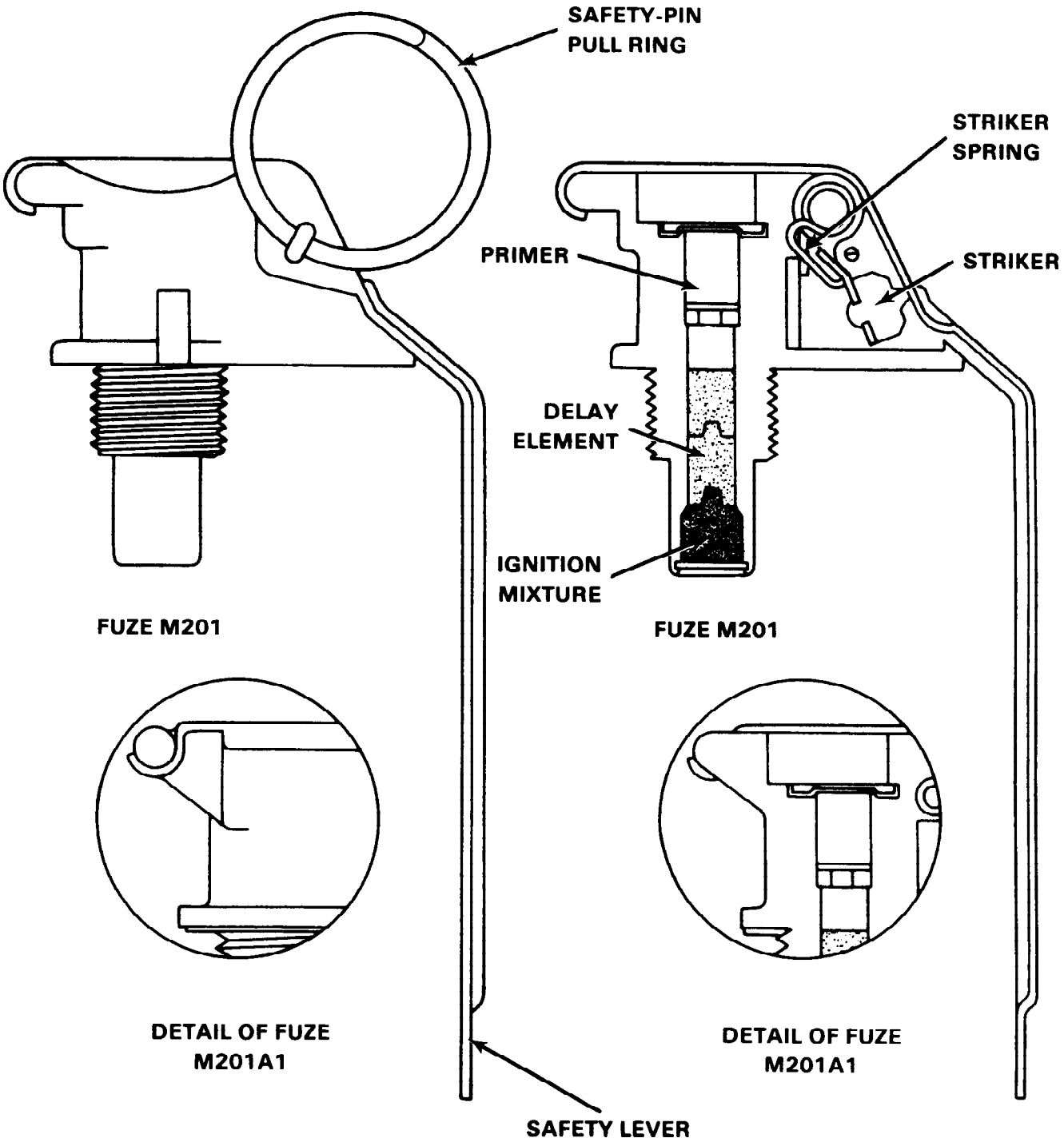


FIgure 6-4.1. M201 and M201A1 Hand Grenade Fuze

6-4.2. FUZE, GRENADE, HAND, M226

6-4.1.1. Intended Use. The M226 Hand Grenade Fuze is issued with the M54 CS Hand Grenade, paragraph 6-2.7. This burning type fuze provides a 8 to 12 second delay before ignition.

6-4.2.2. Description. This fuze, Figure 6-4.2, consists of a body, striker, safety lever, and safety pin to which is attached a pull ring. The body contains a primer, first-fire mixture, delay column, and ignition mixture. The safety lever, held in place by the safety pin, extends over the top of the fuze. The safety lever prevents movement of the spring-loaded striker.

6-4.2.3. Functional Description. Removal of the safety pin permits release of the safety lever. When the safety lever is released, it is forced away from the grenade body by a striker acting under the force of the striker spring. The primer initiates the first-fire mixture which, in turn, initiates the pyrotechnic delay column. The delay column initiates the ignition mixture which ignites the filler in the grenade.

6-4.2.4. Handling and Storage. OP 5, Volume 1, Ammunition Ashore, provides information on safe handling and storage of this fuze.

6-4.2.5. Maintenance. This fuze is subject to deterioration. Frequent inspections are necessary to insure serviceability. Fuzes shall not be removed from grenades and replaced without approval of the Naval Sea Systems Command.

6-4.2.6. SafetyPrecautions. The general safety precautions contained in Chapter 2 and OP 5 apply to this fuze.

6-4.2.7. Shipping Containers. The fuze is packaged one per fiberboard box with 10 fiberboard boxes per metal container.

6-4.2.8. Explosive/Chemical Weight. The aggregate weight of the principle explosive and/or chemical components of the fuze is approximately 27 grams.

6-4.2.9. Identification Data. The M226 Fuze is listed under Drawing D13-10-31, NSN 1330-00-089-7259, and DODIC/NALC G876.

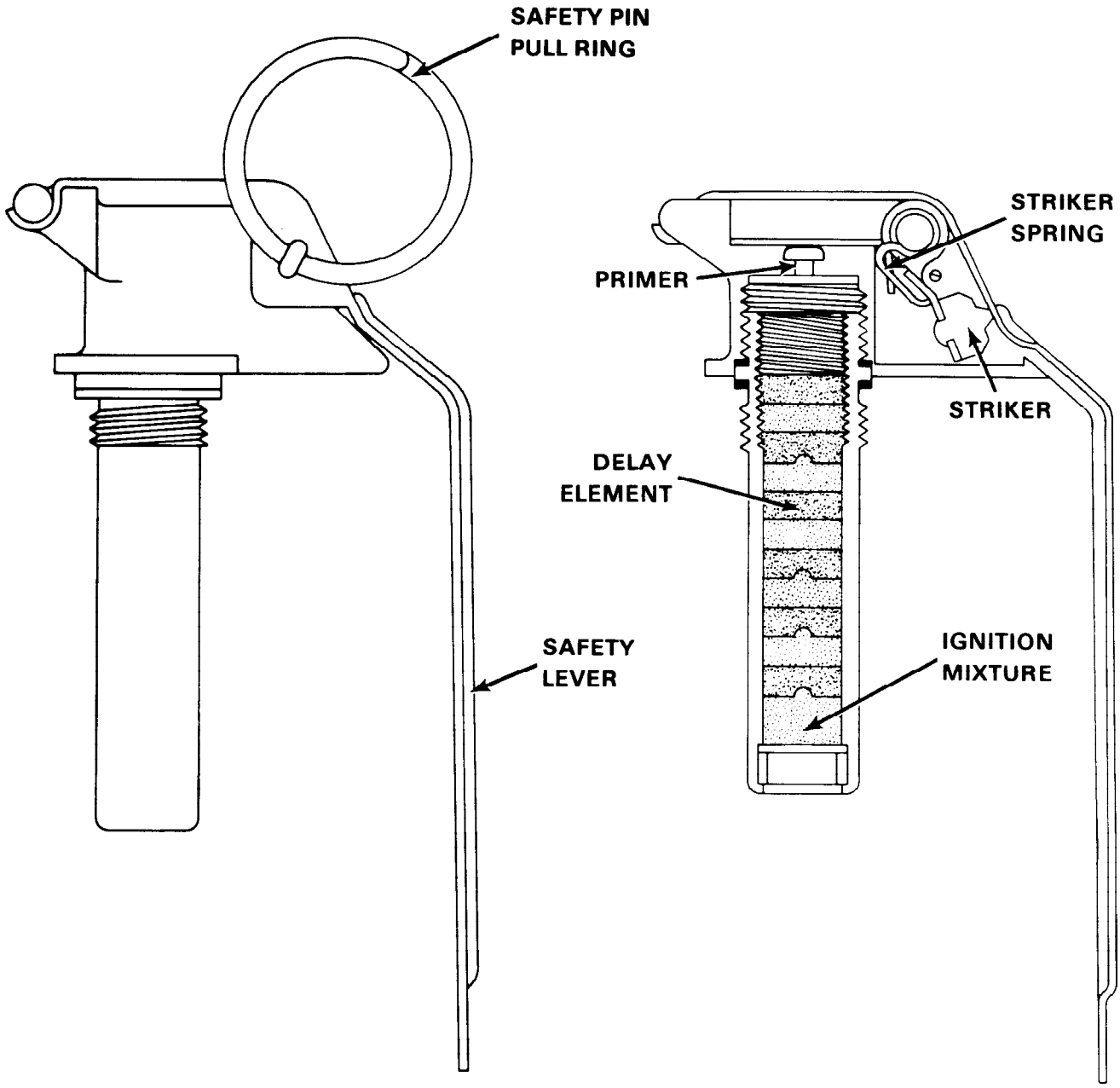


Figure 6-4.2. M226 Hand Grenade Fuze

6-4.3. FUZE, GRENADE, HAND, M227

6-4.3.1. Intended Use. The M227 Hand Grenade Fuze is issued with the M47 Hand Grenade, paragraph 6-2.6. This burning type fuze provides a 1.4 to 3.0 second delay before ignition.

6-4.3.2. Description. This fuze, Figure 6-4.3, consists of a body, arming pin, firing pin, sliding safety latch, safety lever, and safety pin to which is attached a pull ring. The body contains a primer, starter mixture, delay charge, and ignition mixture. The safety lever, held in place by the safety pin, extends over the top of the fuze.

6-4.3.3. Functional Description. Removal of the safety pin allows the safety latch to slide along the safety lever and free it. When the safety lever is released, the arming pin spring expands and forces the arming pin and safety lever from the grenade body. Ejection of the arming pin releases the firing pin, allowing the firing pin spring to drive the firing pin into the primer. The primer ignites the starter mixture which flashes and ignites the delay charge. This, in turn, ignites the ignition mixture which ignites the main filler in the grenade.

6-4.3.4. Handling and Storage. OP 5, Volume 1, Ammunition Ashore, provides information on safe handling and storage of this fuze.

6-4.3.5. Maintenance. This fuze is subject to deterioration. Frequent inspections are necessary to insure serviceability. Fuzes shall not be removed from grenades and replaced without approval of the Naval Sea Systems Command.

6-4.3.6. Safety Precautions. The general safety precautions contained in Chapter 2 and OP 5 apply to this fuze.

6-4.3.7. Shipping Containers. This fuze is packaged one per fiberboard carton.

6-4.3.8. Explosive/Chemical Weight. The aggregate weight of the principle explosive and/or chemical components of the fuze is approximately 5 grams.

6-4.3.9. Identification Data. The M227 Fuze is listed under Drawing 13-10-40, NSN 1330-00-080-2271, and DODIC/NALC G869.

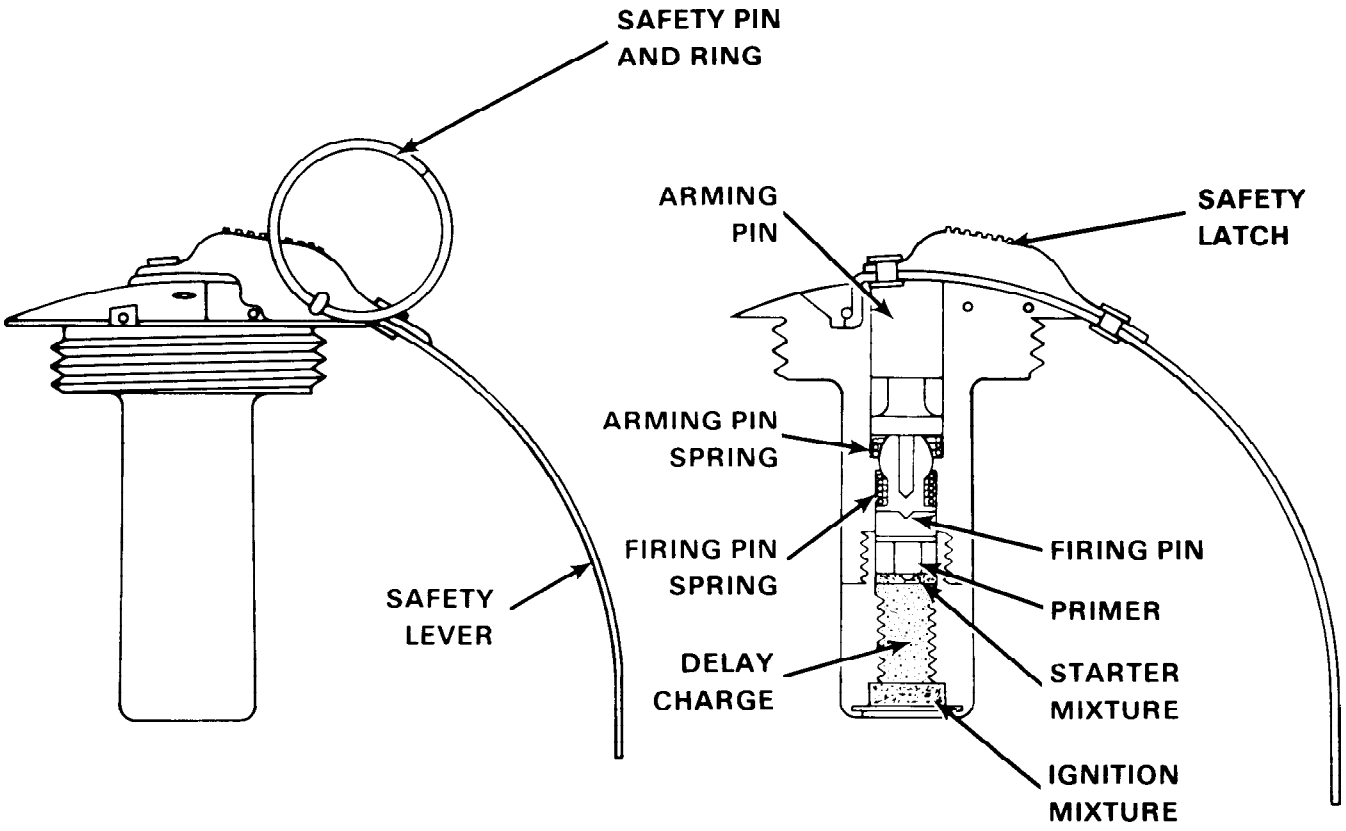


Figure 6-4.3. M227 Hand Grenade Fuze

6-5. GRENADE PROJECTION ADAPTERS

6-5.1. ADAPTER, PROJECTION, GRENADE, M2 AND M2A1

6-5.1.1. Intended Use. The M2 and M2A1 Grenade Projection Adapters provide a means for launching cylindrical chemical hand grenades from rifles.

6-5.1.2. Description. These adapters, Figure 6 5.1, consist of five components: fin assembly, stabilizer tube, claw base plate, three claws, and setback band. The adapters are fabricated from sheet metal and are approximately 5 inches in height. The three spring steel claws grip the lip of the base of the grenade body and hold the grenade in the adapter. The fin assembly is attached to one end of the stabilizer tube. The claw base plate and claws are attached to the other end of the stabilizer. The setback band is placed around the body of the grenade over the safety lever. The M2 and M2A1 Adapter differ only in the method of attaching the claws and claw base plate to the stabilizer tube.

6-5.1.3. Preparation for Firing. The following procedures shall be followed when preparing the adapter for firing:

1. Install the setback band on the grenade with the coil spring directly over the safety lever and slide the band approximately 1 inch from the end of the safety lever.

2. Force the base of the grenade firmly into the claws on the base plate.

3. Slide the tube of the stabilizer assembly over the launcher to the position that will give the desired range.

4. Rotate the grenade and adapter on the launcher so that the safety lever is downward.

5. Remove the safety pin from the grenade and fire the weapon.

6-5.1.4. Functional Description. When the hand grenade with adapter placed on the grenade launcher is fired, inertia causes the setback band to slide toward the rear, releasing the safety lever. The fuze action of the applicable grenade begins to function (see paragraph describing particular hand grenade for information on subsequent functioning). The adapter remains attached to the grenade until the grenade reaches the desired length.

6-5.1.5. Shipping Containers. These adapters are packaged 50 per wooden box. The filled box weighs approximately 48.9 pounds.

6-5.1.6. Identification Data. The following table applies to these adapters.

Model	Drawing	NSN	DODIC/NALC
M2	82-1-84-1	1330-00-028-5829	G805
M2A1	82-1-84-2	1330-00-028-5830	G805

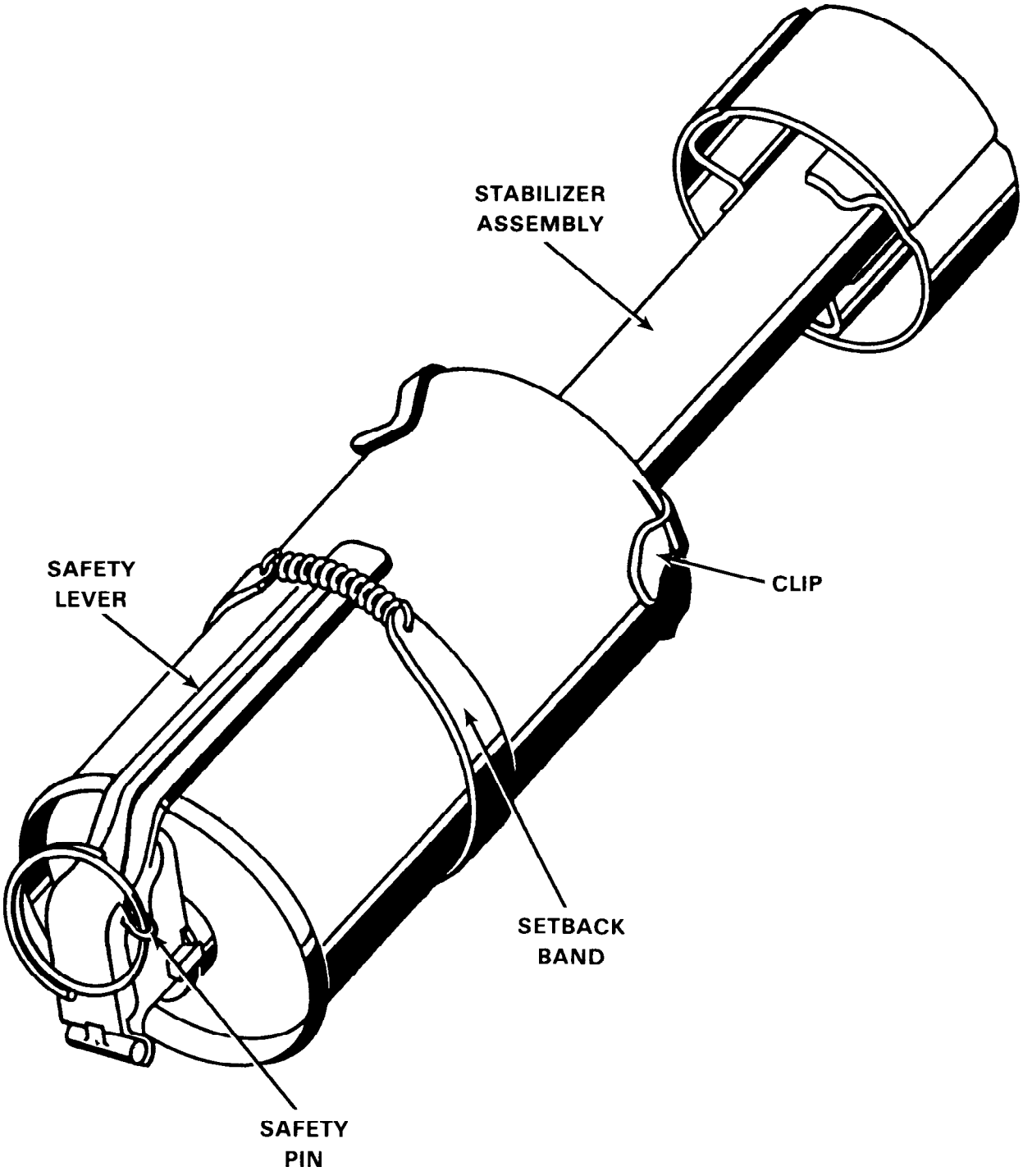


Figure 6-5.1. M2 and M2A1 Grenade Projection Adapter

CHAPTER 7

RIOT CONTROL DISPERSERS

7-1. INTRODUCTION

This chapter covers various chemical dispersers which are used to discharge riot control agents into the atmosphere or on personnel to control uprisings, disturbances, and riots.

7-1.1. GENERAL. Riot control dispersers are pump or pressure operated mechanisms designed to disseminate both liquid and dry form agents. Dispersers can be mounted on aircraft or ground vehicles or can be handheld by personnel on foot.

Table 7-1. Riot Control Dispersers

ITEM	Paragraph	Agent	Agent Weight
Disperser, Riot Control Agent, Portable, M3	7-2.1	CN1, DM1 CS1	20 pounds 8 pounds
Disperser, Riot Control Agent, M5	7-2.2	CS1	48 pounds
Disperser, Riot Control Agent, M32	7-2.3	CSX	60 grams
Disperser, Riot Control Agent, M36	7-2.4	CR	68 grams

7-2. DISPERSERS

7-2.1. DISPERSER, RIOT CONTROL AGENT, PORTABLE, M3

7-2.1.1. Intended Use. The M3 Portable Riot Control Agent Disperser is used to disseminate micropulverized riot control agents for control of disorderly crowds or riotous disturbances. This disperser is designed to be carried on the operator's back and disseminate the dry agents through a gun that controls the flow and directs the agent 40 feet ahead.

7-2.1.2. Description. The M3 disperser, Figure 7-2.1, consists of a M9 portable irritant gas disperser gun connected by an M8 flame-thrower fuel hose to a modified M2A1 portable flame-thrower fuel and pressure unit. The disperser carries its own air pressure supply which exerts pressure on the twin agent tanks. The agent tanks are connected by a diffusion pipe assembly and a tank connector to form one container for the storage of the agent. A pipe and cap assembly is screwed into the top of each agent tank. The pipe and cap assembly is connected through a separate hose assembly to the safety valve adapter seated on top of the safety valve. A shutoff valve connected through the safety valve adapter to the diffusion pipe assembly is used to dissipate air pressure into the atmosphere through the bleeder tube. The pressure tank can be charged in the pressure range of 1700 to 2100 psi and it supplies compressed air to the pressure regulator. The pressure regulator reduces the pressure of air being delivered to the agent tanks to a constant pressure of approximately 70 psi A safety valve is attached to the outlet side of the pressure regulator. A rupture disc contained in a safety head screwed into the base of the safety valve ruptures when pressure in the valve exceeds 525 psi.

The hose group consists of a synthetic rubber hose covered with a wire and cotton braid. A threaded fitting is fastened to each end of the hose. A quick-disconnect coupling half which is screwed into one threaded fitting connects the hose group to the agent tank coupling. The other threaded fitting screws into the valve section of the gun.

The gun group consists of a valve section, a trigger assembly, barrel, rubber tube, and fittings. The flow of agent is controlled by the trigger assembly which consists of a trigger safety and trigger. The gun group is provided with an automatic-rifle type hand grip. The rubber tube carries the agent through a hole drilled in the trigger barrel. The hole is drilled at such an angle that when the trigger is in the inoperative position, the rubber tube is pinched by the barrel and the agent does not flow. When the trigger is depressed, the restriction in the rubber tube is relieved, allowing the agent to be dispersed. The trigger spring keeps the trigger in the inoperative position. A trigger safety prevents accidental discharge.

The disperser can use dry riot control agents (see paragraph 7-2.1.10), or for training purposes, talc may be substituted.

7-2.1.3. Operation. To operate the disperser, personnel must wear a protective mask and approved protective clothing such as coveralls and gloves. The agent tanks are first filled with micropulverized riot control agent, or for practice, with talc. Then the pressure tank is charged with compressed air. The disperser packing chest includes an M4 filling hopper. The filling procedure should take place in a sheltered place.

7-2.1.4. Filling. To fill the agent tanks proceed as follows:

1. Check that the tank coupling plug is securely locked in the agent tank coupling.

2. Open the shutoff valve, disconnect the hose, and remove the pipe and cap assemblies from the agent tanks.

3. Insert the end of the M4 filling hopper into the filling hole of one of the agent tanks.

4. Pull upward on the crank and withdraw the slide cover of the hopper.

5. Open one end of the bag of agent, and fill the hopper with agent.

6. Close the slide cover, push downward on the crank, and turn the crank counterclockwise until the hopper is empty.

7. Pull upward on the crank and remove the hopper.

8. Screw in the pipe and cap assembly and connect the hose.

9. Fill the companion agent tank in the same way and close the shutoff valve.

7-2.1.5. Charging. The disperser pressure tank must be fully charged before the start of a mission, using either a suitable air compressor or commercial cylinders. Charging is best performed with full cylinders; all cylinders must have a pressure reading of at least 600 psi. At least one of the cylinders must have a pressure reading of 1700 psi. At least two cylinders should be used if they are available.

Two charging line assemblies and a filling line assembly from an M27 portable flamethrower-riot control agent disperser kit are required for recharging one or two pressure tanks from commercial cylinders. If only one pressure tank is to be connected to the charging apparatus, the unused charging line connection must be closed with the safety plug which is a part of the filling line assembly. Proceed as follows:

1. Close the pressure tank valve on the disperser.

2. Unscrew the cap from the check valve and screw the charging line fitting into the check valve.

3. Close the bleeder valves on the charging line fittings.

4. To charge the pressure tank, close both filling line hand valves and open the valves on the air cylinders.

5. Determine from the cylinder pressure gauges which cylinder has the lower pressure. Open the filling line valve at the gauge and fill the pressure tanks to the pressure shown by the gauge; then close the valve.

6. Open the other filling line valve and fill the pressure tank or tanks until they reach at least 1700 psi.

7. When the pressure tanks have been filled, close the filling line valve.

8. Open the bleeder valves of the charging lines and leave them open until the pressure in the charging lines has been relieved; then close the bleeder valves.

9. Remove the charging line fittings from the check valves.

10. Screw the threaded caps onto the check valves and tighten the caps with a wrench.

11. Close the valves on the cylinders.

12. Remove the filling lines from the cylinders.

7-2.1.6. Inspecting. Before operating the disperser, the operator must inspect the equipment to determine that the agent tank coupling plugs are securely locked in the coupling, and that the pressure tank is charged and the pressure tank valve is closed. The operator then inspects the gun group and connects it to the hose group and connects the hose group to the agent tank coupling and locks both coupling halves together.

7-2.1.7. Firing. The disperser can be fired from either a standing or kneeling position. The agent tanks must remain in an upright position while firing. To fire the disperser, transfer the gun to the left hand and, using the right hand, turn the pressure tank valve handle in a counterclockwise direction. Air will be heard rushing into the tank group. When the rush of air stops, the disperser is ready to fire.

Point the gun toward the target. With the right hand, depress the trigger safety, and squeeze the trigger. Agent will be dispersed from the gun nozzle and will drift with the wind toward the target. With practice, several bursts of agent can be released before the tanks become empty. Release the trigger to stop firing.

N O T E

If the disperser is fired in a single burst, the duration of firing will be approximately 19 seconds, and the concentration of agent will decrease rapidly. If short bursts of 5 to 6 seconds duration are used, the firing time will increase to 30 seconds, and the concentration of agent will remain constant for each successive burst. Although a heavier concentration may be laid down in a single burst, the short burst procedure permits larger area coverage with effective concentration.

After a mission the operator should bury the surplus agent in a hole about a foot deep after bleeding all air pressure from the tank group. The agent can be dumped out by removing the pipe and cap assemblies and inverting the entire disperser over the hole dug in the earth. All remaining pressure is then bled from the pressure tank through the gun group.

7-2.1.8. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. The filler disperser is designated as a Group B Chemical Ammunition for handling and storage purposes.

7-2.1.9. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this disperser.

7-2.1.10. Shipping Containers. This disperser is packaged one per wooden chest. The filled package weights approximately 100 pounds.

7-2.1.11. Identification Data. The M3 disperser is listed under Specification MIL-D-51031 and NSN 1040-00-711-8296.

7-2.1.12. General Data. The following table provides general data on the M3 disperser:

Weight empty	47 pounds
Weight loaded	
CN1, DM1, or CN1-DM1	67 pounds
CS1	55 pounds
T1 (talc)	76 pounds
Range in still air	40 feet
Duration of firing	
Single burst	19 seconds
Short burst (5-6 sec. duration)	30 seconds
Operating pressure	70 psi
Tank group	
Weight	39 pounds
Height	27 inches
Width	20 inches
Depth	11 inches
Pressure tank	1700 to 2100 psi
Agent tanks	65 to 75 psi
CN1, DM1, CN1-DM1 capacity	20 pounds
CS1 capacity	8 pounds
T1 (talc) capacity	29 pounds
Hose group	
Weight	1.75 pounds
Length	37 inches
Gun group	
Weight	3.5 pounds
Length	26 inches

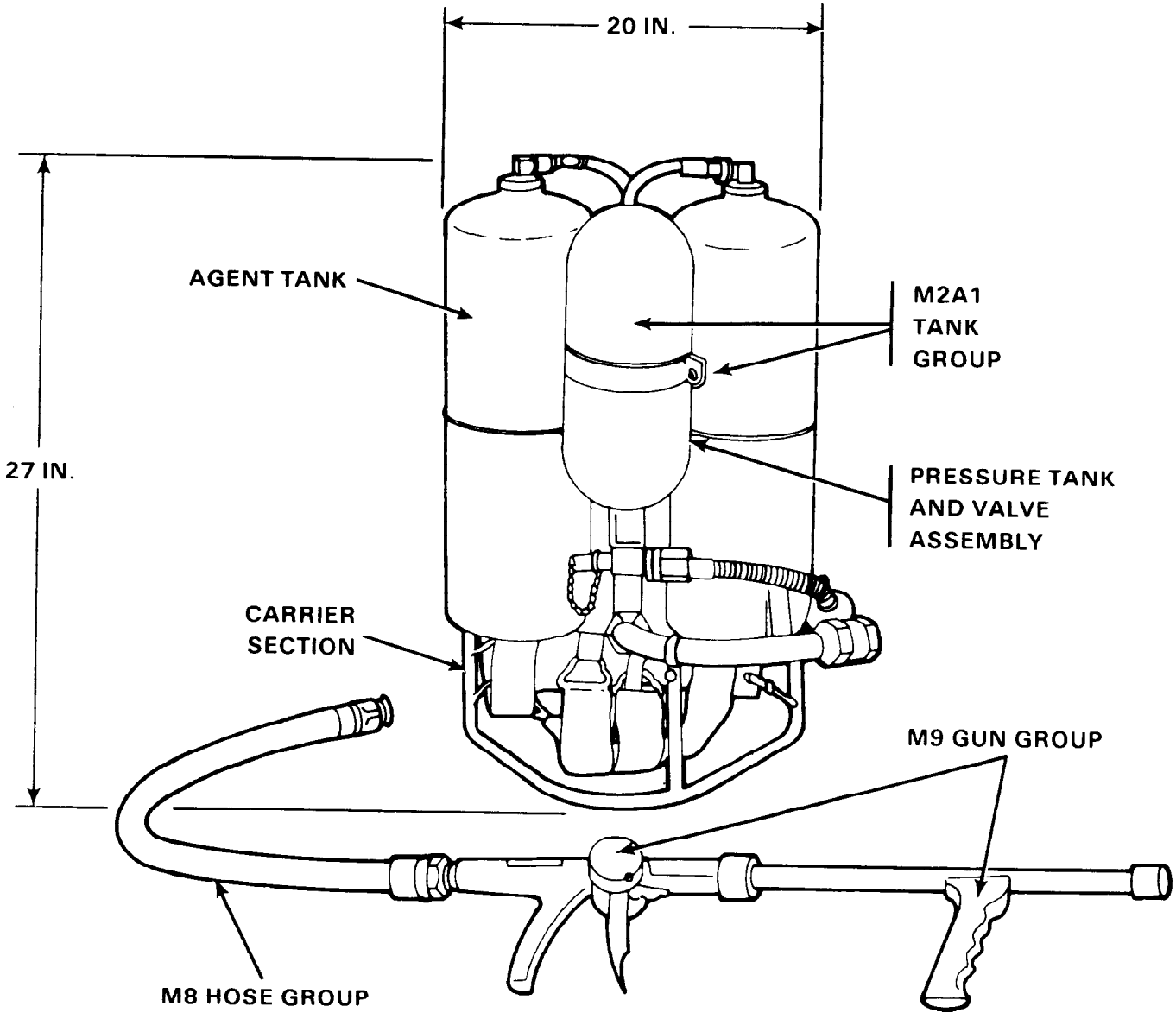


Figure 7-2.1. M3 Portable Riot Control Agent Disperser

7-2.2. DISPERSER, RIOT CONTROL AGENT, M5

7-2.2.1. Intended Use. The M5 Riot Control Agent Disperser is used to spray CS1 riot control agent from a cargo helicopter or a ground vehicle toward or upon disorderly crowds, unruly mobs, or rioters. The spray stings and irritates the eyes, skin, nose, throat, and lungs of exposed personnel.

7-2.2.2. Description. This disperser, Figure 7-2.2, consists of an agent container tank, a pressure group with two air cylinders, a tubular aluminum frame, M9 gun with a 12 foot hose for vehicle mounting, a 12 foot discharge hose for helicopter mounting, and various controls and instruments. Fitting and holddown straps are provided for securing the disperser in a helicopter or ground vehicle. The agent container tank is approximately 24 inches in diameter and 48 inches high and is filled with 48 pounds of CS1 powder or 48 pounds of T3 talc as a simulant agent filling. The two air cylinders contain 1,900 to 2,100 psi of compressed air. This disperser has an operating pressure of 45 to 55 psi and a 2 minute duration of firing. The operating range for ground vehicle in still air is 40 feet and helicopter elevation range is 75 to 100 feet.

7-2.2.3. Functional Description. The agent is filled with CS1 riot control agent. When the operator removes the quick-release pin and opens a valve, pressurized air from the two air cylinders forces the CS1 agent from the agent container tank through the hose. When the disperser is mounted on a helicopter, the CS1 agent can be dispersed from the hose nozzle. When mounted on a ground vehicle, the CS1 agent can be dispersed through the gun nozzle toward the target.

7-2.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. The filled disperser is designated as a Group B Chemical Ammunition for Handling and Storage purposes.

7-2.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this disperser.

7-2.2.6. Shipping Containers. This disperser is packaged one per wooden crate. The filled crate weighs 260 pounds.

7-2.2.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this disperser is approximately 49 pounds.

7-2.2.8. Identification Data. The M5 disperser is listed under Drawing 116-6-166, NSN 1040-00-805-3019, and DODIC/NALC K768.

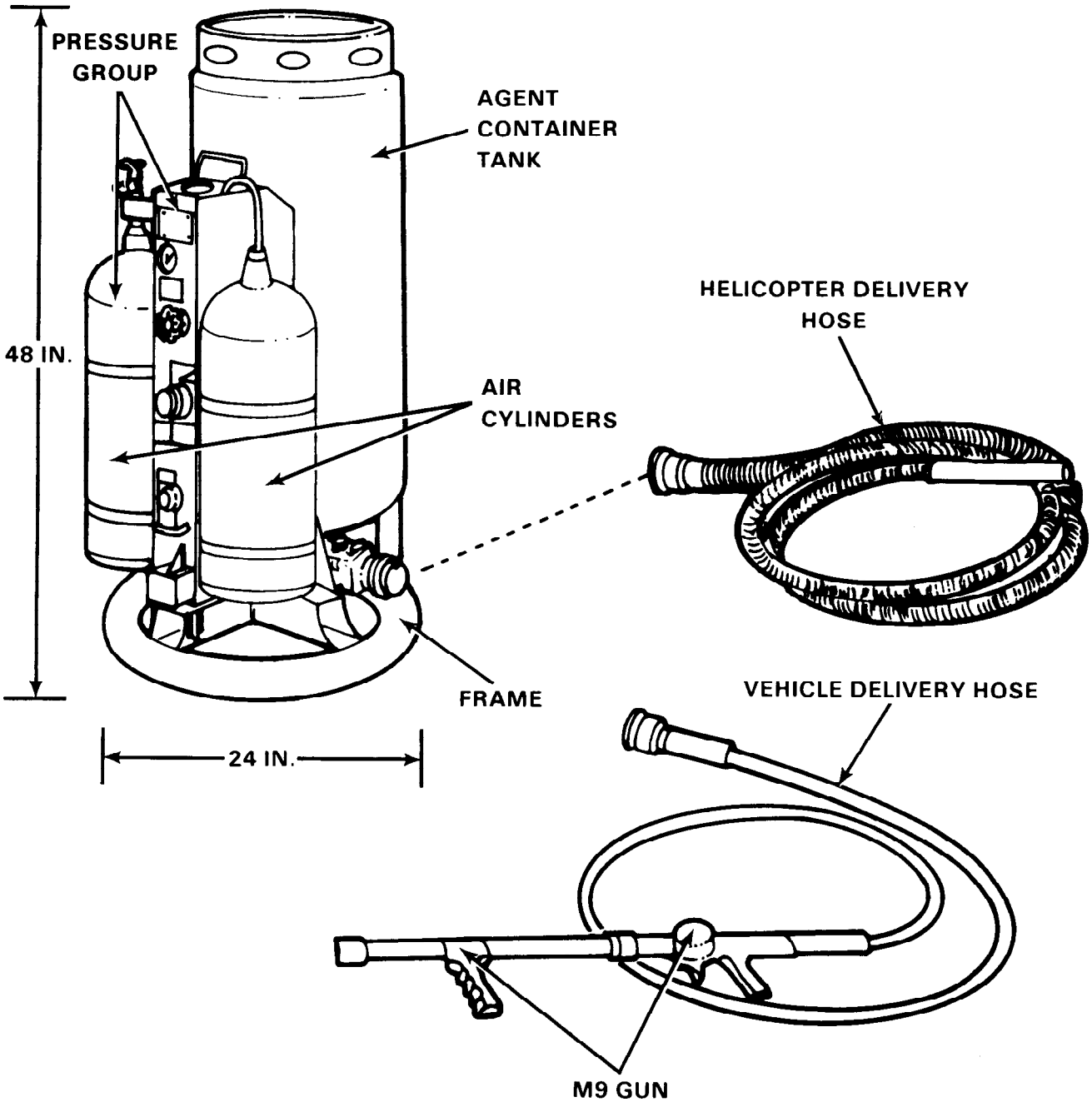


Figure 7-2.2. M5 Riot Control Agent Disperser

7-2.3. DISPERSER, RIOT CONTROL AGENT, CSX, M32

7-2.3.1. Intended Use. The M32 CSX Riot Control Agent Disperser is used to apprehend, control, or subdue unruly persons, trespassers, and rioters by spraying the CSX riot control agent solution from the handheld pressurized can. The spray stings and irritates the eyes, skin, nose, throat, and lungs of exposed personnel.

7-2.3.2. Description. This disperser, Figure 7-2.3, consists of a container, valve assembly, safety clip, and trigger. The container is an aluminum cylinder approximately 1.50 inches in diameter and 6.25 inches in length containing 60 grams of a solution of CS riot control agent (CSX) pressurized with nitrogen gas. The thumb-operated trigger forms the top of the trigger cover, which fits down over the valve assembly. The safety clip is mounted across the top of the trigger. This disperser has a performance pressure of 140 psig at 75°F with a range (jet stream) of 10 to 12 feet. The operating time is 14 to 20 seconds for a continuous stream and for short bursts (one second) is 20 to 25 one second bursts. The carrier is a separately issued leather case with a safety flap and a belt loop, which are secured by snap fasteners to prevent accidental release.

7-2.3.3. Functional Description. The CSX agent solution is released by first sliding back the safety clip and then pressing down on the trigger with the thumb. Trigger pressure opens the valve, which allows CSX agent solution to discharge through the nozzle as a jet stream. When pressure on the trigger is released, the valve closes and the jet stream is shut off.

WARNING

DO NOT BLOCK NOZZLE WITH YOUR FINGER OR THUMB WHEN DISCHARGING AGENT. CSX AGENT WILL IRRITATE YOUR SKIN.

NOTE

DO NOT operate disperser in upside down position because pressurized nitrogen will escape without agent discharging.

7-2.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This disperser is designated as a Group B Chemical Ammunition for handling and storage purposes.

WARNING

DO NOT RUB EYES OR SKIN IF YOU HAVE BEEN CONTAMINATED. THOROUGHLY WASH AFFECTED SKIN AREAS WITH SOAP AND COLD WATER. FOR EYES, FLUSH WITH COLD WATER AND SEEK MEDICAL TREATMENT.

WARNING

TO PREVENT INJURY TO PERSONNEL, DO NOT EXPOSE THE DISPERSER TO TEMPERATURES ABOVE 130°F. THE DISPERSER IS PRESSURIZED AND WHEN EXPOSED TO EXCESSIVE HEAT, IT COULD EXPLODE.

WARNING

TO PREVENT INJURY TO PERSONNEL, DO NOT DESTROY OR PUNCTURE THE PRESSURIZED DISPERSER.

7-2.3.5. Safety Precaution. The general safety precautions contained in Chapter 2 apply to this disperser.

7-2.3.6. Shipping Containers. This disperser is packaged one per sealed vapor-proof bags with 144 contained in a wooden box. The filled box weighs approximately 45 pounds.

7-2.3.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this disperser is approximately 60 grams.

7-2.3.8. Identification Data. The M32 disperser is listed under Drawing 116-6-219, NSN 1365-00-179-4247, and DODIC/NALC K531. The carrier is listed under Drawing 116-6-230 and NSN 1365-00-179-4248.

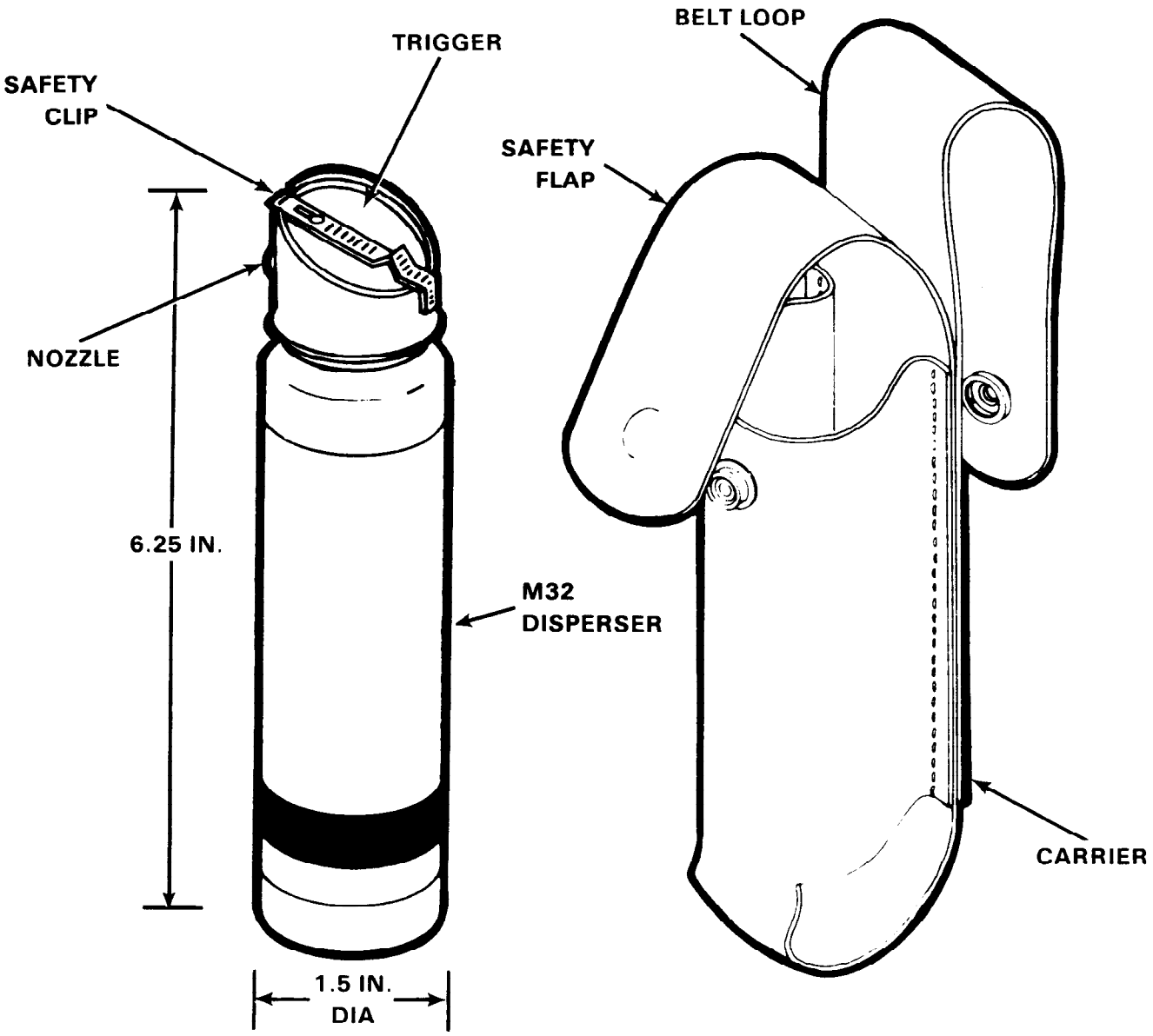


Figure 7-2.3. M32 CSX Riot Control Agent Disperser

7-2.4. DISPERSER, RIOT CONTROL AGENT, CR, M36

7-2.4.1. Intended Use. The M36 CR Riot Control Agent Disperser is used to apprehend, control, or subdue unruly persons, trespassers, and rioters by spraying them with CR agent solution from handheld pressurized can. The spray stings and irritates the eyes, skin, nose, throat, and lungs of exposed personnel.

7-2.4.2. Description. This disperser, Figure 7-2.4, consists of an aluminum cylindrical container with a locking actuator. The container is approximately 1.50 inches in diameter and 6.25 inches in length and is filled with approximately 68 grams of CR riot control agent solution pressurized with nitrogen gas. A tamper-proof seal is located over the top of the actuator. Item identification and warning markings are painted on the container. This disperser has a performance pressure of 140 psig at 75°F with a range (jet stream) of 10 to 12 feet. The operating time is 14 to 24 seconds with a continuous stream and 15 to 25 (one second) bursts for short (one second) bursts. The carrier is a separately issued leather case with an easily accessible safety flap and belt loop, which are secured by snap fasteners to prevent accidental release.

7-2.4.3. Functional Description. The M36 disperser is armed and the CR agent solution dispensed by rotating the actuator counterclockwise, which breaks the seal, and pressing down on the actuator with the index finger. Pressing on the actuator allows the pressurized CR solution to discharge through the nozzle in a continuous jet stream or in short bursts by alternately releasing or increasing pressure on the actuator.

WARNING

DO NOT BLOCK NOZZLE WITH YOUR FINGERS OR THUMB WHEN DISCHARGING AGENT. CR AGENT WILL IRRITATE YOUR SKIN.

NOTE

Do not operate disperser in upside-down position, because pressurized nitrogen will escape without agent discharging.

7-2.4.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This disperser is designated as Group B Chemical Ammunition for handling and storage purposes.

WARNING

DO NOT RUB EYES OR SKIN IF YOU HAVE BEEN CONTAMINATED. THOROUGHLY WASH AFFECTED SKIN AREAS WITH SOAP AND COLD WATER. FOR EYES, FLUSH WITH COLD WATER AND SEEK MEDICAL TREATMENT.

WARNING

TO PREVENT INJURY TO PERSONNEL, DO NOT EXPOSE THE DISPERSER TO TEMPERATURES ABOVE 130°F (54.5°C). THE DISPERSER IS PRESSURIZED AND WHEN EXPOSED TO EXCESSIVE HEAT, IT COULD EXPLODE.

WARNING

TO PREVENT INJURY TO PERSONNEL, DO NOT DESTROY OR PUNCTURE THE PRESSURIZED DISPERSER.

7-2.4.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this disperser.

7-2.4.6. Shipping Containers. This disperser is packaged one per sealed vapor-proof bag with 144 contained in a wooden box. The filled box weighs approximately 45 pounds.

7-2.4.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this disperser is approximately 68 grams.

7-2.4.8. Identification Data. The M36 disperser is listed under Drawing 116-6-271, NSN 1365-00-283-9046, and DODIC/NALC K532. The carrier is listed under Drawing 116-6-230 and NSN 1365-00-178-4248.

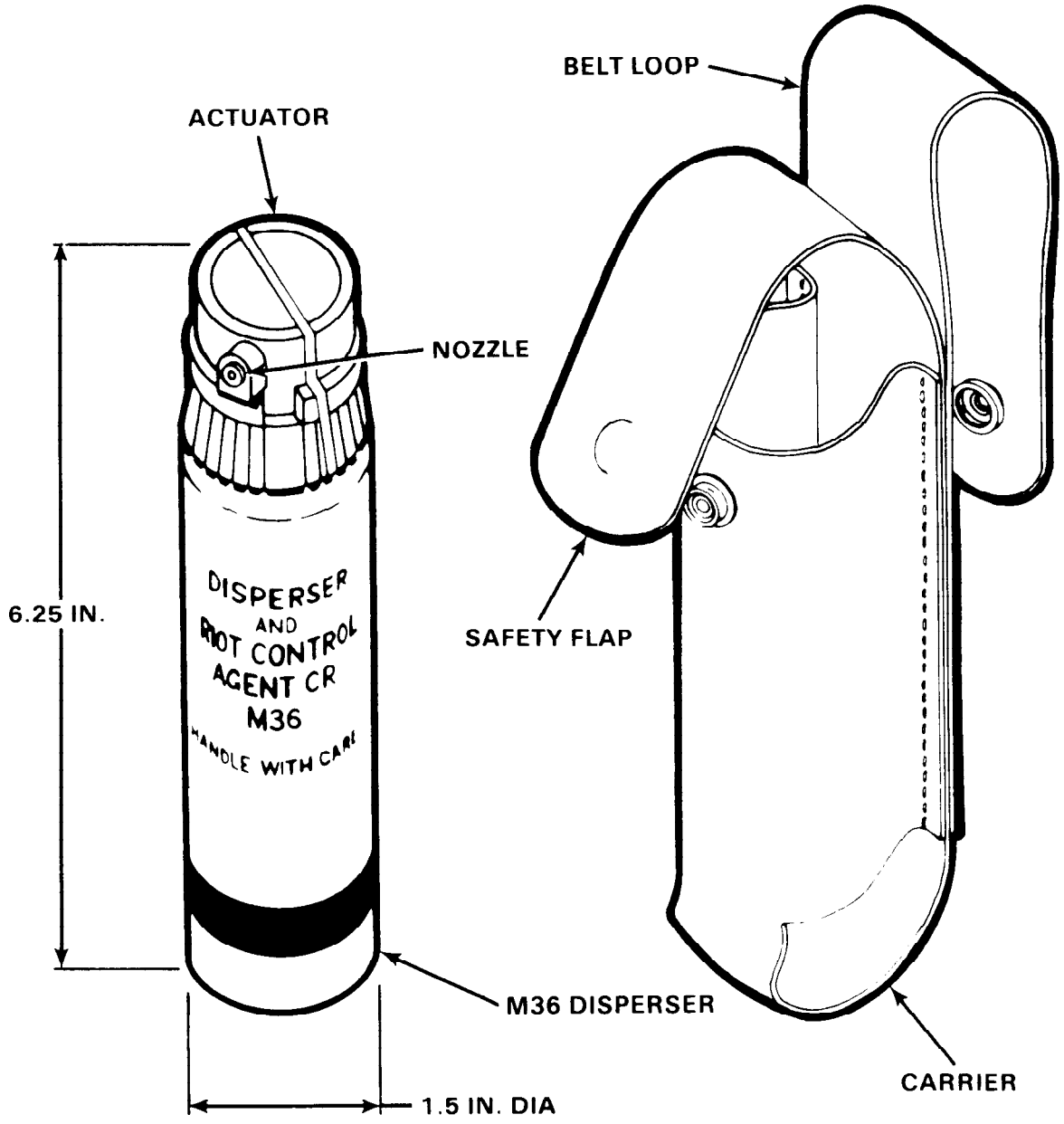


Figure 7-2.4. M36 CR Riot Control Agent Disperser

CHAPTER 8

CHEMICAL AND RIOT CONTROL CARTRIDGES AND PROJECTILES

8-1. INTRODUCTION

This chapter contains general and technical information on cartridges and projectiles which contain toxic chemical or riot control agents and are designed to be fired from mortars, howitzers, and heavy caliber guns and launchers.

8-1.1. GENERAL. Cartridges may contain either toxic chemical agents or riot control agents, while projectiles contain only toxic chemical agents. (See TM 43-0001-28 for additional information.) Data on the amount of terrain that can be contaminated with effective quantities of agent is of a confidential nature, and not presented here. Operational statistics are available in pertinent publications. (See TM 3-200, Capabilities and Employment of Toxic Chemicals.) The standard metric unit of area, and hectare is used in the statistics. One hectare equals 10,000 square meters, or one hundredth square kilometer. Mathematical formulas are used to express the effectiveness of toxic chemical agents on the number of persons affected in a given area. The value LCt_{50} applied to an agent means that 50 percent of the personnel exposed to the agent will become fatalities in the area given in conjunction with the LCt_{50} value. LCt_1 is a dosage fatal to 1 percent of exposed persons.

Table 8-1. Cartridges and Projectiles

Item	Paragraph	Agent	Agent Weight
CHEMICAL CARTRIDGES			
Cartridge, 105mm, Gas, M60	8-2.1	H or HD	2.96 pounds
Cartridge, 105mm, Gas M360	8-2.2	GB	1.63 pounds
Cartridge, 4.2 Inch, Gas, M2	8-2.3	H, HD or HT	6.00 pounds
Cartridge, 4.2 Inch, Gas, M2A1	8-2.3	H, HD or HT	6.00 pounds
RIOT CONTROL CARTRIDGES			
Cartridge, 40mm, Riot Control, M651	8-3.1	CS	2.00 ounces
Cartridge, 40mm, Riot Control, M674	8-3.2	CS	3.30 ounces
Cartridge, 105mm, Riot Control, M629	8-3.3	CS	3.28 pounds
Cartridge, 4.2 Inch, Tactical, M630	8-3.4	CS	4.00 pounds
CHEMICAL PROJECTILES			
Projectile, 155mm, Gas, M104	8-4.1	HD	11.70 pounds
Projectile, 155mm, Gas, M110	8-4.2	HD	9.70 pounds

Table 8-1. Cartridges and Projectiles (Continued)

Item	Paragraph	Agent	Agent Weight
Projectile, 155mm, GB, Gas, M121A1	8-4.3	GB	6.50 pounds
Projectile, 155mm, VX, Gas, M121A1	8-4.4	VX	6.00 pounds
Projectile, 155mm, GB, Gas, M122	8-4.5	GB	6.50 pounds
Projectile, 155mm, GB2, Binary, M687	8-4.6	GB2	24.20 pounds
Projectile, 8 Inch, GB, Gas, M426	8-4.7	GB	15.70 pounds
Projectile, 8 Inch, VX, Gas, M426	8-4.8	VX	15.70 pounds

8-2. CHEMICAL CARTRIDGES

8-2.1. CARTRIDGE, 105MM, GAS, M60

8-2.1.1. Intended Use. The M60 105mm Gas Cartridge is designed to provide a toxic chemical offensive capability using Levinstein Mustard (H) or distilled mustard agent (HD). This cartridge is used with the M52, M52A1, M101, M101A1, M102 and M108 105mm howitzers for anti-personnel effects.

8-2.1.2. Description. This 105mm cartridge, Figure 8-2.1, is a semi-fixed, central burst H or HD gas round. The cartridge is boat-tailed and has ogival nose which is threaded for an adapter. The adapter provides a tight seal for the chemical contents, holds the fuze, and provides a seat for the forward end of the burster tube. The cartridge is approximately 31.10 inches long, weighs 43.27 pounds, and contains 2.96 pounds of filler. The M5 Burster Charge is located through the center of the filler and contains approximately 0.51 pound of tetryol. The cartridge case contains a percussion primer assembly and seven individually bagged and numbered propelling charge increments. The base of the cartridge case is drilled and the primer assembly pressed into the base. The percussion primer assembly consists of a percussion containing black powder. The seven numbered increment bags are tied together, in numerical order, with acrylic cord. These are assembled into the cartridge case, around the primer flash tube, with Increment 1 at the base of the cartridge case and Increment 7 toward the mouth of the cartridge case.

8-2.1.3. Functional Description. The propelling charge is adjusted and the cartridge loaded into the weapon. Impact of the weapon firing pin results in the initiation of the percussion primer which in turn ignites the black powder in the flash tube. The flash tube provides for uniform ignition of the propelling charge producing a rapid expansion of the propellant gas which propels the projectile out of the weapon. Upon impact with the target, the PD fuze detonates the burster charge rupturing the projectile and dispersing the chemical agent. The liquid agent evaporates forming a persistent gas to envelope the target areas.

8-2.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This cartridge is designated as a Group A Chemical Ammunition for handling and storage purposes.

8-2.1.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this cartridge.

8-2.1.6. Shipping Containers. This cartridge is packaged one per fiber container with two containers per wooden box. The filled box weighs approximately 120 pounds.

8-2.1.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this cartridge is approximately 6.22 pounds.

8-2.1.8. Identification Data. The M60 cartridge is listed under Drawing 75-1-109, NSN 1315-00-028-4829, and DODIC/NALC C442.

8-2.1.9. General Data. The following table provides general data on the M60 cartridge:

Projectile Weight	33.46 pounds
Filler Weight	2.96 pounds
Filling Efficiency	8.83 percent
Complete Round Weight	43.27 pounds
Projectile Length (with Fuze)	19.47 inches
Complete Round Length	31.10 inches
Maximum Diameter	4.13 inches
Fuze	PD-M557
Burster	M 5
Burster Charge (HE)	0.51 pounds
Propelling Charge (M1)	2.75 pounds
Cartridge Case	M14 series
Primer	M28A2 or M28B2
Muzzle Velocity	1550 f.p.s.
Maximum Range	11,100 meters

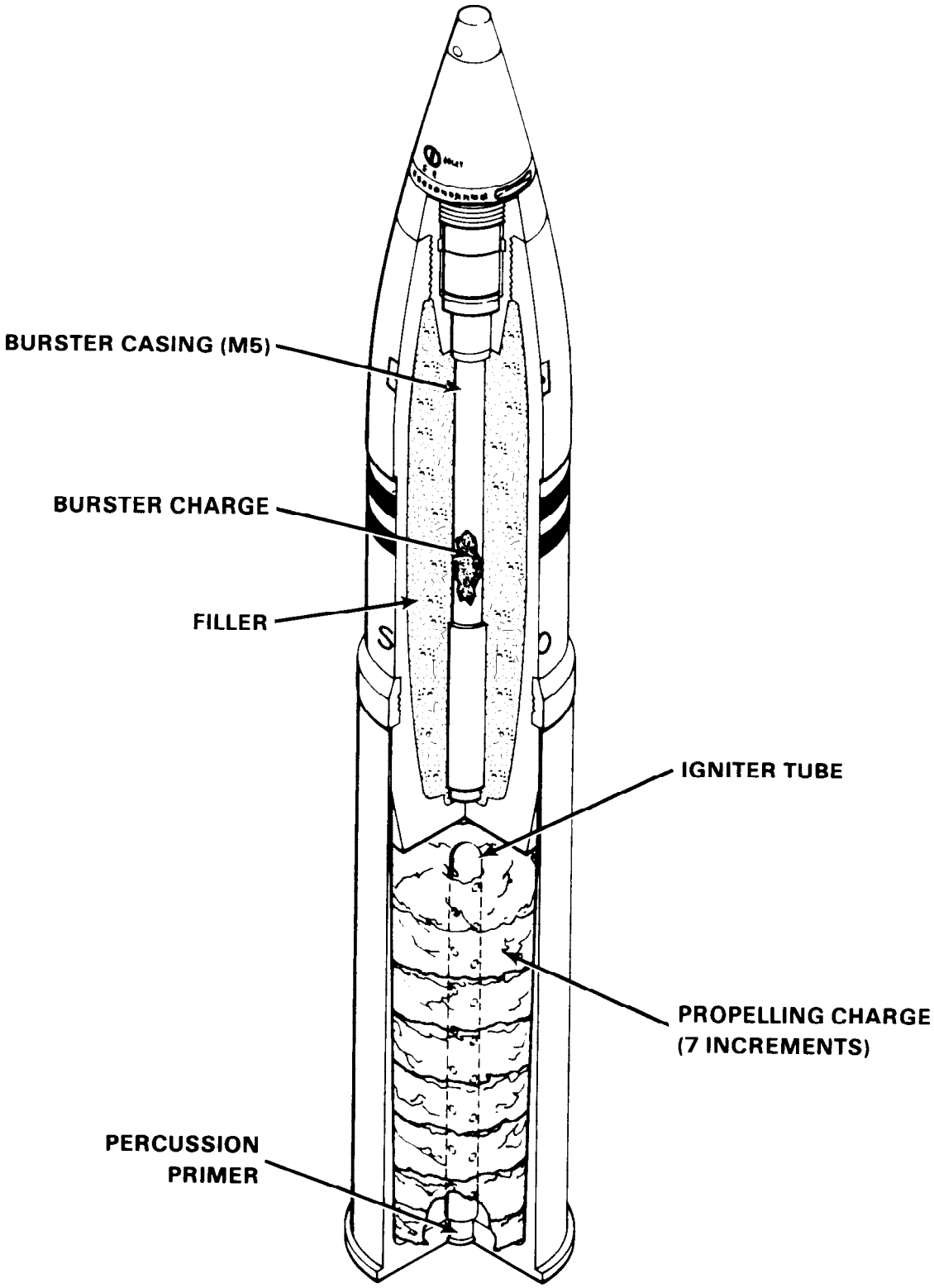


Figure 8-2.1. M60 105mm Gas Cartridge

8-2.2. CARTRIDGE, 105MM, GAS, M360

8-2.2.1. Intended Use. The M360 105mm Gas Cartridge is designed to provide a toxic chemical offensive capability using nonpersistent GB nerve agent. This cartridge is used with the M2A1, M2A2, M103 and M137 105mm howitzers for anti-personnel effects.

8-2.2.2. Description. This 105mm cartridge, Figure 8-2.2, is a semi-fixed, central burst GB gas round. The cartridge is boat-tailed and has ogival nose which is threaded for an adapter. The adapter provides a tight seal for the chemical contents, holds the fuze, and provides a seat for the forward end of the burster tube. The cartridge is approximately 31.18 inches long, weighs 44.57 pounds, and contains 1.63 pounds of filler. The M16 Burster Charge is located through the center of the filler and contains approximately 1.90 pounds of tetryol. The cartridge case contains a percussion primer assembly and seven individually bagged and number propelling charge increments. The base of the cartridge case is drilled and the primer assembly pressed into the base. The percussion primer assembly consists of a percussion containing black powder. The seven numbered increment bags are tied together, in numerical order, with acrylic cord. These are assembled into the cartridge case, around the primer flash tube, with increment 1 at the base of the cartridge case and increment 7 toward the mouth of the cartridge case.

8-2.2.3. Functional Description. The propelling charge is adjusted and the cartridge loaded into the weapon. Impact of the weapon firing pin results in the initiation of the percussion primer which in turn ignites the black powder in the flash tube. The flash tube provides for uniform ignition of the propelling charge producing a rapid expansion of the propellant gas which propels the projectile out of the weapon. Upon impact with the target, the PD fuze detonates the burster charge rupturing the projectile and dispersing the chemical agent. The liquid agent evaporates forming a nonpersistent gas to envelope the target areas.

8-2.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This cartridge is designated as a Group A Chemical Ammunition for handling and storage purposes.

8-2.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this cartridge.

8-2.2.6. Shipping Containers. This cartridge is packaged one per fiber container with two containers per wooden box. The filled box weighs approximately 117 pounds.

8-2.2.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this cartridge is approximately 6.18 pounds.

8-2.2.8. Identification Data. The M360 cartridge is listed under Drawing 75-1-363, NSN 1315-00-203-8985, and DODIC/NALC C441.

8-2.2.9. General Data. The following table provides general data on the M360 cartridge:

Projectile	35.59 pounds
Filler Weight	1.63 pounds
Filling Efficiency	3.66 percent
Complete Round Weight	44.57 pounds
Projectile Length (with Fuze)	19.47 inches
Complete Round Length	31.18 inches
Maximum Diameter	4.13 inches
Fuze	PD-M508
Burster	M16
Burster Charge (HE)	1.90 pounds
Propelling Charge (M1)	2.75 pounds
Cartridge Case	M14
Primer	M28A2 or M28B2
Muzzle Velocity	1550 f.p.s.
Maximum Range	11,300 meters

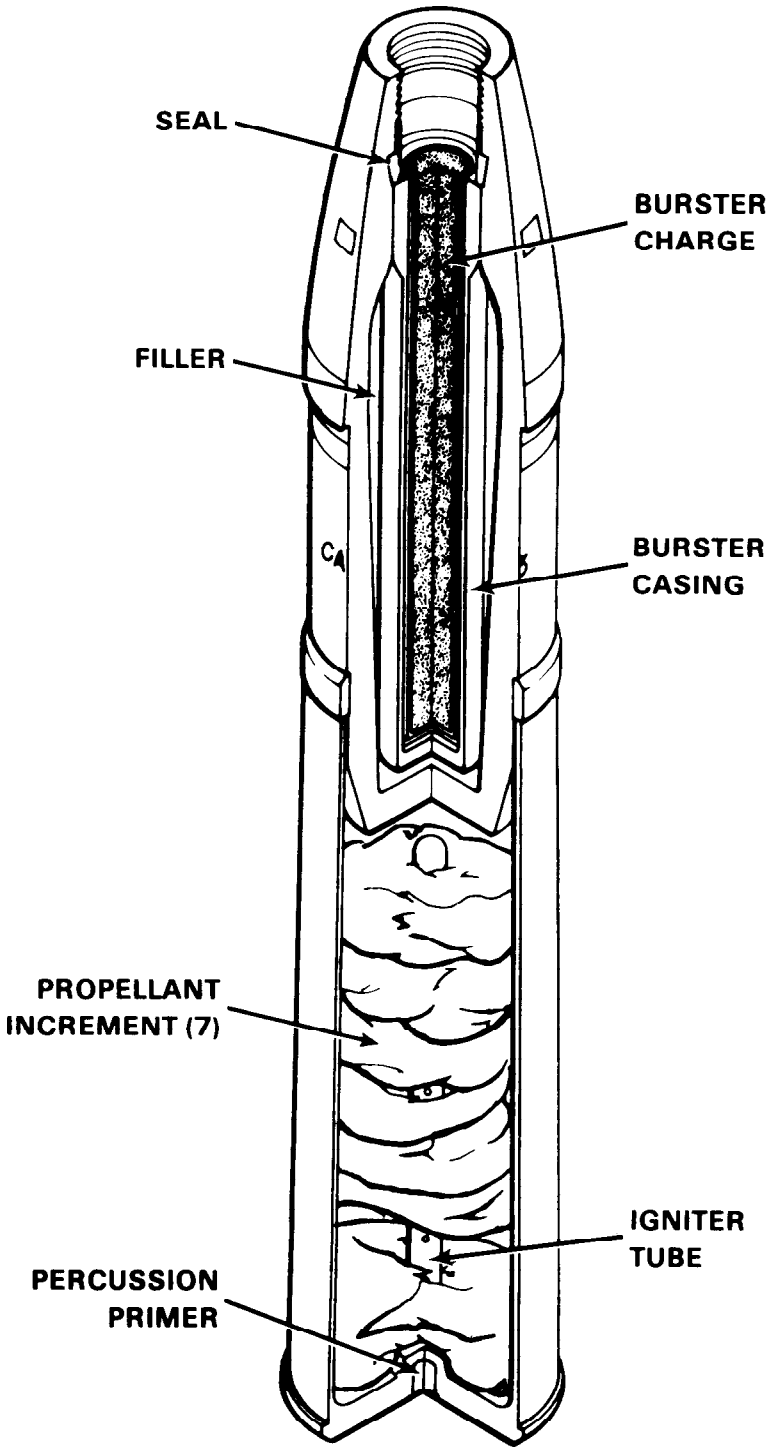


Figure 8-2.2. M360 105mm Gas Cartridge

8-2.3. CARTRIDGE, 4.2 INCH, GAS, M2 AND M2A1

8-2.3.1. Intended Use. The M2 and M2A1 4.2 Inch Gas Cartridges are designed to provide a toxic chemical offensive capability using persistent gases H, HD, or HT. These cartridges are used with the M2 and M30 4.2 inch mortars for anti-personnel effects.

8-2.3.2. Description. These 4.2 inch cartridges, Figure 8-2.3, are semi-fixed, central burst, spin stabilized munitions. The complete round consists of a projectile body, PD fuze with an integral burster, and a tail assembly. These cartridges are approximately 21.01 inches long, weigh 25.50 pounds, and contain 6.00 pounds of filler. The body contains a perforated vane assembly welded to the inside of the body and is designed to accommodate the burster tube that extends from the M8 PD fuze. The tail assembly consists of a pressure plate and rotating disc, a propelling charge, a cartridge container and ignition cartridge, and a striker nut assembly. The M2 cartridge differs slightly from the M2A1 cartridge in the design of the obturating mechanism.

8-2.3.3. Functional Description. When the cartridge is released, it slides down the mortar tube until the percussion primer strikes the firing pin. The flash from the primer ignites the ignition cartridge which, in turn, ignites the propelling charge. The gases from the propelling charge exert pressure on the pressure plate at the base of the projectile which expands the rotating disc, engaging it in the rifling of the tube. The spin imparted to the projectile as it leaves the weapon stabilizes it in flight. The perforated vane causes the liquid filler to rotate with the projectile to reduce the possibility of erratic flight. The fuze functions on impact, detonating the burster charge which ruptures the projectile and disperses the gas filler.

8-2.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This cartridge is designated as a Group A Chemical Ammunition for handling and storage purposes.

8-2.3.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this cartridge.

8-2.3.6. Shipping Containers. This cartridge is packaged one per fiber container with two containers per wooden box. The filled box weighs approximately 75 pounds.

8-2.3.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this cartridge is approximately 6.95 pounds.

8-2.3.8. Identification Data. The following table applies to these type cartridges:

MODEL	FILLER	DWG	NSN	DODIC/NALC
M2	HT	75-1-284	1315-00-028-5024	C703
M2	HD	75-1-284	1315-00-028-5018	C703
M2	H	75-1-284	1315-00-028-5023	C703
M2A1	HD	75-1-284	1315-00-028-5027	C703

8-2.3.9. General Data. The following table provides general data on the M2 and M2A1 cartridges:

Fired Weight	25.50 pounds
Filler Weight	6.00 pounds
Filling Efficiency	25.6 percent
Complete Round Length	21.01 inches
Maximum Diameter	4.19 inches
Ignition Cartridge	M 2
Propelling Charge	M 6
Fuze	PD, M8 (with M14 Burster)
Muzzle Velocity	820 f.p.s.
Maximum Range	4,460 meters

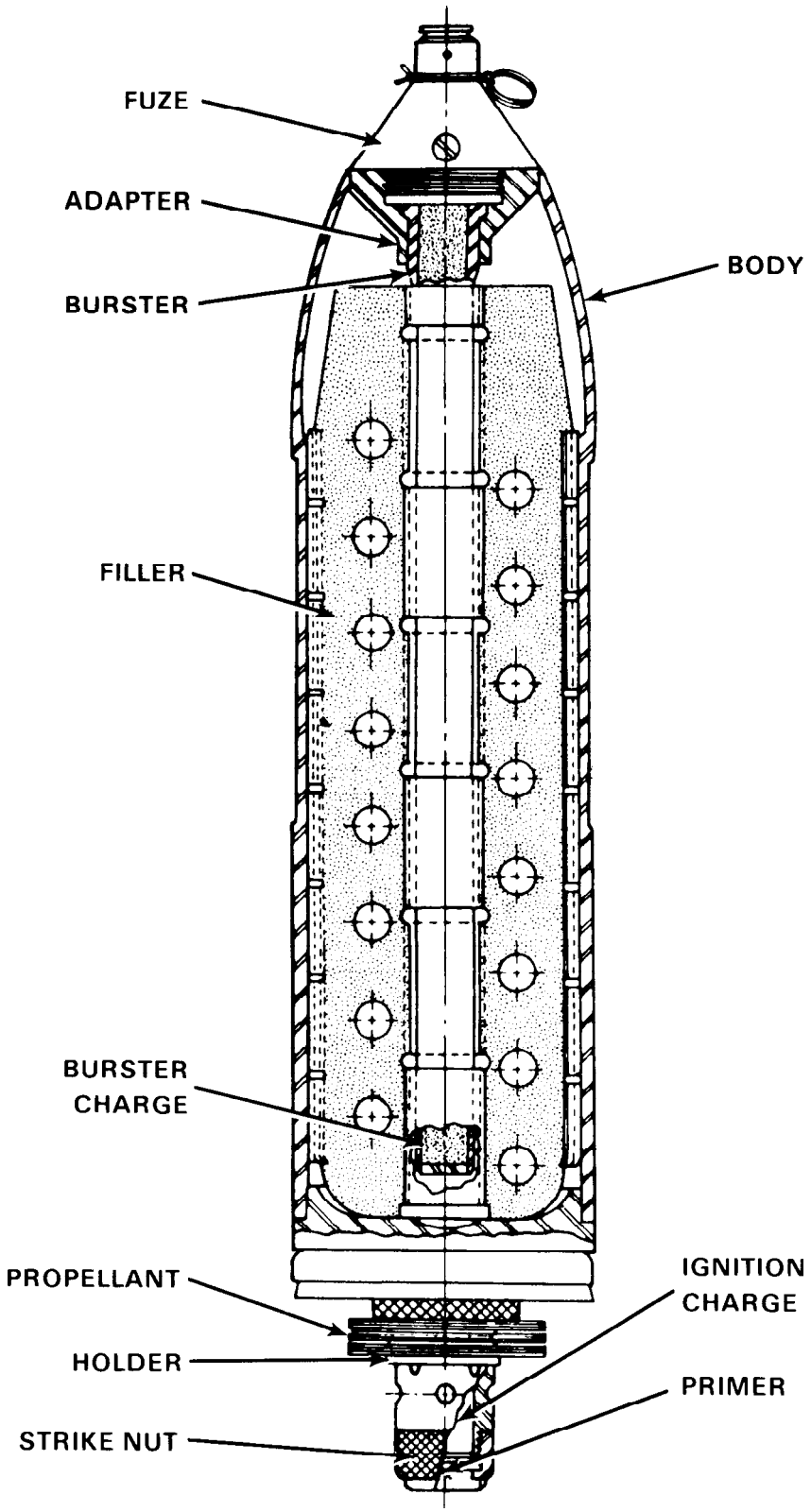


Figure 8-2.3. M2 and M2A1 4.2 Inch Gas Cartridge

8-3. RIOT CONTROL CARTRIDGES

8-3.1. CARTRIDGE, 40MM, RIOT CONTROL, CS, M651

8-3.1.1. Intended Use. The M651 CS Riot Control 40mm Cartridge provides a round for the M79 Grenade Launcher that will place a CS aerosol on point targets up to a 200 meter range or on area targets up to a 400 meter range. This nonpersistent irritating round is especially effective when fired into an enclosed area. The projectile will penetrate window glass or 3/4-inch thick pine boards at 200 meters and will release CS after penetration.

8-3.1.2. Description. The M651 cartridge, Figure 8-3.1, is similar in appearance to other 40mm cartridges, but it is slightly longer and has a flat nose. The cartridge is approximately 4.50 inches long, weighs 10.00 ounces, and contains 2.00 ounces of CS mixture. The projectile end up of the cartridge contains the M581 fuze which is centrifugally and setback-armed, and point detonating (PD). The fuze contains a detonator, primer, and an ignition mixture, each weighing less than 1.0 gram. The rimmed end of the cartridge contains a percussion primer and a double-base propellant. The projectile end of the cartridge is painted gray with red markings and a single red band to indicate a nonpersistent riot control agent filling. The cartridge case is olive drab and has six identification notches.

8-3.1.3. Functional Description. The weapon firing pin strikes the percussion primer to ignite the propelling charge. The burning propelling charge generates sufficient pressure to force the projectile through the muzzle of the weapon. When the projectile is fired, setback forces cause the fuze setback pin to retract from the fuze rotor. The rotor is held in an unarmed position by a firing pin, a centrifugal lock, and the setback pin in the fuze assembly. Centrifugal force, generated by the rotation of the projectile, causes the inertia weights and the centrifugal lock in the fuze to move outward. In turn, the spring-loaded firing pin and the lock retract from the rotor and fuze gear train, respectively. The rotor, now free to rotate, lines up the fuze primer with the explosive train. A fuze escapement mechanism delays arming by controlling rotor movement. The fuze arms after the projectile has traveled at least 45 feet from the launcher tube. Upon impact with the target, the firing pin is forced into the primer. The primer initiates the ignition mixture which, in turn, ignites the first-fire mixture and the CS agent. The gases generated by the burning CS blow out the vent plug. The CS vapors are emitted in the form of smoke for approximately 25 seconds.

8-3.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This cartridge is designated as a Group B Chemical Ammunition for handling and storage purposes.

8-3.1.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this cartridge.

8-3.1.6. Shipping Containers. This cartridge is packaged six rounds per bandoleer per fiberboard container with 4 bandoleers (24 rounds) per wooden box.

8-3.1.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this cartridge is approximately 61.0 grams.

8-3.1.8. Identification Data. The M651 cartridge is listed under Drawing 122-2-6, NSN 1310-00-849-2083, and DODIC/NALC B567.

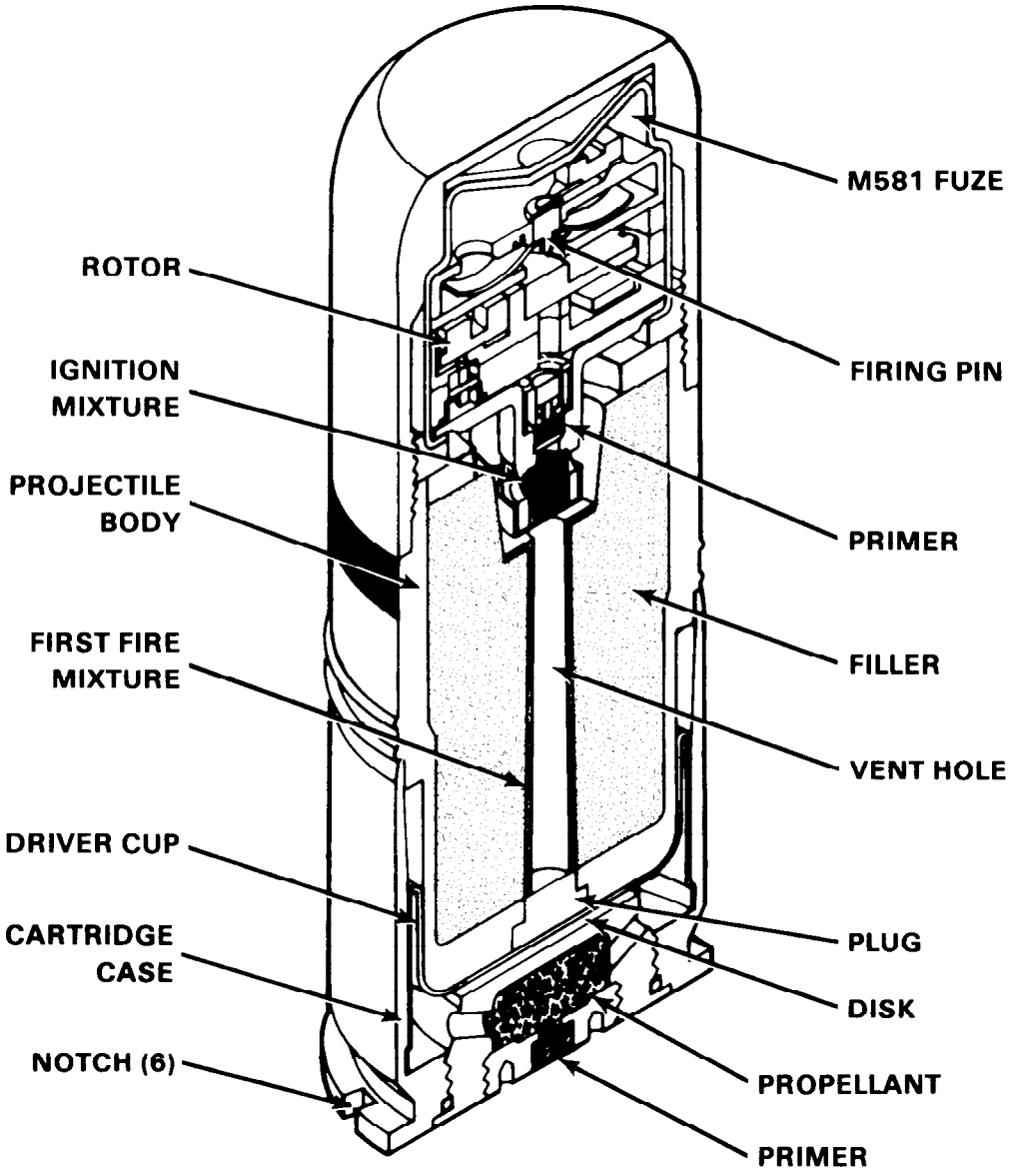


Figure 8-3.1. M651 CS 40mm Riot Control Cartridge

8-3.2. CARTRIDGE, 40MM, RIOT CONTROL, CS, M674

8-3.2.1. Intended Use. The M674 CS Riot Control 40mm Cartridge is intended primarily for use by law enforcement agencies in such applications as mob dispersion, controlling riots, and protecting law enforcement personnel. The cartridge produces a nonpersistent irritating effect and may be fired from the M79 Grenade Launcher or the AN-M8 Pyrotechnic Pistol or fired by hand.

8-3.2.2. Description. The M674 cartridge, Figure 8-3.2, consists of a firing cap assembly, launcher adapter, and cartridge barrel that houses a rubber body assembly. The body assembly is the munition projectile and contains 3.30 of CS filler. The surfaces of the cartridge barrel and firing cap assembly are coated with pumice paint to provide for positive gripping during hand firing. Waterproof tape holds the firing cap assembly in place over the muzzle end of the cartridge barrel. The firing cap assembly is used only for hand firing. The detachable launcher adapter fits over the primer end of the cartridge for firing from the M79 Grenade Launcher. The cartridge is approximately 8.81 inches long and weighs 12.00 ounces. The cartridge houses a percussion primer, black powder propellant charge, delay element, and three ignition pellets. The cartridge is painted gray with red identification markings and a single red band to indicate a nonpersistent riot control agent.

8-3.2.3. Functional Description. When inserted into the M79 Grenade Launcher, the cartridge is positioned by the launcher adapter. The adapter is removed for insertion in the AN-M8 pyrotechnic pistol. For hand firing, the adapter is removed and the firing cap is placed over the base of the cartridge barrel. Striking the firing cap sharply with the palm of the hand drives the firing pin to initiate the percussion primer. The primer ignites the propelling charge which propels the projectile and simultaneously ignites the delay pellets. After 3 to 6 seconds, the CS agent is ignited, generating gas which ruptures the thin walls of the emission holes. CS vapors are emitted in the form of smoke for approximately 36 seconds.

8-3.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This cartridge is designated as a Group B Chemical Ammunition for handling and storage purposes.

8-3.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this cartridge.

8-3.2.6. Shipping Containers. This cartridge is packaged four per bandoleer per container with ten containers (40 cartridges) per wooden box. The filled box weighs approximately 50 pounds.

8-3.2.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this cartridge is approximately 6.22 pounds.

8-3.2.8. Identification Data. The M674 cartridge is listed under Drawing D122-3-101, NSN 1310-00-935-9229, and DODIC/NALC B537.

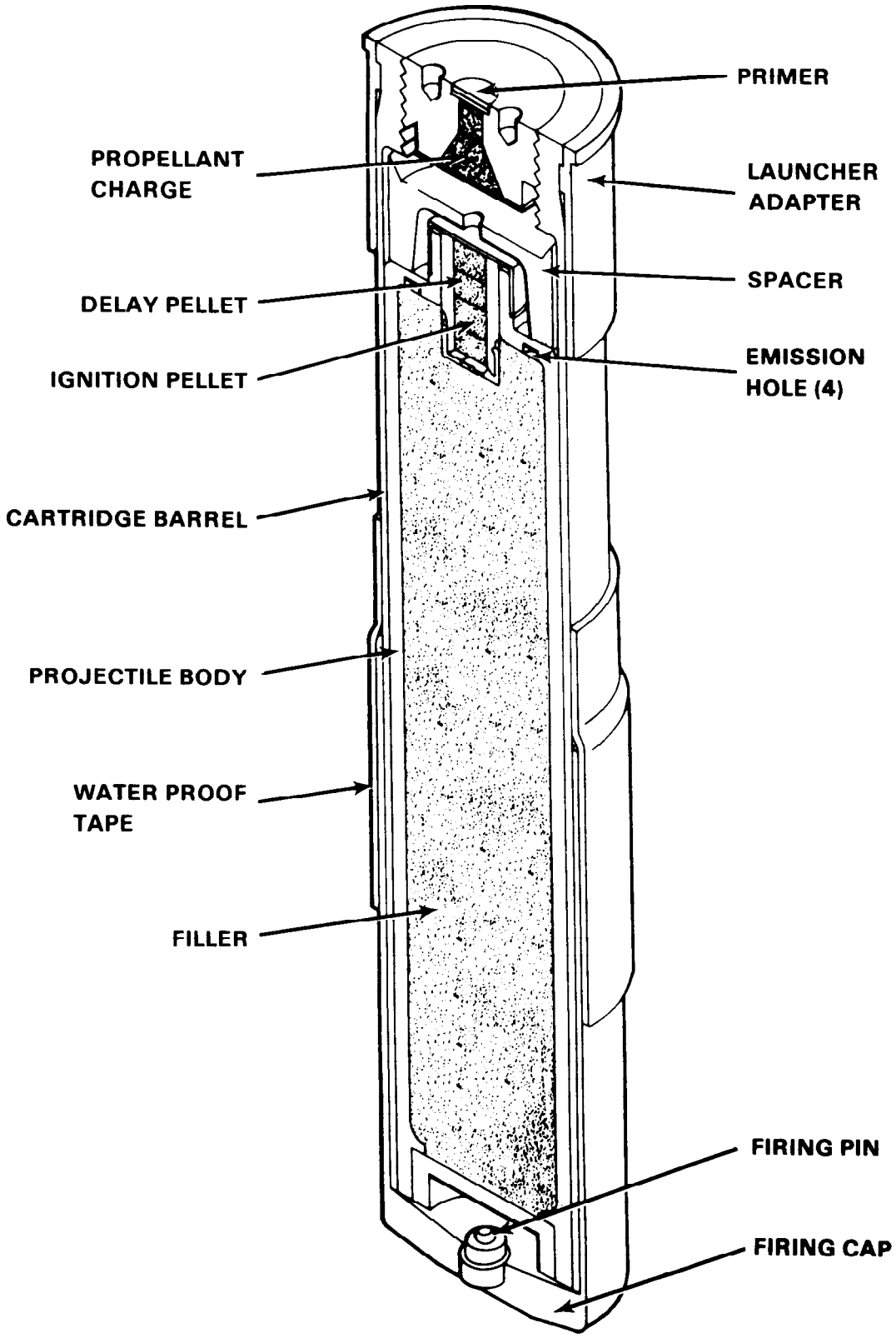


Figure 8-3.2. M674 CS 40mm Riot Control Cartridge

8-3.3. CARTRIDGE, 105MM, TACTICAL, CS, M629

8-3.3.1. Intended Use. The M629 CS Tactical 105mm Cartridge is designed to provide harassing effects on personnel by the emission of nonpersistent irritant CS agent. This cartridge is used with the M52, M52A1, M101, M101A1, M102 and M108 105mm howitzers.

8-3.3.2. Description. This cartridge, Figure 8-3.3, is a semi-fixed percussion-primed round with a spin-stabilized projectile containing base-ejected CS canisters. The projectile consists of a hollow steel forging with streamlined ogive, gilding metal rotating band, and pinned steel base plug. The M548 MTSQ or M565 MT Fuze is internally threaded into the nose of the projectile. The projectile cavity contains an expelling charge and four CS pyrotechnic-filled canisters. The expelling charge consists of 1.78 ounces of black powder in a plastic container. It is assembled to the rear of the fuze and separated from the CS canisters by an aluminum baffle plate with flash hole. Each CS canister contains 0.82 pound of CS pyrotechnic mixture and 0.81 ounce of starter mixture. Located in the center of each CS canister is a perforated flash tube. The base plug is held in place by three shear pins and three twist pins. The complete projectile assembly is free-fitted to a steel cartridge case. The cartridge case contains a percussion primer assembly and seven individually bagged and numbered propelling charge increments. The base of the cartridge case is drilled and the primer assembly is pressed into the base. The percussion primer assembly consists of a percussion ignition element and a perforated flash tube containing black powder. The seven numbered increment bags are tied together, in numerical order, with acrylic cord. These are assembled into the cartridge case around the primer flash tube with Increment 1 at the base of the cartridge case and Increment 7 toward the mouth of the cartridge case.

8-3.3.3. Functional Description. If the projectile is unfuzed, the closing plug is removed and a fuze assembled to the projectile prior to adjusting the charge and loading the cartridge into the weapon. Impact of the weapon firing pin results in the initiation of the percussion primer which, in turn, ignites the black powder in the flash tube. The flash tube provides for uniform ignition of the propelling charge producing a rapid expansion of the propellant gas which propels the projectile out of the weapon tube. Engagement of the projectile rotating band with the rifling of the weapon tube imparts spin to the projectile providing in-flight stability. Projectile functioning is dependent upon the fuze used and may function on impact (instantaneous or delay), function above ground either at a predetermined height based upon time of flight, or function in proximity with the target area. The fuze functions and ignites the black powder in the expelling charge. The flash from the expelling charge ignites the four CS canisters through the perforations in the flash tubes. Concurrently, the pressure from the ignition of the expelling charge shears the retaining pins, blows out the base plug and expels the burning canisters into the airstream. The CS pyrotechnic mixture in the canisters burns and emits irritating fumes for approximately 60 seconds.

8-3.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This cartridge is designated as a Group B Chemical Ammunition for handling and storage purposes.

8-3.3.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this cartridge.

8-3.3.6. Shipping Containers. This cartridge is packaged one per fiber container with two containers per wooden box. The filled box weighs approximately 120 pounds.

8-3.3.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this cartridge is approximately 6.66 pounds.

8-3.3.8. Identification Data. The M629 cartridge is listed under Drawing 9220225, NSN 1315-00-143-7128, and DODIC/NALC C468.

8-3.3.9. General Data. The following table provides general data on the M629 cartridge.

Projectile Weight	31.00 pounds
Filler Weight	3.28 pounds
Complete Round Weight	42.00 pounds
Projectile Length (with Fuze)	15.45 inches
Complete Round Length	32.17 inches
Maximum Diameter	4.13 inches
Fuze	MTSQ-M548 or MT-M565
Expelling Charge (Black Powder)	1.8 ounces
Propelling Charge	2.80 pounds
Cartridge Case	M14 series
Primer	M28A2 or M28B2
Muzzle Velocity	1621 f.p.s.
Maximum Range	11,500 meters

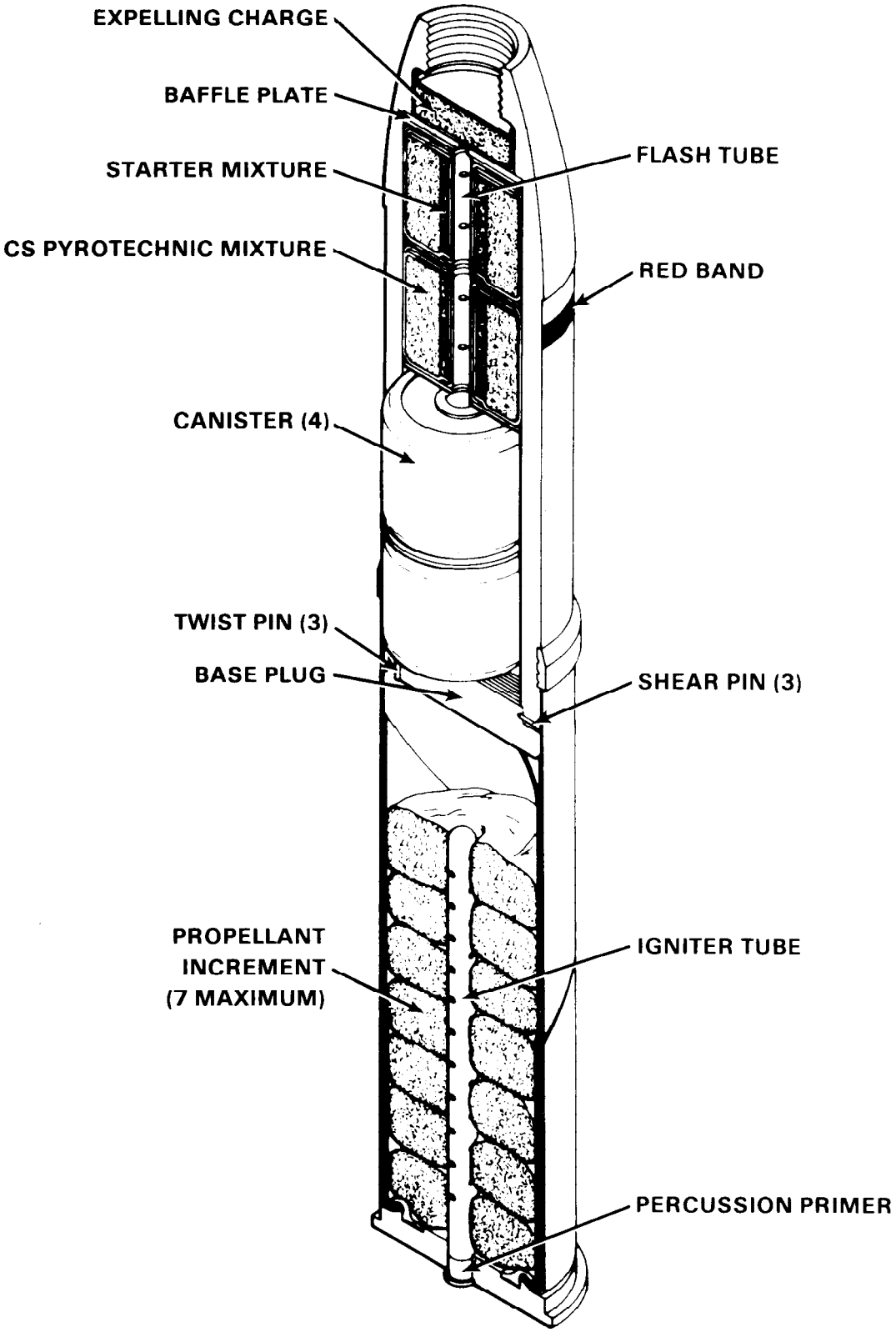


Figure 8-3.3. M629 CS 105mm Tactical Cartridge

8-3.4. CARTRIDGE, 4.2 INCH, TACTICAL CS, M630

8-3.4.1. Intended Use. The M630 CS Tactical 4.2 Inch Cartridge is designed to provide harassing effects on personnel by the emission of nonpersistent irritant CS agent. This cartridge is used with the M2 and M30 mortars.

8-3.4.2. Description. This cartridge, Figure 8-3.4, is a percussion-primed mortar round with a spin-stabilized projectile containing base-ejected CS canisters. The complete round consists of a projectile body with a detachable base plug, a time fuze, and a tail assembly. The steel tube body is designed to accommodate an expelling charge immediately below the fuze, and the base plug is attached with four equally spaced shear pins. The body contains four canisters of CS pyrotechnic mixture, each with a small charge of starter mixture. An aluminum baffle separates the expelling charge from the canisters, and chipboard spacers separate the canisters from each other. The baffle, the spacers, and the canisters have a center hole allowing the flash from the expelling charge to provide ignition. The tail assembly includes a pressure plate and rotating disc, a propelling charge, a cartridge container and ignition cartridge, and a striker nut assembly.

8-3.4.3. Functional Description. When the cartridge is released, it slides down the mortar tube until the percussion primer strikes the firing pin. The flash from the primer ignites the ignition cartridge which, in turn, ignites the propelling charge. The gases from the propelling charge exert pressure on the pressure plate at the base of the projectile which expands the rotating disk, engaging it in the rifling of the tube. The spin imparted to the projectile as it leaves the weapon stabilizes it in flight. Upon functioning of the time fuze, the expelling charge is ignited. Flash from the expelling charge ignites each of the canisters, and the burning canisters are expelled from the projectile body. Average burning time of each canister is 60 seconds, producing a gas which causes extreme burning of the eyes, coughing, difficulty in breathing, and chest tightness.

8-3.4.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This cartridge is designated as a Group B Chemical Ammunition for handling and storage purposes.

8-3.4.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this cartridge.

8-3.4.6. Shipping Containers. This cartridge is packaged one per fiber container with two containers per wooden box. The filled box weighs approximately 76 pounds.

8-3.4.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this cartridge is approximately 4.82 pounds.

8-3.4.8. Identification Data. The M630 cartridge is listed under Drawing 9220299, NSN 1315-00-026-9425, and DODIC/NALC C710.

8-3.4.9. General Data. The following table provides general data on the M630 cartridge:

Filler Weight	4.00 pounds
Complete Round Weight	27.10 pounds
Complete Round Length	25.70 inches
Maximum Diameter	4.19 inches
Fuze	MTSQ-M548 or MT-565
Ignition Cartridge (M2A2)	11.00 grams Black Powder
Propelling Charge (M36A1)	2.60 ounces Black Powder
Muzzle Velocity	299 mps
Maximum Range	5,650 meters

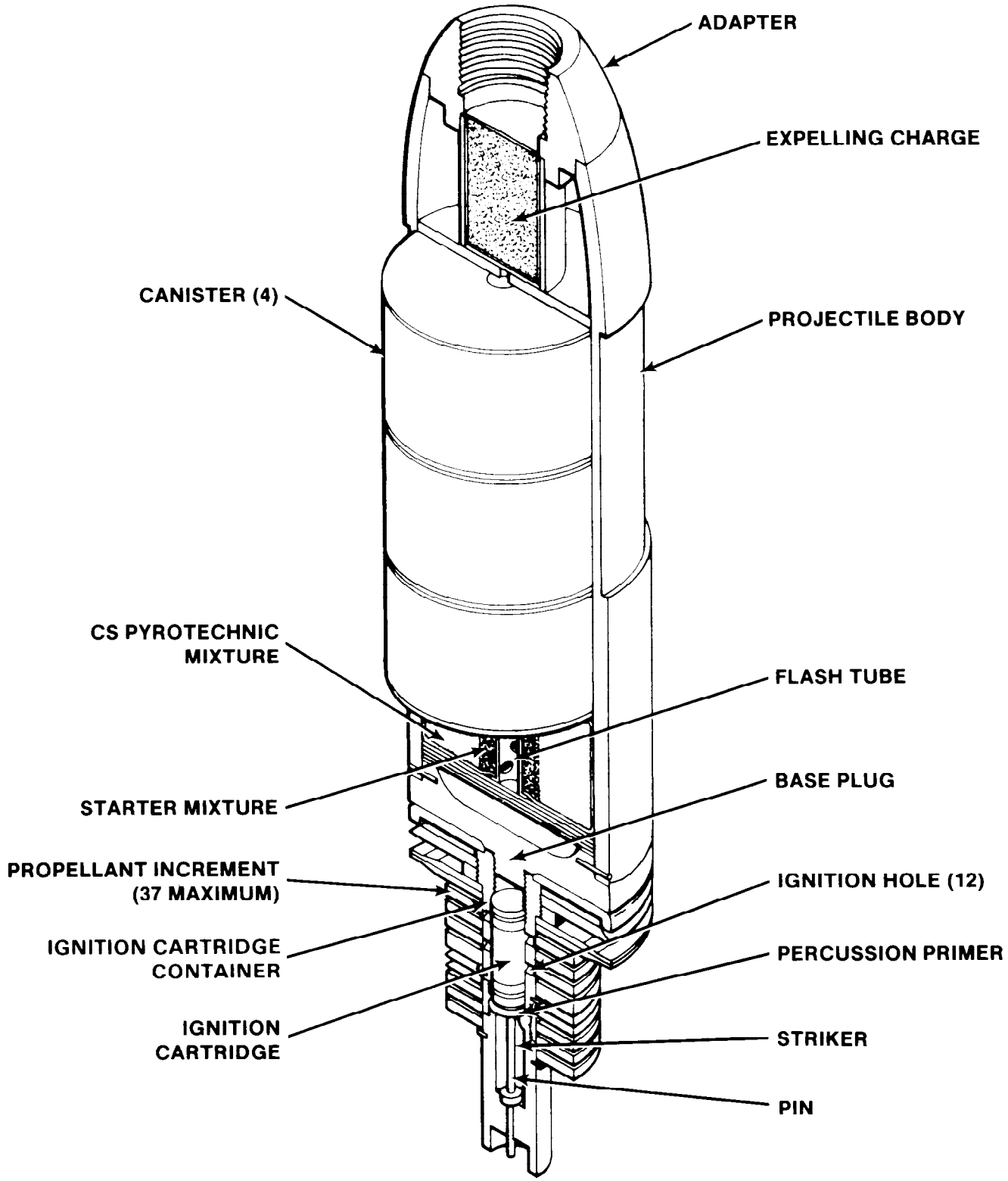


Figure 8-3.4. M630 CS 4.2 Inch Tactical Cartridge

8-4. CHEMICAL PROJECTILES

8-4.1. PROJECTILE, 155 MM, GAS, PERSISTENT, HD, M104

8-4.1.1. Intended Use. The M104 HD Persistent 155mm Gas Projectile is used to produce a toxic effect on personnel and to contaminate habitable areas. This projectile is fired from the M1 Series, M45, M126 Series, M185, and M199 155mm howitzers.

8-4.1.2. Description. The M104 projectile, Figure 8-4.1, consists of a forged steel body containing a filler of 11.70 pounds of distilled mustard gas (HD) and a M6 burster. The burster consists of 0.83 pound of tetrytol in a thin steel or aluminum tube. The tetrytol filled tube is housed in the M1 burster casing which extends the full length of the projectile. The burster casing is assembled after the projectile cavity is filled with the HD agent. A threaded adapter, press fitted to the forward end of the burster casing, seals the nose end of the projectile. The projectile is issued unfuzed, with an eyebolt lifting plug threaded in the fuze adapter. A PD fuze is normally used with this projectile. A 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.

8-4.1.3. Functional Description. When the weapon is fired, the burning propellant generates rapidly expanding gases to propel the projectile through the barrel with the velocity required to reach the target. The soft alloy of the rotating band engages the barrel rifling to impart spin to the projectile for stability in flight. The rotating band also forms a seal to prevent escape of gas pressure past the projectile. The PD fuze functions on impact to explode the burster. The burster ruptures the projectile case and disperses the HD filler. The HD gas permeates the atmosphere on release and remains effective for more than 10 minutes.

8-4.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This projectile is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

SINCE THE BURSTER IN THIS PROJECTILE IS LOADED WITH TETRYTOL, THE PROJECTILE IS NOT TO BE STORED OR FIRED AT TEMPERATURES EXCEEDING +125°F.

8-4.1.5. Safety Precaution. The general safety precautions contained in Chapter 2 apply to this projectile.

8-4.1.6. Shipping Containers. This projectile is packed eight per pallet. The filled pallet weighs approximately 797 pounds.

8-4.1.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this projectile is approximately 12.53 pounds.

8-4.1.8. Identification Data. The M104 projectile is listed under Drawing 75-14-296, NSN 1320-00-529-7350, and DODIC/NALC D484.

8-4.1.9. General Data. The following table provides general data on the M104 projectile:

Projectile Weight (as fired)	94.60 pounds
Filler Weight	11.70 pounds
Projectile Length (with eyebolt)	26.78 inches
Fuze	PD-M557, MTSQ-M520, or MTSQ-M564
Burster	M 6
Burster Charge (Tetrytol)	0.83 pound
Propelling Charge	M19
Primer	M82, Mk 15, or Mk 34
Muzzle Velocity (super charged)	2,800 f.p.s.
Maximum Range (super charge)	25,715 yards
Muzzle Velocity (normal charge)	2,100 f.p.s.
Maximum Range (normal charge)	18,605 yards

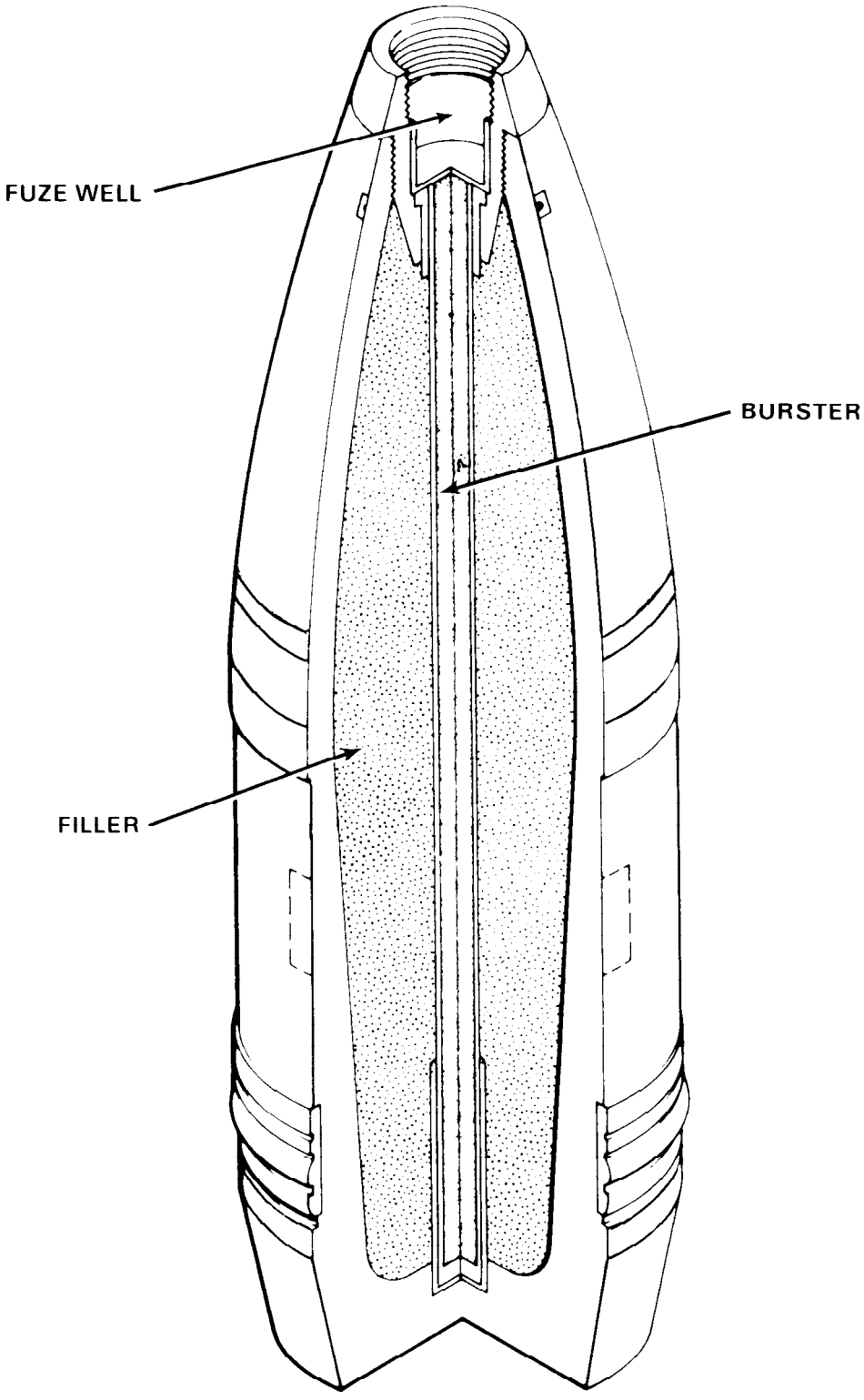


Figure 8-4.1. M104 HD 155mm Persistent Gas Projectile

8-4.2. PROJECTILE, 155MM, GAS, PERSISTENT, HD, M110

8-4.2.1. Intended Use. The M110 HD Persistent 155mm Gas Projectile is used to produce a toxic effect on personnel and to contaminate habitable areas. This projectile is fired from the M1 series, M45, M126 series, and M199 155mm howitzers.

8-4.2.2. Description. The M110 projectile, Figure 8-4.2, consists of a forged steel body containing a filler of 9.70 pounds of distilled mustard gas (HD) and a M6 burster. The burster consists of 0.83 pound of tetrytol in a thin steel or aluminum tube. The tetrytol filled tube is housed in the M1 burster casing which extends the full length of the projectile. The burster casing is assembled after the projectile cavity is filled with the HD agent. A threaded adapter, press fitted to the forward end of the burster casing, seals the nose end of the projectile. The projectile is issued unfuzed, with an eyebolt lifting plug threaded in the fuze adapter. A PD fuze is normally used with this projectile. A 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.

8-4.2.3. Functional Description. When the weapon is fired, the burning propellant generates rapidly expanding gases to propel the projectile through the barrel with the velocity required to reach the target. The soft alloy of the rotating band engages the barrel rifling to impart spin to the projectile for stability in flight. The rotating band also forms a seal to prevent escape of gas pressure past the projectile. The PD fuze functions on impact to explode the burster. The burster ruptures the projectile case and disperses the HD filler. The HD gas permeates the atmosphere on release and remains effective for more than 10 minutes.

8-4.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This projectile is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

SINCE THE BURSTER IN THIS PROJECTILE IS LOADED WITH TETRYTOL, THE PROJECTILE IS NOT TO BE STORED OR FIRED AT TEMPERATURES EXCEEDING +125°F.

8-4.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this projectile.

8-4.2.6. Shipping Containers. This projectile is packed eight per pallet. The filled pallet weighs approximately 797 pounds.

8-4.2.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this projectile is approximately 10.53 pounds.

8-4.2.8. Identification Data. The M110 projectile is listed under Drawing 75-14-317, NSN 1320-00-529-7352, and DODIC/NALC D543.

8-4.2.9. General Data. The following table provides general data on the M110 projectile:

Projectile Weight (as fired)	92.50 pounds
Filler Weight	9.70 pounds
Projectile Length (with eyebolt)	26.78 inches
Fuze	PD-M557, MTSQ-M520, or MTSQ-564
Burster	M 6
Burster Charge (Tetrytol)	0.83 pound
Propelling Charge	M3 (5.5 pounds) or M4A1 (13.2 pounds)
Primer	M82 or Mk 2A4
Muzzle Velocity	684 m.p.s.
Maximum Range	18,100 meters

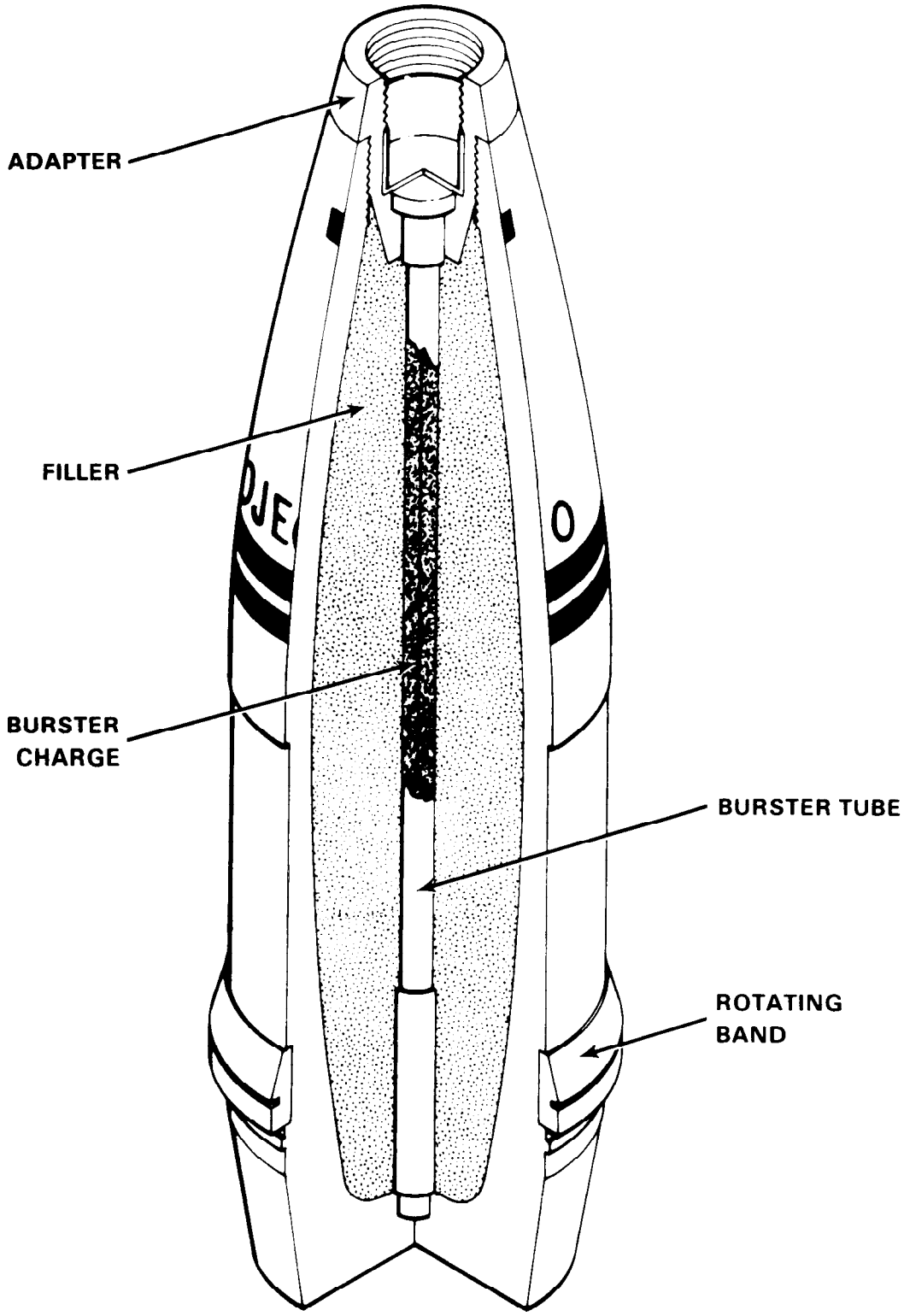


Figure 8-4.2. M110 HD 155mm Persistent Gas Projectile

8-4.3. PROJECTILE, 155MM, GAS, NON-PERSISTENT, GB, M121A1

8-4.3.1. Intended Use. The M121A1 GB Non-persistent 155mm Gas Projectile is used to produce a toxic effect on personnel and to contaminate habitable areas. This projectile is fired from the M1 series, M45, M126 series, M185, and M199 155mm howitzers.

8-4.3.2. Description. The M121A1 projectile, Figure 8-4.3, consists of a forged steel body containing a filler of 6.50 pounds of GB agent, supplementary 0.3 pound TNT charge, and M71 Burster. The M71 Burster is a thin metal cylinder filled with approximately 2.0 pounds of Composition B extending through the center of the M15 Burster Casing. The burster casing is assembled after the projectile cavity is filled with the GB agent. A threaded adapter, press fitted to the forward end of the burster casing, seals the nose end of the projectile. The projectile is issued unfuzed, with an eyebolt lifting plug threaded in the fuze adapter. A point detonating or proximity fuze is installed before loading in the weapon. When a proximity fuze is used, the supplementary charge is removed. A 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.

8-4.3.3. Functional Description. When the weapon is fired, the burning propellant generates rapidly expanding gases to propel the projectile through the barrel with the velocity required to reach the target. The soft alloy of the rotating band engages the barrel rifling to impart spin to the projectile for stability in flight. The rotating band also forms a seal to prevent escape of gas pressure past the projectile. When a PD fuze is used, the fuze detonates the supplementary charge on impact. The supplementary charge detonates the burster which ruptures the projectile case and heats the agent so that dispersal is in the gaseous state. When a proximity fuze is employed, detonation of the burster tube results directly from action of the fuze booster and occurs on approach to the target.

8-4.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This projectile is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

SINCE THE BURSTER IN THIS PROJECTILE IS LOADED WITH COMPOSITION B, THE PROJECTILE IS NOT TO BE STORED OR FIRED AT TEMPERATURES EXCEEDING +125°F.

8-4.3.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this projectile.

8-4.3.6. Shipping Containers. This projectile is packed eight per pallet. The filled pallet weighs approximately 831 pounds.

8-4.3.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this projectile is approximately 8.5 pounds.

8-4.3.8. Identification Data. The M121A1 projectile is listed under Drawing 8861030, NSN 1320-00-892-4186, and DODIC/NALC D542.

8-4.3.9. General Data. The following table provides general data on the M121A1 projectile:

Projectile Weight	101.23 pounds
Filler Weight	6.50 pounds
Filling Efficiency	6.43 percent
Projectile Length (with fuze)	27.54 inches
Maximum Diameter	6.09 inches
Fuze	PD-M557, Prox M514 series or M728
Burster	M71
Burster Charge	2.00 pounds
Propelling Charge	M3 (5.5 pounds) or M4A1 (13.19 pounds)
Primer	Mk 2A4
Muzzle Velocity	1850 f.p.s.
Maximum Range	14.920 meters

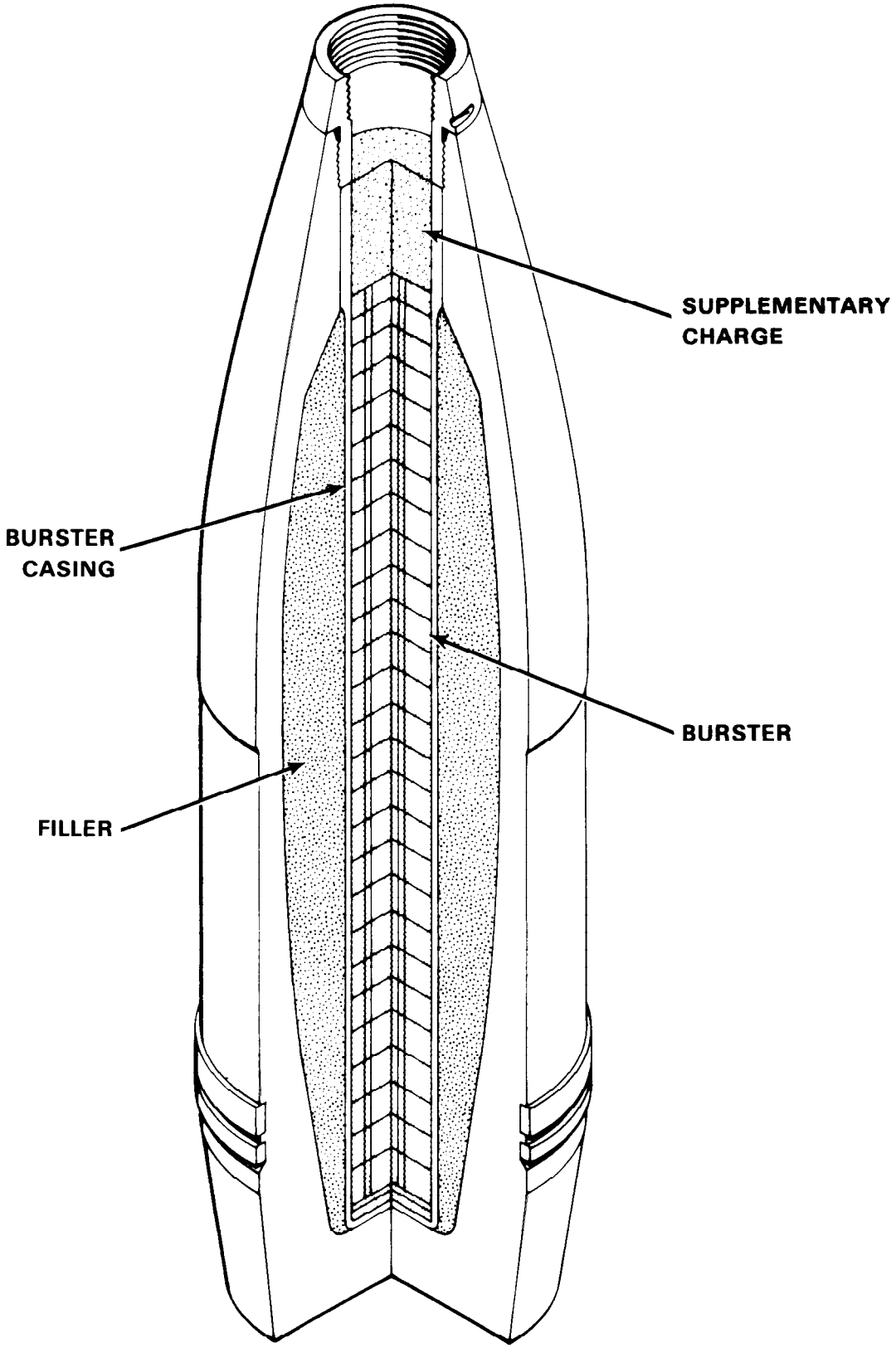


Figure 8-4.3. M121A1 GB 155mm Nonpersistent Gas Projectile

8-4.4. PROJECTILE, 155MM, GAS, PERSISTENT, VX, M121A1

8-4.4.1. Intended Use. The M121A1 VX Persistent 105mm Gas Projectile is used to produce a toxic effect on personnel and to contaminate habitable areas. This projectile is fired from the M1 series, M45, M126 series, M185 and M199 155mm howitzers.

8-4.4.2. Description. The M121A1 projectile, Figure 8-4.4, consists of a forged steel body containing a filler of 6.00 pounds of VX agent, supplementary 0.3 pound TNT charge, and M71 Burster. The M71 Burster is a thin metal cylinder filled with approximately 2.0 pounds of Composition B extending through the center of the M15 Burster Casing. The burster casing is assembled after the projectile cavity is filled with the VX agent. A threaded adapter, press fitted to the forward end of the burster casing, seals the nose end of the projectile. The projectile is issued unfuzed, with an eyebolt lifting plug threaded in the fuze adapter. A point-detonating or proximity fuze is installed before loading in the weapon. When a proximity fuze is used, the supplementary charge is removed. A 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.

8-4.4.3. Functional Description. When the weapon is fired, the burning propellant generates rapidly expanding gases to propel the projectile through the barrel with the velocity required to reach the target. The soft alloy of the rotating band engages the barrel rifling to impart spin to the projectile for stability in flight. The rotating band also forms a seal to prevent escape of gas pressure past the projectile. When a PD fuze is used, the fuze detonates the supplementary charge on impact. The supplementary charge detonates the burster which ruptures the projectile case and heats the agent so that dispersal is in the gaseous state. When a proximity fuze is employed, detonation of the burster tube results directly from action of the fuze booster and occurs on approach to the target.

8-4.4.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This projectile is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

SINCE THE BURSTER IN THIS PROJECTILE IS LOADED WITH COMPOSITION B, THE PROJECTILE IS NOT TO BE STORED OR FIRED AT TEMPERATURES EXCEEDING +125°F.

8-4.4.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this projectile.

8-4.4.6. Shipping Containers. This projectile is packed eight per pallet. The filled pallet weighs approximately 831 pounds.

8-4.4.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this projectile is approximately 8.0 pounds.

8-4.4.8. Identification Data. The M121A1 projectile is listed under Drawing 8861031, NSN 1320-00-756-2888, and DODIC/NALC D568.

8-4.4.9. General Data. The following table provides general data on the M121A1 projectile:

Projectile Weight	101.23 pounds
Filler Weight	6.0 pounds
Filling Efficiency	6.43 percent
Projectile Length (with Fuze)	27.54 inches
Maximum Diameter	6.09 inches
Fuze	PD-M557, Prox M514 series or M728
Burster	M71
Burster Charge	2.00 pounds
Propelling Charge	M3 (5.5 pounds) or M4A1 (13.19 pounds)
Primer	Mk 2A4
Muzzle Velocity	1850 f.p.s.
Maximum Range	14.920 meters

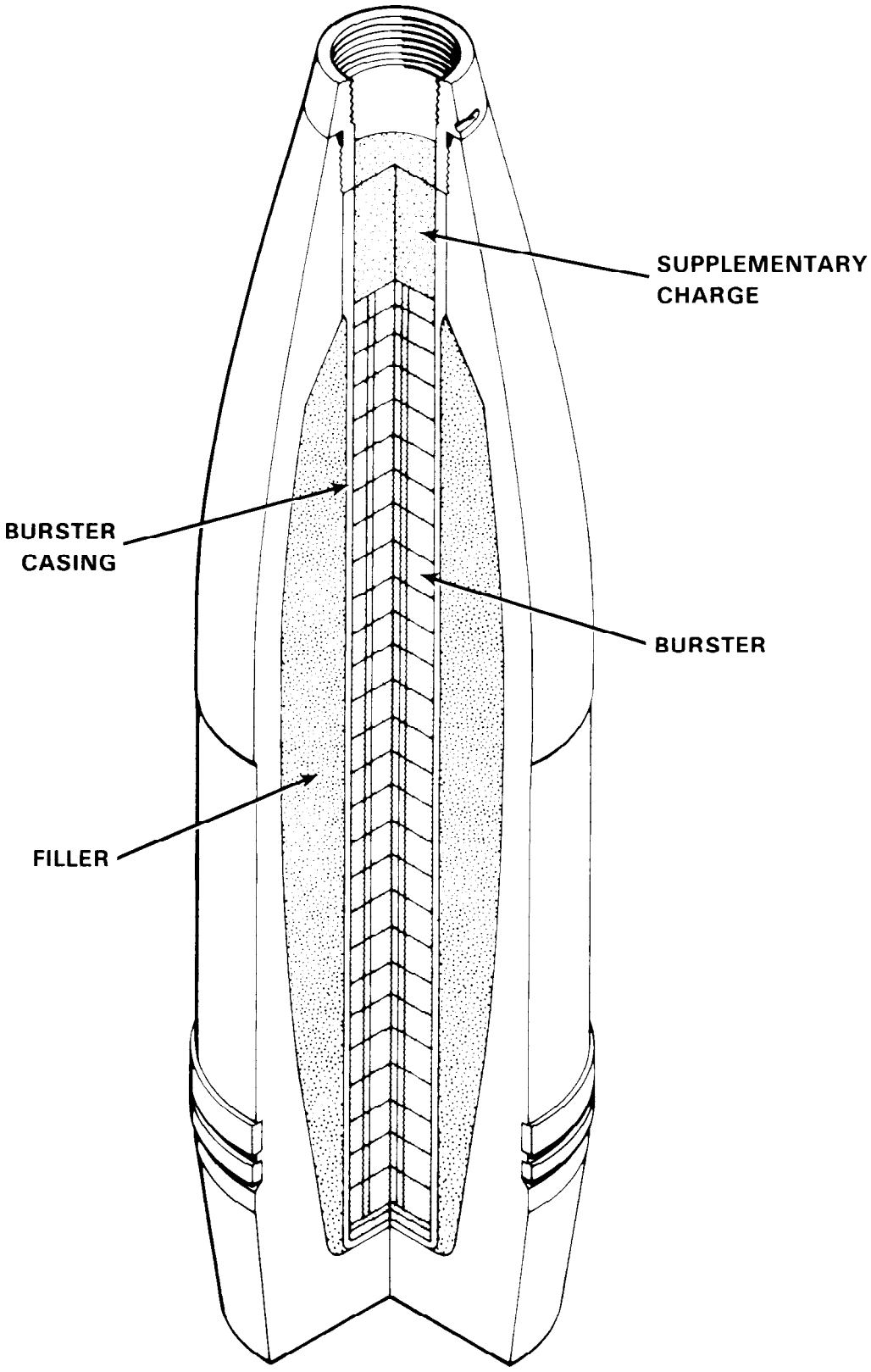


Figure 8-4.4. M121A1 VX 155mm Persistent Gas Projectile

8-4.5. PROJECTILE, 155MM, GAS, NON-PERSISTENT, GB, M122

8-4.5.1. Intended Use. The M122 GB Nonpersistent 155mm Gas Projectile is designed to provide toxic chemical offensive capability using the GB nerve agent. This projectile is fired from the M2 and M46 155mm guns.

8-4.5.2. Description. The M122 projectile, Figure 8-4.5, consists of a forged steel body containing a filler of 6.5 pounds of GB agent and a burster charge of 4.7 pounds of high explosives. 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 PD fuze. A 2-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 projectile body is painted gray with three green bands.

8-4.5.3. Functional Description. When the weapon is fired, the burning propellant generates rapidly expanding gases to propel the projectile through the barrel with the velocity required to reach the target. The soft alloy of the rotating band engages the barrel rifling to impart spin to the projectile for stability in flight. The rotating band also forms a seal to prevent escape of gas pressure past the projectile. Upon impact, the PD fuze detonates the burster which ruptures the projectile case and heats the agent so that dispersal is in the gaseous state.

8-4-5.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This projectile is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

SINCE THE BURSTER IN THIS PROJECTILE IS LOADED WITH HIGH EXPLOSIVES, THE PROJECTILE IS NOT TO BE STORED OR FIRED AT TEMPERATURES EXCEEDING +125°F.

8-4.5.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this projectile.

8-4.5.6. Shipping Containers. This projectile is packed eight per pallet. The filled pallet weighs approximately 804 pounds.

8-4.5.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this projectile is approximately 11.2 pounds.

8-4.5.8. Identification Data. The M122 projectile is listed under Drawing 75-14-704, NSN 1320-00-592-9034, and DODIC/NALC D483.

8-4.5.9. General Data. The following table provides general data on the M122 projectile:

Projectile Weight	97.78 pounds
Filler Weight	6.50 pounds
Filling Efficiency	6.65 percent
Projectile Length (with Fuze)	27.54 inches
Maximum Diameter	6.09 inches
Fuze	PD-508
Burster	M16
Burster Charge, M37	4.7 pounds HE
Propelling Charge, M19	31.6 pounds
Muzzle Velocity	2800 f.p.s.
Maximum Range	23,480 meters (super charged)

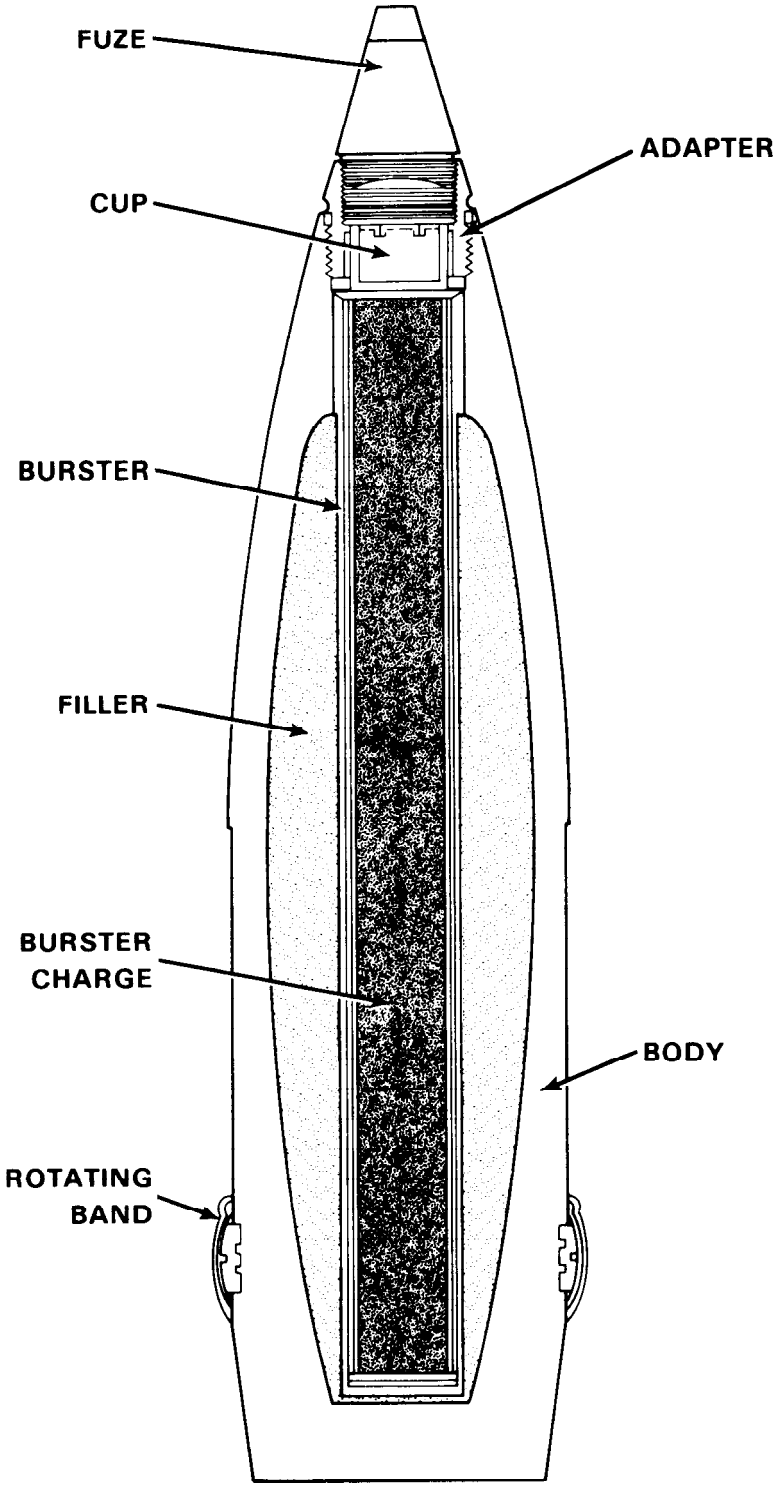


Figure 8-4.5. M122 GB 155mm Nonpersistent Gas Projectile

8-4.6. PROJECTILE, 155MM, GAS, GB2, BINARY, M687

8-4.6.1. Intended Use. The M687 Binary 166mm Gas Projectile is intended to provide a lethal agent retaliatory capability commensurate with existing system but will not present a lethal agent during storage and handling. This nonpersistent GB2 projectile is fired from the M126 and M198 155mm howitzers.

8 4.6.2. Description. This projectile, Figure 8-4.6, consists of a forged steel body with two separate canisters containing two relatively nontoxic chemicals. These two chemical canisters combine during functioning to produce the lethal GB2 agent for release on target. The two nontoxic chemical canisters are the M20 DF (difluoromethylphosphine oxide) Canister and the M21 OPA (isopropyl alcohol-isopropylamine) Canister. The M21 OPA Canister is kept separate from the munition during shipping and storage. The projectile is approximately 37.0 inches long and weighs 94.0 pounds. The M57 Burster and the M557 PD Fuze are located in the nose end of the projectile. A rotating band encircles the projectile body near the base and is protected by a grommet which is removed before loading the projectile into the weapon. The projectile is painted gray with one broken green band and one 0.50 inch wide broken green band near the forward end. A 0.25 inch solid yellow band is around the olive. The one 0.50 inch wide broken green band is covered with a gray rubber sleeve until the M21 OPA Canister is inserted into the projectile.

8-4.6.3. Functional Description. Prior to projectile firing, the base of the projectile is unthreaded and the cardboard spacer, installed in the M21 canister cavity, is removed. An M21 canister is installed, and the base is reinstalled. The plastic rotating band grommet and the rubber sleeve covering the one 0.50 inch wide broken green band are removed. The eyebolt plug is removed, and the fuze is assembled to the projectile. Upon projectile firing, setback force ruptures the M20 and M21 burst disks, allowing the DF and OPA to mix. Projectile spin further mixes and two fluids, forming GB2 agent. Upon impact, the fuze detonates the burster which ruptures the projectile body, causing dispersal of GB2 agent.

8-4.6.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This projectile is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

SINCE THE BURSTER IN THIS PROJECTILE IS LOADED WITH COMPOSITION B, THE PROJECTILE IS NOT TO BE STORED OR FIRED AT TEMPERATURES EXCEEDING +125°F.

8-4.6.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this projectile.

WARNING

USE COPIOUS AMOUNTS OF WATER TO WASH AFFECTED AREAS OF THE BODY, AND SEEK MEDICAL HELP IMMEDIATELY WHEN EXPOSED TO EITHER ISOPROPYL ALCOHOL-ISOPROPYLAMINE (OPA) OR DIFLUOROMETHYLPHOSPHINE OXIDE (DF). OPA IS A HIGHLY FLAMMABLE LIQUID AND EMITS HARMFUL VAPORS THAT WILL AFFECT THE HUMAN BODY. DF, WHEN EXPOSED TO AIR OR WATER, BECOMES HIGHLY ACIDIC, CAUSING IT TO BE VERY CORROSIVE. IT ALSO EMITS VAPORS HARMFUL TO THE HUMAN BODY.

8-4.6.6. Shipping Containers. The M687 binary projectile is packed (less the M21 OPA Canister) eight per wooden pallet. The filled pallet weighs approximately 825 pounds. The M21 OPA Canister is packaged, shipped, and stored separately from the projectile.

8-4.6.7. Explosive/Chemical Weight. The aggregate weight of the principal explosives and chemical components in this projectile is approximately 26.4 pounds.

8-4.6.8. Identification Data. The M687 projectile is listed under Drawing 100-70-135, Specification MIL-P-51434, NSN 1320-00-431-6259, and DODIC/NALC D594.

8-4.6.9. General Data. The following table provides general data on the M687 binary projectile:

Projectile Weight (filled)	93.00 pounds
Filler Weight (GB2)	24.20 pounds
Chemical Reactants	
M20 DF Canister	10.10 pounds
M21 OPA Canister	14.10 pounds
Projectile Length (with Fuze)	37.00 inches
Maximum Diameter	6.09 inches
Fuze	PD-M557
Burster	M57
Burster Charge	2.20 pounds

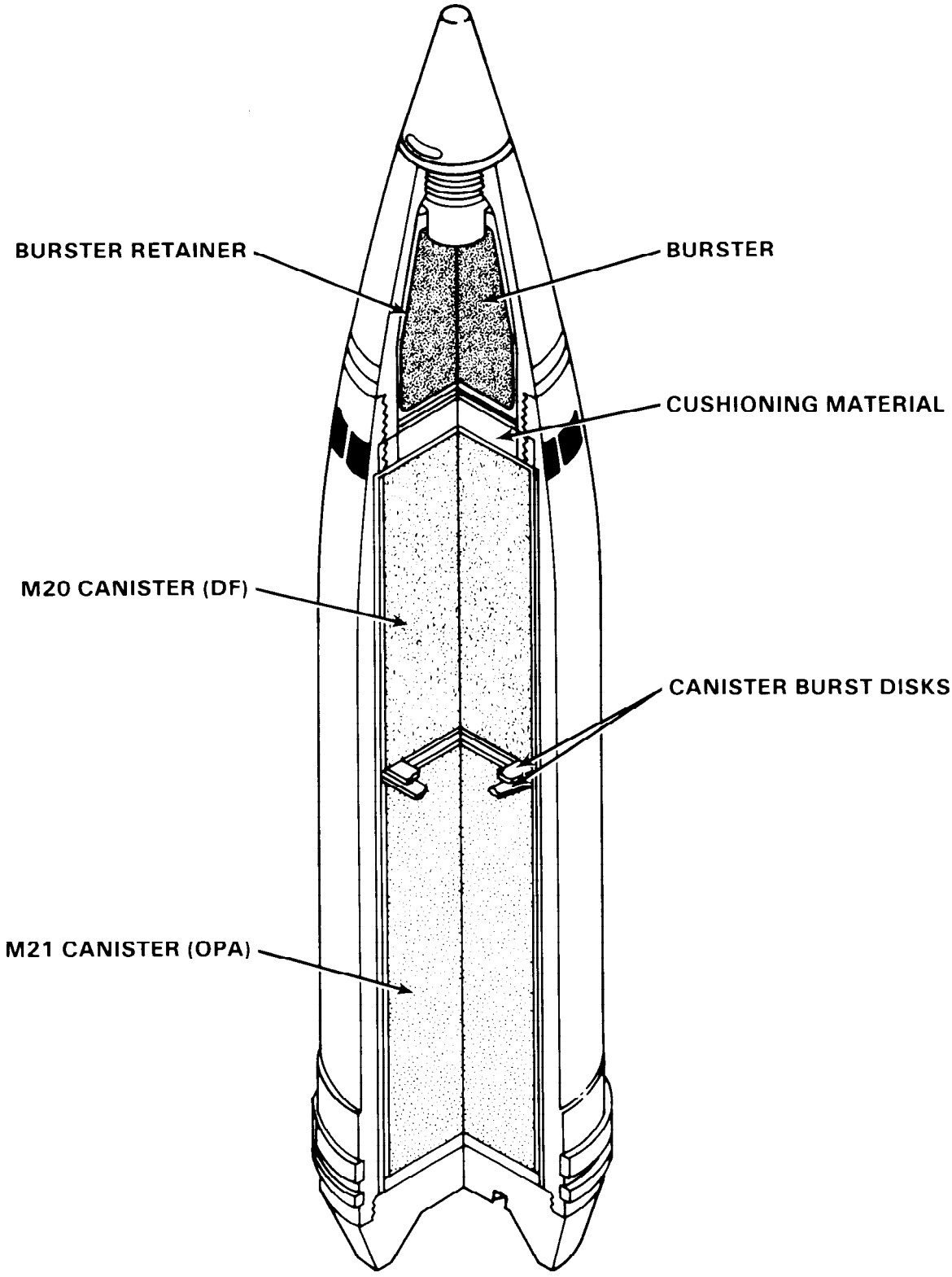


Figure 8-4.6. M687 GB2 Binary 155mm Gas Projectile

8-4.7. PROJECTILE, 8 INCH, GAS, NONPERSISTENT, GB, M426

8-4.7.1. Intended Use. The M426 GB Nonpersistent 8 Inch Gas Projectile is used to deliver and disperse the casualty producing GB agent. This projectile is fired from the M2 Series and M47 8 Inch cannons.

8-4.7.2. Description. The M426 GB projectile, Figure 8-4.7, is a hollow steel forging, ballistically similar to the standard HE Projectile M106. A tubular burster casing of thin metal, containing a Composition B4 burster, occupies the center of the shell and seals in the agent. The remainder of the interior space is filled with liquefied GB nonpersistent gas. A threaded steel adapter provides a receptacle for a point-detonating or proximity fuze. For shipment and handling, an eyebolt lifting plug is installed in the fuze cavity of the adapter. A rotating band of gilding metal encircles the casing near the rear, and is protected by a grommet.

8-4.7.3. Functional Description. Ignition of the primer by the breech firing pin results in ignition of the propelling charge. The burning propellant generates rapidly expanding gases to propel the projectile through the cannon barrel at the velocity required to reach the target. The rotating band of soft gilding metal is incised by the barrel rifling and imparts a high rate of spin to the projectile. The snug fit of the rotating band also serves to prevent escape of gas pressure past the projectile. The spin insures stable flight of the projectile. When a point-detonating fuze is employed, impact causes the fuze to detonate the supplementary charge and the supplementary charge detonates the burster tube. The burster ruptures the shell case, releasing the agent. The liquefied agent expands to a gaseous state by heating from the burster charge. If a proximity fuze is fitted, action on the burster tube is direct from the booster element of the fuze, and projectile rupture occurs on approach to the target.

8-4.7.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This projectile is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

SINCE THE BURSTER IN THIS PROJECTILE IS LOADED WITH COMPOSITION B, THE PROJECTILE IS NOT TO BE STORED OR FIRED AT TEMPERATURES EXCEEDING +125°F.

8-4.7.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this projectile.

8-4.7.6. Shipping Containers. This projectile is packed six per pallet. The filled pallet weighs approximately 1253 pounds.

8-4.7.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this projectile is approximately 22.91 pounds.

8-4.7.8. Identification Data. The M426 GB projectile is listed under Drawing 8860620-1, NSN 1320-00-892-4305, and DODIC/NALC D696.

8-4.7.9. General Data. The following table provides general data on the M426 GB projectile:

Projectile Weight	200.0 pounds
Filler Weight	15.90 pounds
Filling Efficiency	7.85 percent
Projectile Length (with Fuze)	35.11 inches
Maximum Diameter	7.99 inches
Fuze	PD-M557, Prox M514 series or M728
Supplemental Charge	0.26 pound
Burster Charge	6.95 pounds
Propelling Charge	M2 (28.3 pounds) or M1 (13.3 pounds)
Primer	Mk 2A4
Muzzle Velocity	1950 f.p.s.
Maximum Range	16,900 meters

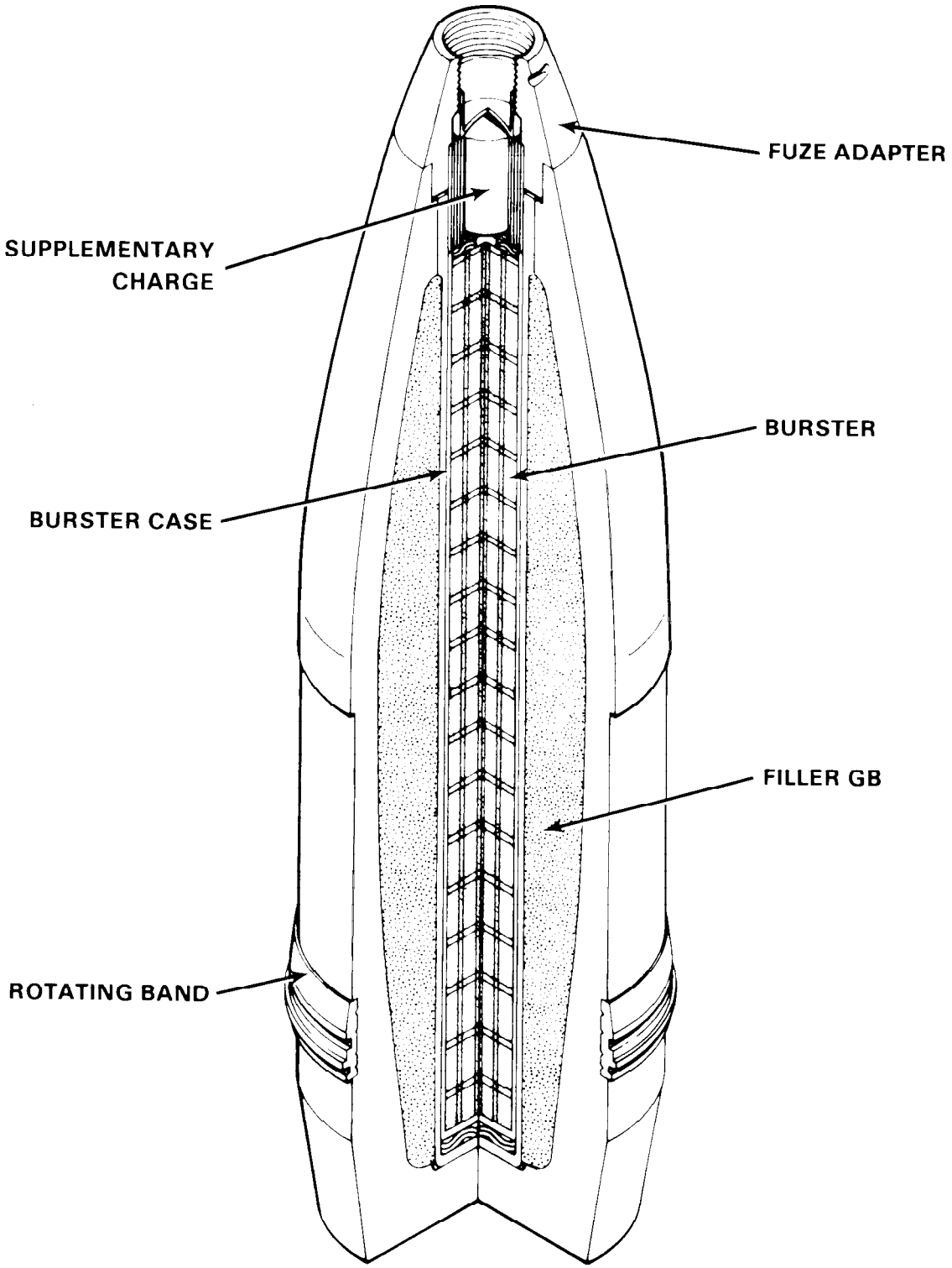


Figure 8-4.7. M426 GB 8 Inch Nonpersistent Gas Projectile

8-4.8. PROJECTILE, 8 INCH, GAS, PERSISTENT, VX, M426

8-4.8.1. Intended Use. The M426 VX Persistent 8 Inch Gas Projectile is used to deliver and disperse the casualty producing VX agent and to contaminate habitable areas. This projectile is fired from the M2 Series and M47 8 Inch cannons.

8-4.8.2. Description. The M426 VX projectile, Figure 8-4.8, is a hollow steel forging, ballistically similar to the standard HE Projectile M106. A tubular burster casing of thin metal, containing a Composition B4 burster, occupies the center of the shell and seals in the agent. The remainder of the interior space is filled with liquefied VX persistent gas. A threaded steel adapter provides a receptacle for a point-detonating or proximity fuze. For shipment and handling, an eyebolt lifting plug is installed in the fuze cavity of the adapter. A rotating band of gilding metal encircles the casing near the rear, and is protected by a grommet.

8-4.8.3. Functional Description. Ignition of the primer by the breech firing pin results in ignition of the propelling charge. The burning propellant generates rapidly expanding gases to propel the projectile through the cannon barrel at the velocity required to reach the target. The rotating band of soft gilding metal is incised by the barrel rifling and imparts a high rate of spin to the projectile. The snug fit of the rotating band also serves to prevent escape of gas pressure past the projectile. The spin insures a stable flight of the projectile. The spin insures stable flight of the projectile. When a point-detonating fuze is employed, impact causes the fuze to detonate the supplementary charge and the supplementary charge detonates the burster tube. The burster ruptures the shell case, releasing the agent. The liquefied agent expands to a gaseous state by heating from the burster charge. If a proximity fuze is fitted, action on the burster tube is direct from the booster element of the fuze, and projectile rupture occurs on approach to the target.

8-4.8.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This projectile is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

SINCE THE BURSTER IN THIS PROJECTILE IS LOADED WITH COMPOSITION B, THE PROJECTILE IS NOT TO BE STORED OR FIRED AT TEMPERATURES EXCEEDING +125°F.

8-4.8.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this projectile.

8-4.8.6. Shipping Containers. This projectile is packed six per pallet. The filled pallet weighs approximately 1253 pounds.

8-4.8.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this projectile is approximately 22.91 pounds.

8-4.8.8. Identification Data. The M426 VX projectile is listed under Drawing 8860620-2, NSN 1320-00-892-4306, and DODIC/NALC D695.

8-4.8.9. General Data. The following table provides general data on the M426 VX projectile.

Projectile Weight	200.0 pounds
Filler Weight	14.10 pounds
Filling Efficiency	7.85 percent
Projectile Length (with Fuze)	35.11 inches
Maximum Diameter	7.99 inches
Fuze	PD-M557, Prox M514 series or M728
Supplemental Charge	0.26 pound
Burster Charge	6.95 pounds
Propelling Charge	M2 (28.3 pounds) or M1 (13.3 pounds)
Primer	Mk 2A4
Muzzle Velocity	1950 f.p.s.
Maximum Range	16,900 meters

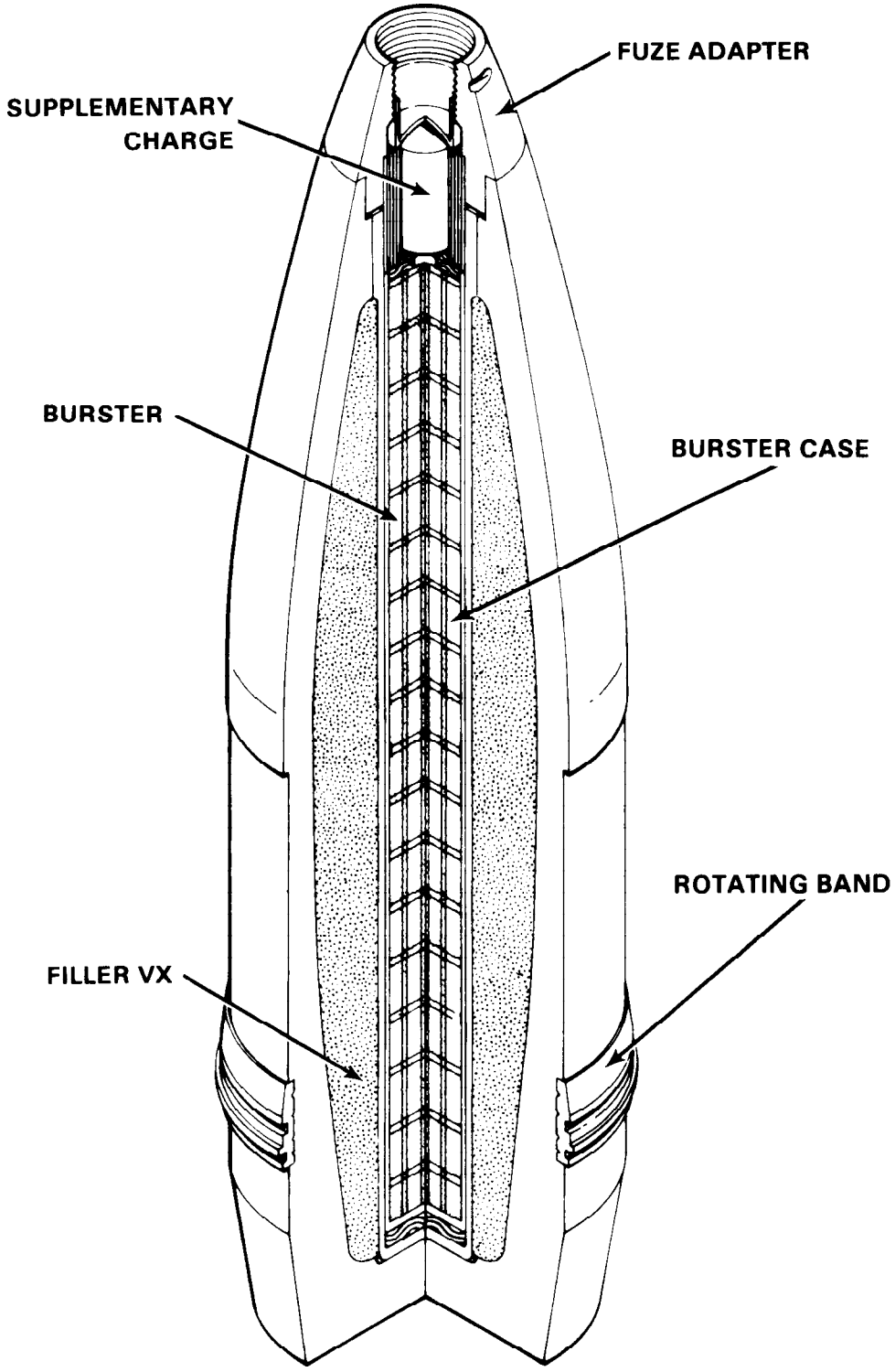


Figure 8-4.8. M426 VX 8 Inch Persistent Gas Projectile

CHAPTER 9

CHEMICAL MINES

9-1. INTRODUCTION

This chapter provides general and technical information on chemical land mines which are used to disperse toxic chemical agents from fixed locations.

9-1.1. GENERAL. These mines are designed to provide area contamination in barrier and nuisance minefields. The chemical agent may be in liquid or vapor form. The chemical mine may be used in anti-tank minefields or elsewhere as an antipersonnel mine. Composite minefields containing chemical land mines and HE antipersonnel anti-tank mines are particularly effective. The presence of HE mines reduces traversal speed, thereby forcing greater exposure to chemical contaminates. The presence of chemical mines slows breaching operations as it discourages rapid mine-clearing techniques. Chemical land mines may be initiated by action of the enemy or by remote control. Chemical mines are shipped empty, with the exception of the chemical mine M23. All chemical mines depend on blast effect for dispersing the chemical agent. The weather, type terrain, and soil affect the period of time for which these chemical agents are effective.

Table 9-1. Chemical Mines

Item	Paragraph	Agent	Agent Weight
Mine, Chemical Agent, M23	9-2.1	VX	10.5 pounds
Mine, Chemical Agent, M1	9-2.2	HD	9.9 pounds

9-2. LAND MINES

9-2.1. MINE, CHEMICAL AGENT, VX, M23

9-2.1.1. Intended Use. The M23 VX Chemical Agent Mine is designed to provide obstacles that restrict enemy movement. The mine is usually employed in combination with high explosive mines in mine fields to contaminate demolition work.

9-2.1.2. Description. The M23 mine, Figure 9-2.1, is similar in size, shape, and function to the M15 antitank mine. The 2-gallon persistent VX mine is approximately 13.00 inches in diameter, 5.0 inches high, and weighs 22.9 pounds (unfuzed). The mine can be identified visually and by touch by the eight raised projections spaced in pairs, at 90° intervals, around the periphery of the top of the mine. Primary fuzing consists of the M603 fuze, in the top of the mine, which is activated by a belleville spring assembly requiring a pressure of 300 to 400 pounds for activation. Secondary fuzing consists of a side and bottom fuze wells designed to accept the standard M1 activator and the M1A1, M2, M3, or M5 firing device. Secondary fuzing provides an antipersonnel capability by booby trapping. The mine is painted gray with green markings, and three green bands and one yellow band are used to indicate a nerve agent filling and a high explosive content, respectively.

9-2.1.3. Functional Description. Before planting the mine, the safety fork in the M603 fuze is removed, the fuze is inserted into the top fuze well, and the arming plug is installed. After planting the mine, the indicator knob on the arming plug is turned to the ARMED position, and an arming plug shutter is placed directly over the fuze pressure plate. The mine is now armed. A pressure of 300 to 400 pounds on the mine pressure plate compresses the belleville spring in the fuze and causes the arming plug shutter to press the fuze pressure plate downward. Force on the fuze plate depresses the belleville spring which snaps the firing pin into the detonator, initiating the detonator, booster, and burster, which disperses the toxic VX agent.

9-2.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This mine is designated as a Group A Chemical Ammunition for handling and storage purposes.

9-2.1.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this mine.

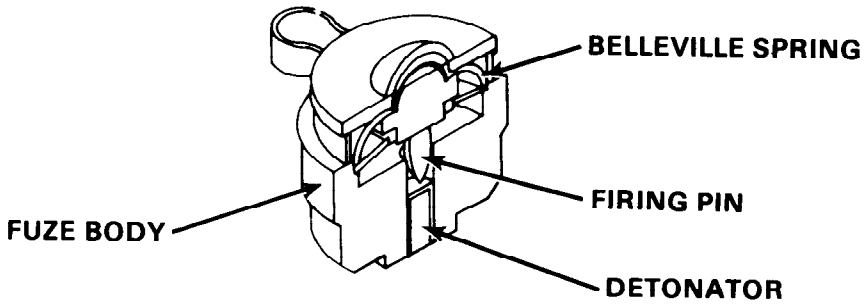
9-2.1.6. Shipping Containers. This mine is packaged three per steel drum with 3 primary (M603) fuzes and 3 M1 activators included. The filled drum weighs approximately 155 pounds.

9-2.1.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this mine is approximately 11.5 pounds.

9-2.1.8. Identification Data. The M23 mine is listed under Drawing 37-1-13, NSN 1345-00-542-1580, and DODIC/NALC K257.

9-2.1.9. General Data. The following table provides general data on the M23 mine:

Mine Weight (unfuzed)	22.90 pounds
Filler Weight	10.50 pounds
Maximum Height	5.00 inches
Maximum Diameter	13.00 inches
Fuze	M603
Booster (RDX)	M120 (11.0 grams)
Burster Charges (Composition B)	13.00 ounces



FUZE

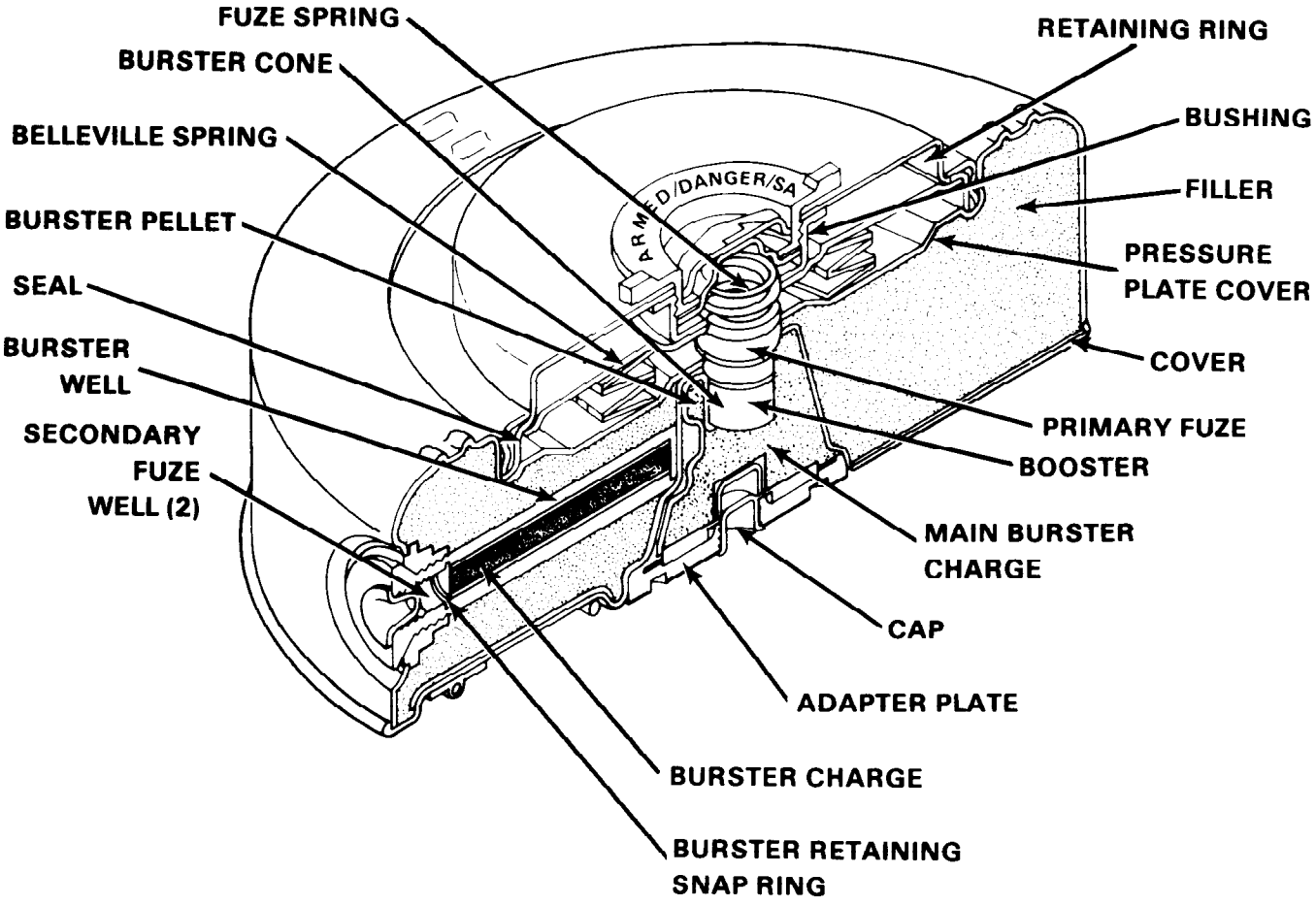


Figure 9-2.1. M23 VX Chemical Agent Gas Mine

9-2.2. MINE, CHEMICAL AGENT, M1

9-2.2.1. Intended Use. The M1 Chemical Mine Agent is used to disperse persistent HD distilled mustard agent from fixed locations. The mine is used to provide area contamination in barrier and interdictory mine fields. In training exercises this mine is filled with non-toxic MR simulated mustard.

9-2.2.2. Description. This mine, Figure 9-2.2, consists of a 1-gallon rectangular metal can approximately 10.56 inches high, 6.56 inches wide, and 4.12 inches deep fitted with a carrying handle and a threaded cap. The cap is lined with a rubber or cork gasket and faced with lead foil. Two short copper wires are soldered to one side of the mine for use when attaching a burster charge. The capacity of the mine is 1.1 gallons, which allows for a 10-percent void when the mine is filled with 1 gallon of liquid filler. The mine is painted gray with green markings. Two green bands are used to indicate a persistent agent filling. The mine is filled in the field with approximately 9.9 pounds (1.0 gallon) of HD or MR.

9-2.2.3. Functional Description. After the mine is filled and bursting charge attached (usually detonating cord), the mine is planted with the bursting charge down. The bursting charge is detonated and disperses the chemical filling of the mine over a radius of approximately 5.0 yards.

9-2.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. The filled mine is designated as a Group A Chemical Ammunition for handling and storage purposes.

CAUTION

FILLED MINES SHOULD NOT BE STORED FOR MORE THAN 30 DAYS AND SHOULD BE VENTED PERIODICALLY TO PREVENT PRESSURE FROM BUILDING UP AND TO MINIMIZE LEAKS.

9-2.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this mine.

9-2.2.6. Shipping Containers. This mine is packaged 10 (empty) per fiber container. The filled container weighs approximately 15 pounds.

9-2.2.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this mine is approximately 9.9 pounds.

9-2.2.8. Identification Data. The empty mine is listed under Drawing 37-5-5, NSN 1345-00-289-6938, and DODIC/NALC K260.

9-2.2.9. General Data. The following table provides general data on the M1 mine:

Weight (filled)	11.0 pounds
Height	10.56 inches
Width	6.56 inches
Depth	4.12 inches
Capacity	1.10 gallons
Material	Light Gage Metal
Filler Agent	H D
Filler Weight	9.90 pounds
Bursting Charge	Detonating Cord (4-foot length)

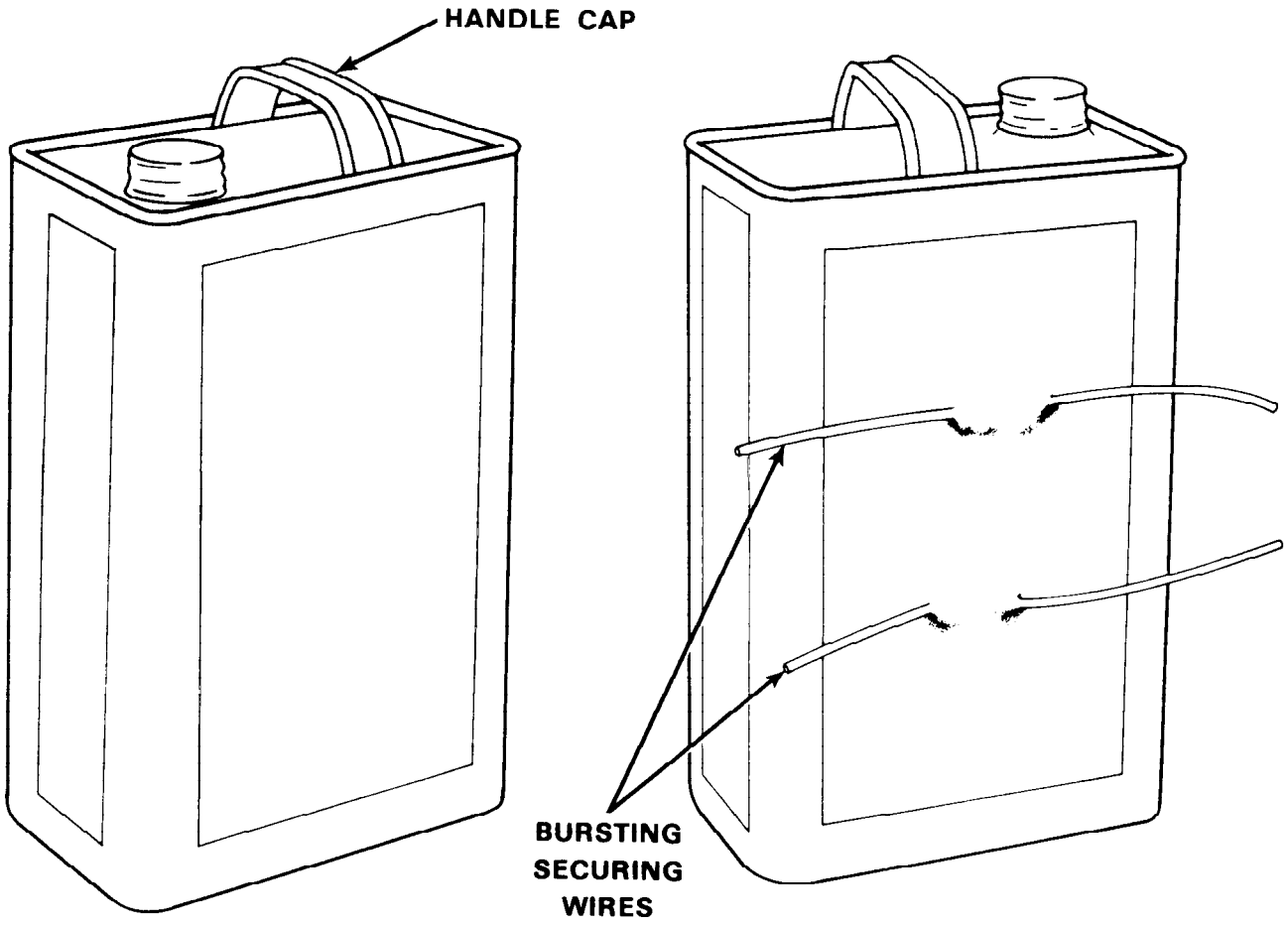


Figure 9-2.2. M1 Chemical Agent Mine

CHAPTER 10

CHEMICAL BOMBS AND CLUSTERS

10-1. INTRODUCTION

This chapter describes large chemical bombs and riot control clusters which are used for aerial delivery of toxic chemical and riot control agents.

10-1.1. GENERAL. A chemical bomb is composed of all the component parts required to drop and function a bomb. The design of each bomb determines what component parts constitute a complete round. A typical complete round is composed of a bomb body, a chemical filling, a tail fin, burster or igniter, one or more fuzes, and arming wires.

Bombs in classes above 100 pounds are regarded as large. Nominal weight classification is an approximate dimensional weight equivalent which does not necessarily agree with actual weight.

The bodies of large bombs are round in cross section and have rounded or ogival noses and tapered rear sections. Large bomb bodies which must withstand high internal pressure are forged or cast from steel; when internal pressures are not high, the bodies are made of thin sheet steel or aluminum. Large bomb bodies are equipped with lugs for suspension from aircraft bomb stations. The lugs may be attached permanently to the bomb body (older style bombs), or in some instances, (new types), they are removable.

The standard toxic agent fillings for chemical bombs are HD (distilled mustard) and GB. GB is classed as a nonpersistent agent and HD as persistent. Chapter 4 presents the characteristics of these agents individually.

Tail fins stabilize falling bombs. On large bombs, fins usually consist of four metal vanes supported by a framework and are installed on the bomb immediately before loading the munition in an aircraft.

A burster is an explosive charge designed to be used to burst the body and release the filling in a chemical bomb. Bursters are not used with bombs that rupture on impact.

An arming wire is used to prevent a bomb fuze from being armed while installed in an aircraft until the time for the drop. An arming wire consists of one or two brass wires fitted with a swivel loop and includes one or more safety clips.

Bombs and their components are assigned names at the time they are made standard items of issue. The name then becomes the standard nomenclature by which the item is identified and stocked. The standard nomenclature of bombs includes the name of the type of item, nature of contents, military symbol for filling, the weight classification, and the model number; for example: Bomb, Gas, Nonpersistent, GB, 500-Pound Mk 94 Mod 0.

Table 10-1. Chemical Bombs and Clusters

Item	Paragraph	Agent	Agent Weight
Bomb, Chemical Agent, 500-pound Mk 94 Mod 0	10-2.1	GB	108.0 pounds
Bomb, Chemical Agent, 500-pound, Mk 116 Mod 0	10-2.2	GB	347.0 pounds
Cluster, Canister, Riot Control, 50 pound, M158	10-3.1	CS	23.9 pounds

10-2. CHEMICAL BOMBS

10-2.1. BOMB, CHEMICAL AGENT, MK 94 MOD 0

10-2.1.1. Intended Use. The Mk 94 Mod 0 Chemical Agent Bomb is intended for the aerial delivery of the toxic chemical agent GB on selected targets to incapacitate enemy personnel.

10-2.1.2. Description. This bomb, Figure 10-2.1, is essentially a Mk 82 GP fin-stabilized, low-drag bomb which has been modified for GB filling. The modification consists largely in the elimination of the electric cable conduits from the low drag bomb and adding a burster and a filling hole. This 500-pound nonpersistent GB bomb consists of a bomb body, fin assembly, arming wire, nose fuze, long-stem tail fuze, burster tube, suspension, and hoisting lugs. The body is of steel construction with a minimum wall thickness of 0.4 inch, and is painted gray with green markings and three green bands around the body. Two suspension lugs are spaced 14 inches apart, with a hoisting lug located at the center of gravity. The lugs are screwed into the body. A burster well extends the length of the body cavity. The walls at the nose and tail end of the welded bomb body are internally threaded to receive the burster retainer and the metal plug, respectively. The burster retainer is screwed into the nose after installation of the explosive burster. A nose fuze adapter is then screwed into the nose to accommodate the nose fuze. The tail end of the body is threaded to receive the metal plug.

When the bomb is filled with GB agent, a void is left for expansion. Helium is injected into this void and is used to check seal integrity. The filling hole (charging well) is closed by installation of a steel ball as a primary seal, and a steel plate, resistance welded to the body, as a secondary seal.

Shipping plugs are installed in the nose and tail of the body. The hoisting lug is wrapped and packed in the tail shipping plug and a steel shipping cap is installed over the rear of the body. The burster, fuze, arming wire, fin assembly, and hoisting lug are packaged and shipped separately. The suspension lugs are packaged and shipped in the fin assembly case.

The burster, fuze, arming wire, and fin assembly are assembled to the bomb body in the field or aboard the aircraft carrier, to form a complete round.

10-2.1.3. Functional Description. When the bomb is released from the aircraft, the arming wire is withdrawn permitting the fuze to arm. The nose fuze detonates upon impact. The nose fuze initiates the burster which explodes the bomb and disperses the chemical agent.

10-2.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This bomb is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

WHEN HANDLING THE MK 94 NONPERSISTENT GAS BOMB, PERSONNEL, SHOULD WEAR IMPERMEABLE PROTECTIVE CLOTHING, CONSISTING OF BUTYL RUBBER SUIT, HOOD, GLOVES, BOOTS, AND FOOT COVERS, IMPREGNATED UNDERWEAR, SOCKS, AND GLOVES, AND PROTECTIVE MASKS TO GUARD AGAINST LEAKING GB.

10-2.1.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this bomb.

10-2.1.6. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this bomb is approximately 125 pounds.

10-2.1.7. Identification Data. The Mk 94 bomb is listed under Drawing LD 165800, NSN 1325-00-566-0324, and DODIC/NALC E384.

10-2.1.8. General Data. The following table provides general data on the Mk 94 bomb:

Length of assembled bomb (with fuze)	88.79 inches
Body diameter	10.75 inches
Fin span	15.06 inches
Weight of empty bomb body	278.0 pounds
Filling	G B
Filling weight	108.0 pounds
Weight of assembled bomb	441.0 pounds
Arming wire assembly	M6A2
Burster (HBX-1)	16.1 pounds
Nose fuze	M904E2

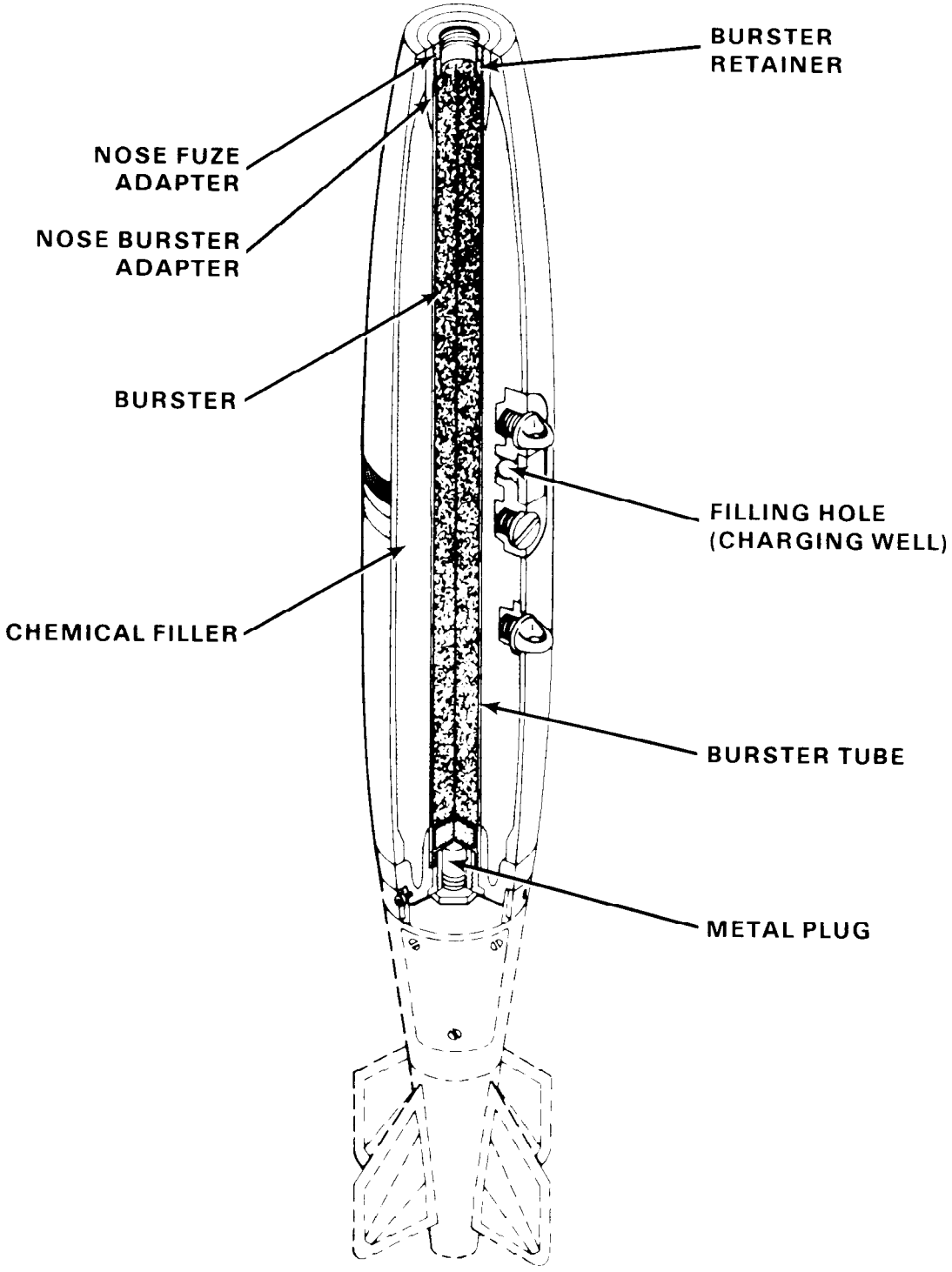


Figure 10-2.1. Mk 94 Mod 0 Chemical Agent Bomb

10-2.2. BOMB, CHEMICAL AGENT, MK 116 MOD 0

10-2.2.1. Intended Use. The Mk 116 Mod 0 Chemical Agent Bomb (Weteye) is intended for aerial delivery of the toxic chemical nerve agent GB on selected targets to incapacitate enemy personnel.

10-2.2.2. Description. This bomb, Figure 10-2.2, is an airdropped, free-fall, fin-stabilized chemical bomb containing approximately 347.0 pounds of nerve agent GB. This 500-pound gas bomb consists of a light weight aluminum body approximately 7.7 feet long and 14.0 inches in diameter with a nose fuze on the front end and an extendible fin assembly on the base end. The extendible fin assembly, which is spring-loaded, is activated immediately after the bomb is released from the aircraft. A strongback cradle with attaching lugs is secured to the bomb by two support bands. The bomb contains a central burster consisting of four burster charges each containing 5.5 pounds of cast Composition B. An adapter booster containing 6.9 ounces of tetryl is located behind the fuze well. The bomb is painted gray with a green band and a yellow band around the center of the body. The green band indicates a toxic chemical agent filler, and the yellow band indicates a high explosive.

10-2.2.3. Functional Description. When the bomb is released from the aircraft, the arming wire is withdrawn, allowing the fuze to arm. At the same time, the fin-release wire is withdrawn, activating the spring-tension extendible fins. Upon impact the fuze functions, initiating the tetryl booster which ignites the burster. The burster explodes the bomb and disseminates the GB nerve agent.

10-2.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This bomb is designated as a Group A Chemical Ammunition for handling and storage purposes.

WARNING

WEAR ADEQUATE PROTECTIVE CLOTHING AND A PROTECTIVE MASK DURING ALL LOADING AND HANDLING PROCEDURES.

WARNING

USE CAUTION WHEN WORKING AROUND THE UNACTUATED FINS. THE EXTENDIBLE FINS ARE UNDER SPRING TENSION, AND RELEASE OF THESE COMPONENTS COULD CAUSE SERIOUS INJURY.

10-2.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this bomb.

10-2.2.6. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this bomb is approximately 369.5 pounds.

10-2.2.7. Identification Data. The Mk 116 bomb is listed under Drawing LD 270366, NSN 1325-00-890-7937, and DODIC/NALC E382.

10-2.2.8. General Data. The following table provides general data for the Mk 116 bomb:

Bomb Weight (filled)	562.0 pounds
Filler Weight	347.0 pounds
Bomb Length	7.7 feet
Maximum Diameter	14.0 inches
Fuze	Nose only
Booster (tetryl)	6.9 ounces
Burster (Composition B)	22.0 pounds

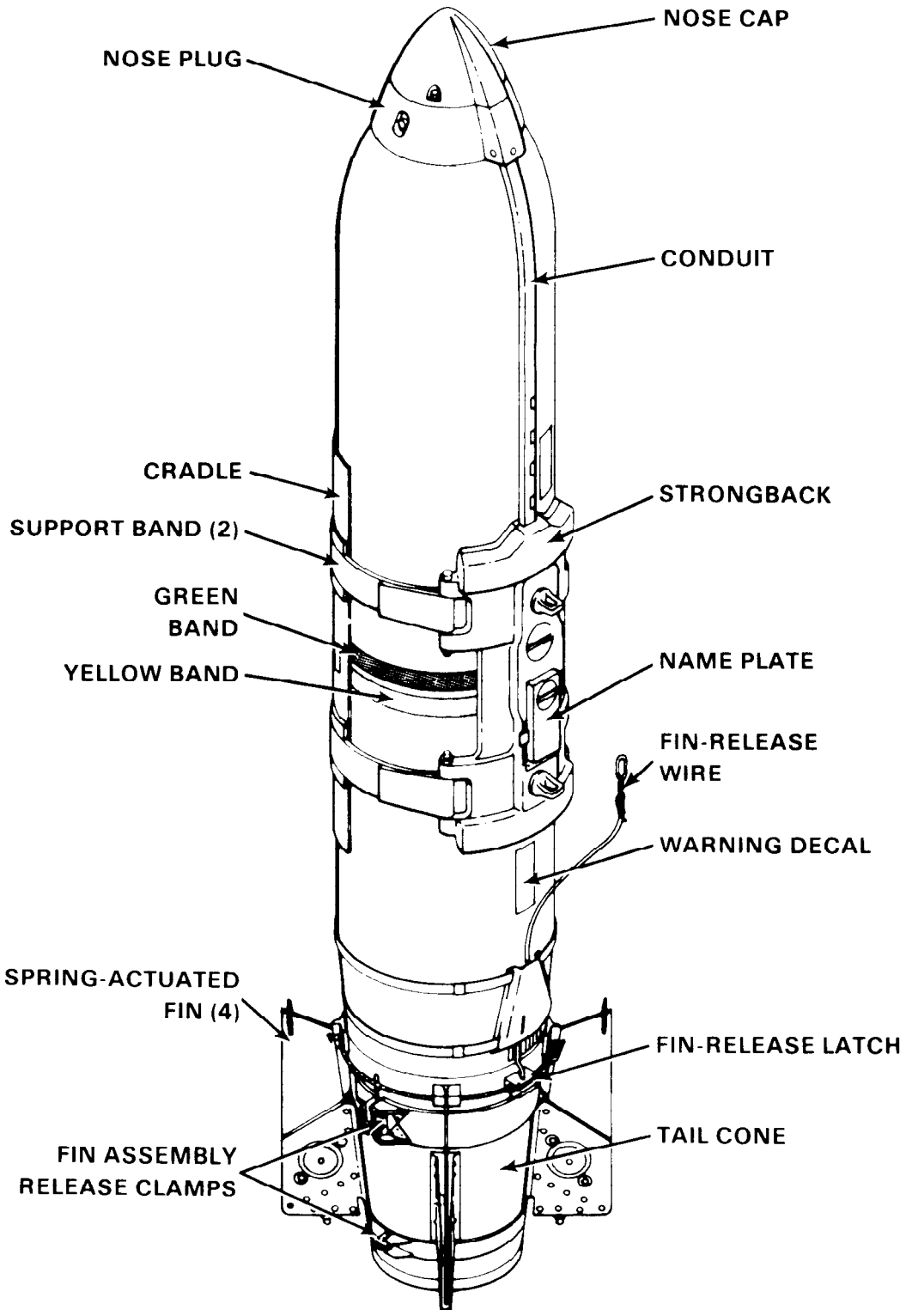


Figure 10-2.2. Mk 116 Mod 0 Chemical Agent Bomb

10-3. CHEMICAL CLUSTERS

10-3.1. CLUSTER, CANISTER, RIOT CONTROL, CS, M158

10-3.1.1. Intended Use. The M158 CS Riot Control Canister Cluster is used for aerial delivery of CS on selected targets at various altitudes. The cluster is pushed out of helicopters and is tactically used to deploy large quantities of CS canisters.

10-3.1.2. Description. The M158 50-pound cluster, Figure 10-3.1, is approximately 27 inches long, 10.10 inches high, and 8.50 inches wide. The cluster consists of eight plastic modules heat-sealed together and fastened to a fuze bar assembly. The eight modules each contain 33 M16 Riot Control CS canisters. The 264 CS canister each contain approximately 1.45 ounces of CS pyrotechnic mixture, 0.76 gram of black powder, and 1.0 gram of ignition composition. The fuze assembly with a E63R2 or E63R3 initiator is installed on the fuze bar assembly. The fuze bar assembly contains a pyrotechnic delay which leads from the modules to two junction blocks. The fuze assembly has a RDX detonator, and two lead-azide primers, each containing less than 1.0 gram of explosive. The two junction blocks each contain less than 1.0 gram of XM3 composition. The cluster is clear and has a band of gray tape with a single red stripe encircling the midsection.

10-3.1.3. Functional Description. Before hand dropping the cluster, the E63R3 initiator is installed and the altitude is set. The safety plug is removed, and the arming wire is attached to the aircraft. When the cluster drops from the aircraft, the arming wire withdraws, releasing the spring-loaded arming pin. The mechanical timer starts and, after the preset time has elapsed, the spring-loaded slide release pin in the initiator body moves upward, withdrawing the pin from the fuze on the cluster. This action releases the spring-loaded detonator slide in the fuze housing. The detonator slide strikes the firing pin and initiates the detonator which, in turn, detonates two primers. The primers ignite a pyrotechnic delay train that travels through the fuze bar, the junction blocks, and to each of the eight modules. This action ignites an igniter cup that fires the expelling charge which separates the modules. The end modules separate 2.4 seconds after drop, with two modules (one from each end) separating at 0.5-second intervals thereafter. Simultaneously, each expelling charge ignites its module canister.

10-3.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This cluster is designated as a Group B Chemical Ammunition for handling and storage purposes.

10-3.1.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this cluster.

10-3.1.6. Shipping Containers. This cluster is packaged one per fiberboard container and sealed in a moisture proof bag. The sealed bag is packed in a cushion-lined wooden box. The filled box weighs approximately 92.0 pounds.

10-3.1.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this cluster is approximately 25.9 pounds.

10-3.1.8. Identification Data. The M158 cluster is listed under Drawing 14-23-1867, NSN 1325-00-930-5866, and DODIC/NALC F497.

10-3.1.9. General Data. The following table provides general data on the M158 cluster:

Length	27.00 inches
Width	8.50 inches
Height	10.10 inches
Canister (264)	M16
Filler Agent	CS
Filler Weight	23.9 pounds
Fuze	E63R2 or E63R3

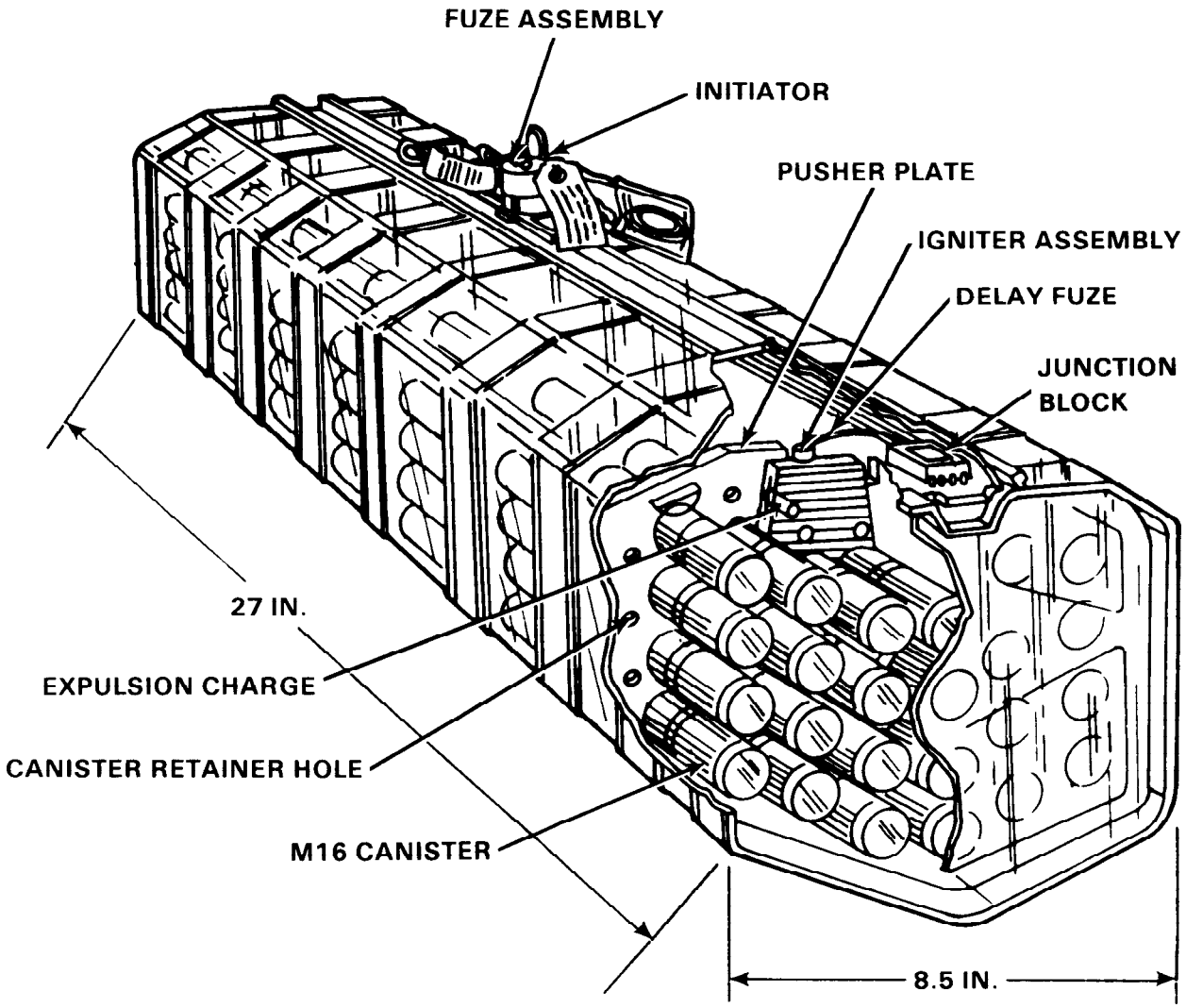


Figure 10-3.1. M158 CS Riot Control Canister Cluster

CHAPTER 11

CHEMICAL SPRAY TANKS

11-1. INTRODUCTION

This chapter provides general and technical information on the various chemical spray tanks.

11-1.1. GENERAL. Chemical spray tanks are bulk containers of an aerodynamic configuration which are designed for external attachment to the underside of an aircraft for the dissemination of toxic chemical agents, smokes, and incapacitating chemical agents. Agents that may be distributed by the tanks described in this chapter are included in Chapter 4.

Two of the tanks carry their own air supply for spraying, while the third tank utilizes ram air that enters the tank after the pilot fires nose and tail explosive charges to open an air passage through the agent container. The three tanks under discussion are controllable by the pilot.

Table 11-1. Chemical Spray Tanks

Item	Paragraph	Agent	Agent Weight
Spray Tank, Liquid Aircraft, Aero 14B	11-2.1	As Required	84 gallons
Spray Tank, Airborne, Aero 15A	11-2.2	As Required	31 gallons
Tank, Chemical, Aircraft, Mk 12 Mod 0	11-2.3	FS Smoke	38 gallons

11-2. SPRAY TANKS

11-2.1. SPRAY TANK, LIQUID AIRCRAFT, AERO 14B

11-2.1.1. Intended Use. The Aero 14B Liquid Aircraft Spray Tank is designed to provide chemical offensive capability as a pressure spray, single fluid, air-to-surface system.

11-2.1.2. Description. This spray tank, Figure 11-2.1, is a pressure-controlled, combination storage and airborne dispersion system for various liquid chemical agents such as GB and VX nerve agents. The spray tank consists of a nose assembly, center section, tail section, pressure control system, and discharge nozzle assembly. The nose assembly contains a 1800 psi tank with regulator that can reduce the tank pressure to 100 psi for operation. The discharge nozzle is located at the rear of the tail section. Four removable fins are attached to the tail section. The center section contains the agent reservoir. A pneumatically operated valve controlled by the pilot releases the agent through the discharge tube. Two integral lugs, spaced 30 inches apart, are provided for tank attachment to the underside of the aircraft. A minimum of two fins are required for gravity drop, although four are provided on the normal spray tank. The fins are adjustable in 45 degree increments. No fins are required for ejector type racks.

11-2.1.3. Functional Description. The liquid aircraft spray tank can be filled in the field with VX or GB agent or other agents as required. When approaching the target, the pilot activates the tank by an electrical switch coupled to the pneumatic valve through the electrical connector on top of the center section. The agent is then forced out through the nozzle in the tail by the air released from the pressure tank in the nose section. Exact operational area coverages vary with prevailing meteorological conditions and reports of developmental results are of a secret nature. Six to twenty gallons of liquid per second can be disseminated in continuous or intermittent bursts.

11-2.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This spray tank is designated as a Group A Chemical Ammunition for handling and storage purposes.

11-2.1.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this spray tank.

11-2.1.6. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this filled spray tank is approximately 750 pounds.

11-2.1.7. Identification Data. The Aero 14B spray tank is listed under Drawing 54A50E1.

11-2.1.8. General Data. The following table provides general data on the Aero 14B spray tank:

Filled weight	Up to 1554 pounds
Empty weight	660 pounds
Overall length	190.0 inches
Maximum diameter	22.0 inches
Agent capacity	84 gallons
Tank pressure	1800 psi
Operating pressure	100 psi
Suspension	2 lugs, 30 in. apart
Used with	Aircraft A-1, A-4 and AF-1E
Dispensing rate	6 to 20 g.p.s.
Shipping weight	
Center section container (with spray tank empty)	909 pounds
Center section container (with spray tank filled)	1810 pounds (max.)
Components container	650 pounds
Filling unit used	Filling Unit, Chemical Tank, Mk 4 Mod 0

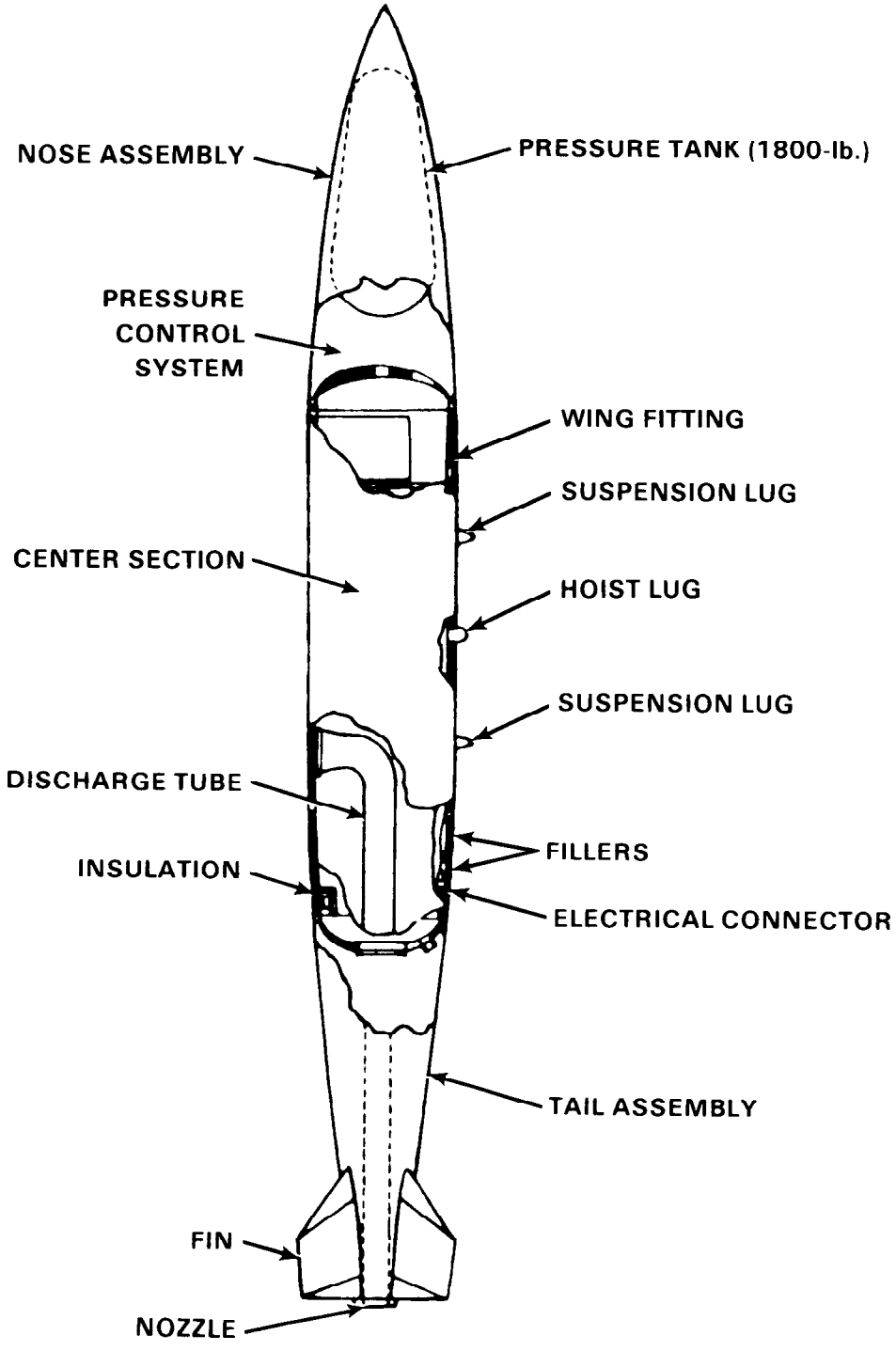


Figure 11-2.1. Aero 14B Liquid Aircraft Spray Tank

11-2.2. SPRAY TANK, AIRBORNE, AERO 15A

11-2.2.1. Intended Use. The Aero 15A Airborne Spray Tank is a system designed to disseminate insecticide and various liquid agents from a helicopter. With minor modifications, the system can be adapted to operate from ground vehicles or small agricultural aircraft. A control box mounted in the cockpit allows the tank or tanks to be fired at will by the pilot.

11-2.2.2. Description. The Aero 15A Spray Tank, Figure 11-2.2, is cylindrical and is constructed of heavy aluminum. Rounded nose and tail fairings provide minimum resistance under low speed aerodynamic conditions. The tank has a capacity of 31 gallons with 5 gallons space reserved as a void. Spray action power is provided by a spherical pressure bottle with filtered compressed air or compressed nitrogen. The high pressure gas supply is controlled by a pressure regulator that maintains 50 psi on the agent storage reservoir. To disseminate the agent from the tank, the pilot activates that spray tank control box switch.

A low pressure gauge is mounted in a cutout in the nose fairing, and the pilot can view this gauge through the cockpit window to be sure the pressure required to disseminate agent is present.

The heart of the Aero 15A tank is the pressure control system assembly. Its main components are the pressure bottle and holder assembly, bottle valve, safety head and regulator assembly, low pressure gauge, solenoid valve, and check valve. This system is mounted on the forward part of the agent reservoir, except for the solenoid valve which is mounted on the rear of the reservoir. The front end components are protected by the nose fairing.

The pressure bottle receives its gas charge through a filter assembly that contains a check valve, purifying filter and high pressure gauge.

A bottle valve distributes filtered, compressed air or nitrogen from the bottle to the pressure regulating 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 d.c., electrically operated solenoid valve controlled by the pilot's control box.

The safety head and regulator assembly incorporates a pressure regulator, relief valve, low pressure rupture disc, a bleeder and various couplings. The regulator provides the uniform 50 psi to expel agent from the reservoir. The relief valve is set at 75 psi, and the rupture disc is set at 100 psi to prevent over-pressurization of the tank and regulator. The safety bleeder releases any pressure left in the regulated line after use.

The outlet valve mounted on the rear of the agent reservoir and sheltered by the tail fairing controls the discharge of agent from the reservoir. The outlet valve is opened by the same electrical impulse as the bottle valve; the bottle valve releases high pressure air which passes through a check valve and travels through a tube back to the gas chamber of the outlet valve. This high pressure air moves a piston within the chamber, allowing the agent from the reservoir to pass through a cylinder and out through an attached spray boom. The piston is spring-loaded so that it will return and insure tight sealing of the outlet valve.

The discharge nozzle assembly can be attached to the output of the outlet valve in any of three positions: horizontal left, horizontal right, or straight down. The boom accommodates 21

nozzles. Two sets of nozzles are supplied, one set providing 4 g.p.m. delivery, the other 20 g.p.m. Combinations of these interchangeable nozzles will produce intermediate delivery rates.

11-2.2.3. Functional Description. When installing the spray tanks on the helicopter, the nozzles are oriented for left or right side delivery, and each nose fairing is oriented so that the low pressure gauges will face the cockpit windows.

The tank reservoir may be filled before mounting on the helicopter. The complete assembly may be placed on a scale and carefully filled until the total weight of the spray tank reaches 375 pounds. Any spillage must be washed off the equipment. The nose fairing is removed, and the pressure bottle charged with clean dry air or nitrogen from a pneumatic system. The air is applied to the filler check valve.

The nose fairing is replaced, and the tank is lifted into place on the aircraft bomb hooks. Only after checking that the pilot's control box switch is in the OFF position, is the tank coupled to the electrical lead from the aircraft.

Five seconds before approaching the target area, the pilot sets the cockpit control box to the ON position to allow the tanks to become pressurized. This will insure the tank spraying at full flow rate at the edge of the spray track.

For subsequent intermittent firing, throw the ON-OFF switch on the cockpit control box to the ON or OFF position as desired to start or stop discharge. After the initial firing, the delay time is small and can be neglected.

Spray tactics for insects are based on low altitude (50 to 100 feet) and low airspeed (approximately 35 knots) where the aircraft downwash distributes the insecticide or agent across the terrain. This process is similar to a large spray gun. Under special circumstances, where downwash is negligible, it might be desirable to spray at a higher altitude, and higher airspeed, and in a direction normal to the wind field. Under these conditions, the ground dosage distribution will vary considerably from that of low-altitude and low airspeed spraying.

An increase in spray altitude above 100 feet will increase evaporation losses. An altitude of roughly 500 feet under warm weather can produce considerable mass loss of agent due to evaporation.

The flow rate required increases with altitude and airspeed. The ground dosage will decrease with increasing airspeed and altitude as the tank is operated at a fixed flow rate.

The drift distance of drops becomes greater with altitude and windspeed and care has to be taken to insure adequate ground dosages.

The drift distance increases or the drops get smaller with the larger drops falling out closer to the flight line.

The swath width increases with increasing altitude; however, the spray tends to fall out on the downwind side of the flight path. The flight path should be adjusted upwind so the fallout is in the target area.

Best results for crosswind spraying will be obtained in low windspeeds with thermal inversions. For best results, this technique should be supervised by personnel familiar with the numerous variable associated with the diffusion of aerosols and sprays by wind fields.

Normal spraying from a helicopter will be conducted with the spray booms in the horizontal position. At the recommended spraying speeds, downwash from the aircraft assists in distributing the insecticide over the terrain; hence, for best results, it is necessary to align the spray boom so that the aerodynamic forces

can produce their optimum effect. The optimum pitch attitude can be established by fastening a wool tuft on an outboard position of the boom and observing the downwash angle. Multiple holes are provided on the mounting end of the boom for setting the boom in close. It is necessary to mount the boom in this manner to prevent insecticide from blowing back on the boom and producing large droplets of agent. It is advisable to place the small flow rate nozzles on the outboard position of the spray boom. This allows aerodynamic forces to spread the smaller droplets out to the edges of the swath.

11-2.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This spray tank is designated as a Group A Chemical Ammunition for handling and storage purposes.

11-2.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this spray tank.

11-2.2.6. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this filled spray tank is approximately 260 pounds.

11-2.2.7. Identification Data. The Aero 15A spray tank is listed under Drawing 57A9821.

11-2.2.8. General Data. The following table provides general data on the Aero 15A spray tank:

Empty weight	111.0 pounds
Filled weight	375.0 pounds
Agent weight	260.0 pounds
Overall length	57.75 inches
Maximum diameter	22.00 inches
Boom length	26.40 inches
Net agent capacity	31.0 gallons
Bottle pressure	800 psi at 70°F
Operating pressure	50 psi
Suspension	2 lugs, 14 inches apart
Used with	Helicopter UH-34
Dispensing rate	4 to 20 g.p.m.
Center of gravity loaded	At station 34.10 inches
Pressure bottle diameter	15.18 inches
Electrical requirements	27 watts inductive, 24 volts d.c. 37 watts inductive, 28 volts d.s.

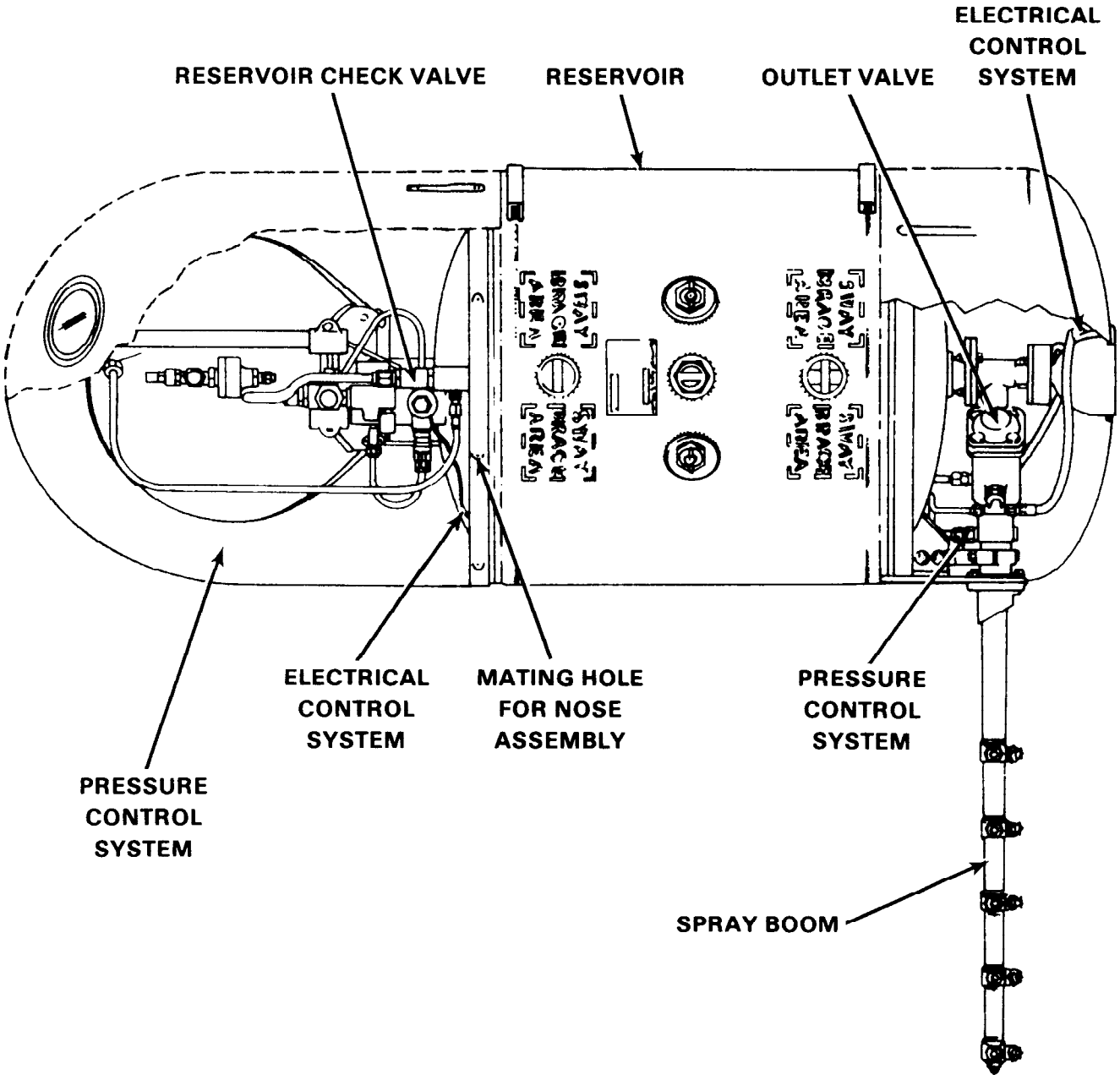


Figure 11-2.2. Aero 15A Airborne Spray Tank

11-2.3. TANK, CHEMICAL, AIRCRAFT, MK 12 MOD 0

11-2.3.1. Intended Use. The Mk 12 Mod 0 Aircraft Chemical Tank is designed to generate a smoke screen from an aircraft. It provides for chemical smoke screen capability for high performance aircraft. The tank is mounted on wing bomb racks.

11-2.3.2. Description. The Mk 12 tank, Figure 11-2.3 is approximately 108.0 inches long and 12.0 inches in diameter. The smoke agent is contained in 500 perforated aluminum spheres which are expelled from the rear door of the tank and float to earth spilling their smoke agent as they fall in altitude and drift in trajectory. Half the spheres are drilled with a 1/2-inch hole and half are drilled with a l/8-inch hole. The smoke agent readily spills out of the 1/2-inch hole type spheres, disseminating its curtain in the air. The smoke agent remains inside the spheres with the 1/8-inch holes until the spheres strike the earth and shatter, building up a ground based curtain of smoke. The free smoke liquid surrounding the spheres inside the tank forms the uppermost portion of the three-level smoke screen. The ground impact points are so dense that the individual clouds merge to form a solid wall that is carried downwind.

A glass plate is used as a closure in the nose inlet and when shattered permits ram air to be used as the discharge pressure to distribute the smoke filled spheres.

The aft closure tailplate is hinged at the bottom and is secured by a mechanism activated by a Mk 1 Mod 0 explosive bolt. The bolt is electrically fired by a 24 volt d.c. signal from the cockpit at the same moment the nose detonator is fired to shatter the glass plate.

The configuration of the tank causes a downward deflection of its slip stream. The main section of the tank is a steel-epoxy sandwich structure consisting mainly of a 14-inch diameter outer shell and a 12-inch diameter inner tank. The inner tank is the container for the smoke agent and the aluminum spheres. Threaded steel filling plug fitting are welded between the inner tank and outer tank. A steel hardback provides four bomb rack mounting holes on either 14-inch or 30-inch centers. A steel conduit between the inner tank and outer shell protects the electrical wiring harness.

The tank must be filled by means of a special closed system vacuum filling unit to keep the smoke agent from coming into contact with the atmosphere. The associated Chemical Tank Filling Unit, Mk 1 Mod 0 (paragraph 13-2.1) evacuates the storage chamber to 26 to 28 inches of mercury. This causes smoke agent to flow from its storage container into the inner tank through the filler hole and completely fills the spheres and the void around them with little entrapment of air. Ten sets of spheres and gaskets are supplied for refilling each tank.

The smoke agent, FS, is a liquid mixture of 55 percent sulfur trioxide and 45 percent chlorosulfonic acid. This mixture reacts with the moisture in the air forming sulfuric acid droplets which refract and scatter light to form the screen.

11-2.3.3. Operation. The tank is first inspected for integrity of gaskets and electrical insulation. A new glass air inlet seal is seated in the nose closure. The tank is then tilted and filled with 500 aluminum spheres, half with large holes and half with small, thoroughly mixed. The rear closure is closed and sealed, and the explosive bolt, minus its impulse cartridge is installed.

The tank is now filled with smoke agent using the prescribed chemical filling unit. Personnel must wear transparent face masks and protective clothing. The tank should not be filled until close to operational flight time, and should never be used as a storage vessel.

For best results, the aircraft should approach the target area at an altitude below 300 feet. The tank becomes operative when the pilot closes the 24 volt d.c. power circuits to the nose inlet detonator and the tail closure explosive bolt. This opens the tank at both ends. Ram air enters the nose ejecting the contents of the tank, both free liquid and spheres which are deflected downward from the aircraft. A single tank will produce a smoke screen approximately 1200 feet long. If two tanks are used in succession, the length of the screen is approximately doubled. Exact length of the smoke screen is related to aircraft speed. High humidity conditions enhance the effectiveness of the screen.

WARNING

AIRCRAFT SHOULD NEVER LAND WITH FULL TANKS; IN CASE OF AN ABORTIVE MISSION, THE CONTENTS MUST BE DISCHARGED IN A SAFE AREA. IN THE EVENT THAT EITHER NOSE OR TAIL EXPLOSIVES FAIL TO DETONATE, THE SMOKE CANNOT ESCAPE PROPERLY, AND THE TANK MUST BE JETTISONED.

11-2.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This tank is designated as a Group B Chemical Ammunition for handling and storage purposes.

11-2.3.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this tank.

11-2.3.6. Identification Data. The Mk 12 tank is listed under Drawing LD 546080 and NSN 1040-00-802-3469.

11-2.3.7. General Data. The following table provides general data on the Mk 12 tank:

Weight empty	350 pounds
Weight full	1000 pounds
Length	108.0 inches
Outside diameter	14.0 inches
Inside diameter	12.0 inches
Agent capacity	38 gallons
Filler	500 2.7 in. diameter sphere (250 drilled with 1/8-in. hole) (250 drilled with 1/2-in. hole)
Suspension	2 lugs, 14 inches apart; 2 lugs, 30 inches apart
Used with	USN (A-4, AF-1E) aircraft
Agent	FS Smoke agent
Electrical power	24 volts d.c. from aircraft
Electrical detonator	Mk 83 Mod 0
Explosive bolt	Mk 1 Mod 0
Shipping weight	583 pounds
Shipping cubage	39.5 cubic feet
Filling unit used	Filling unit, Vacuum Chemical, Mk 1 Mod 0
Smoke coverage	1200 foot curtain

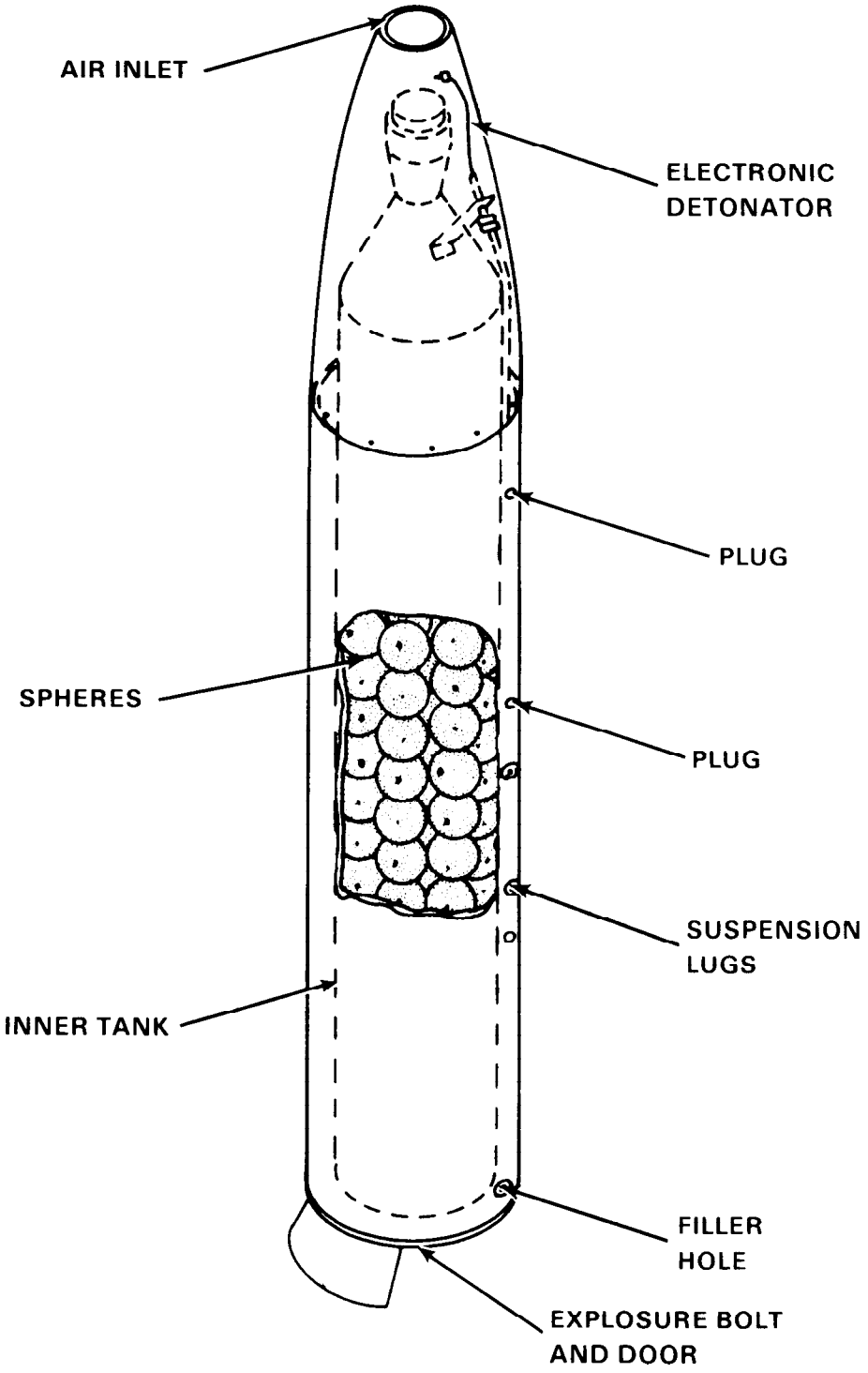


Figure 11-2.3. Mk 12 Mod 0 Aircraft Chemical Tank

CHAPTER 12

CHEMICAL AGENT BULK CONTAINERS

12-1. INTRODUCTION

This chapter describes chemical agent bulk containers and associated transfer equipment.

12-1.1. GENERAL. Chemical agent bulk containers are vessels designed for the storage and shipment of bulk quantities of dangerous liquids. The containers may be used to store agents that are gaseous at atmospheric pressure, to store liquids at atmospheric pressure to prevent their vaporization, or can be used to store liquids that produce a violent reaction when coming into contact with the atmosphere. The containers are equipped with suitable fittings to permit the closed-system transfer of dangerous or atmosphere-activated liquids into the spray tanks or bombs with which they are to be used. Figure 12-2.1 is a typical external view of the three bulk containers discussed in this chapter. Figure 12-2.2 shows the distinguishing characteristics of the three types described. Army publications, TM 3-255, Chemical Filling and Handling Equipment, gives more detailed instructions for filling, venting, and draining one-ton containers.

12-1.2. SAFETY PRECAUTIONS. Conduct filling and transfer operations downwind from personnel. Be sure that all receptacles to be filled are clean, dry, and leakproof. Make certain that all fittings are tight, and that all items of equipment used are in good working condition. Be sure that personnel are thoroughly familiar with the characteristics of the equipment being used. Have first aid supplies and equipment available for instant use. See NAVMED P-5041 for information on treatment of casualties.

12-1.2.1. Protective Clothing. See that all personnel handling chemical agent are equipped with protective masks (TM 3-4240-202-15) and protective clothing (TM 3-304).

12-1.2.2. Decontamination. Have on hand decontamination materials and apparatus required for the chemical being handled. See Chapters 4 and 5 of this manual and TM 3-220 for information on decontamination.

12-1.2.3. Special Precautions for Handling FS. Carefully remove any resinous coating that appears in the bottoms of receptacles. This coating, which is a partially solidified rust preventive compound, reacts slowly with FS causing dangerous pressure to build up in the receptacle after it has been filled and closed. If the coating can be only partially removed, make sure that the receptacle is vented properly until the reaction between the FS and the coating has ceased.

WARNING

FS REACTS VIOLENTLY WITH WATER. THE REACTION RELEASES HEAT AND CAUSES SULFURIC ACID TO BE FORMED. WHEN LOADING FS INTO A RECEPTACLE, BE SURE THAT PERSONNEL STAY AWAY FROM OPENINGS IN THE RECEPTACLE UNTIL ANY VIOLENT REACTION HAS SUBSIDED. START FS FLOWING SLOWLY, AND STOP THE FLOW IMMEDIATELY IF A VIOLENT REACTION TAKES PLACE. RESUME THE FLOW WHEN THE REACTION HAS CEASED.

Table 12-1. Chemical Agent Bulk Containers

Item	Paragraph	Capacity
Container, One-Ton, Type A	12-2.1	170 gallons
Container, One-Ton, Type D	12-2.2	170 gallons
Container, One-Ton, Type E	12-2.3	170 gallons

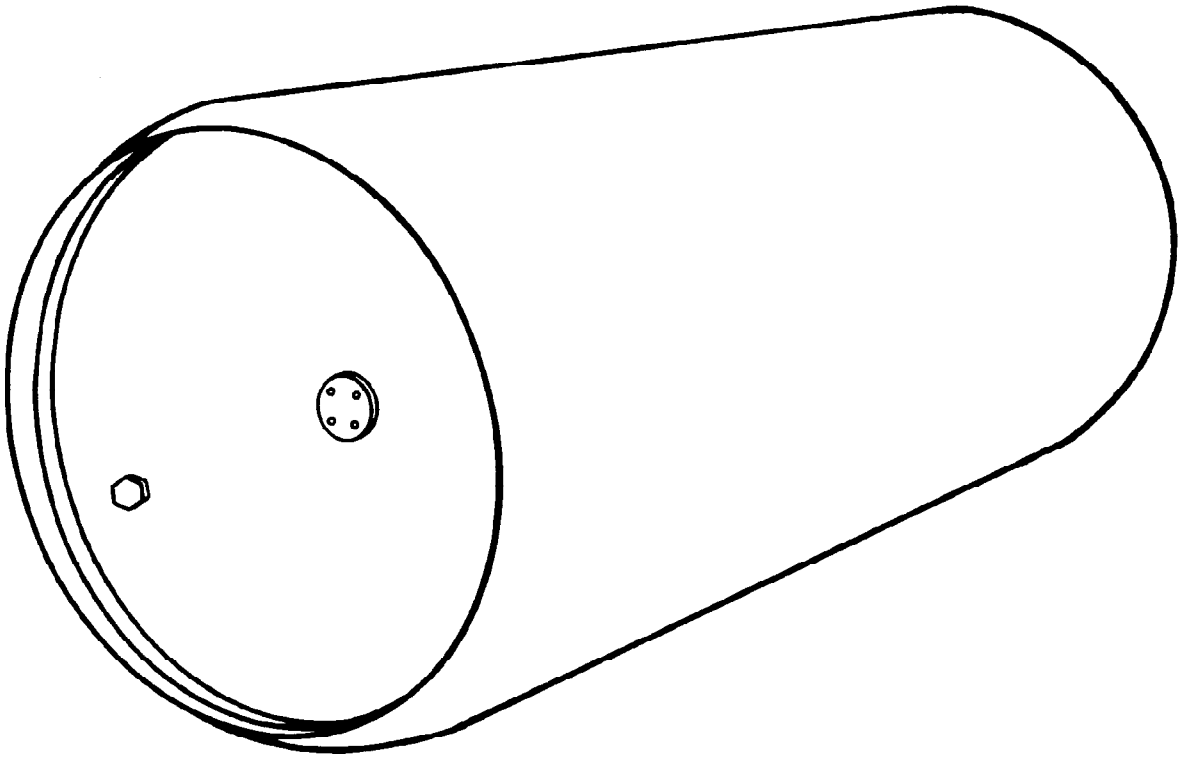
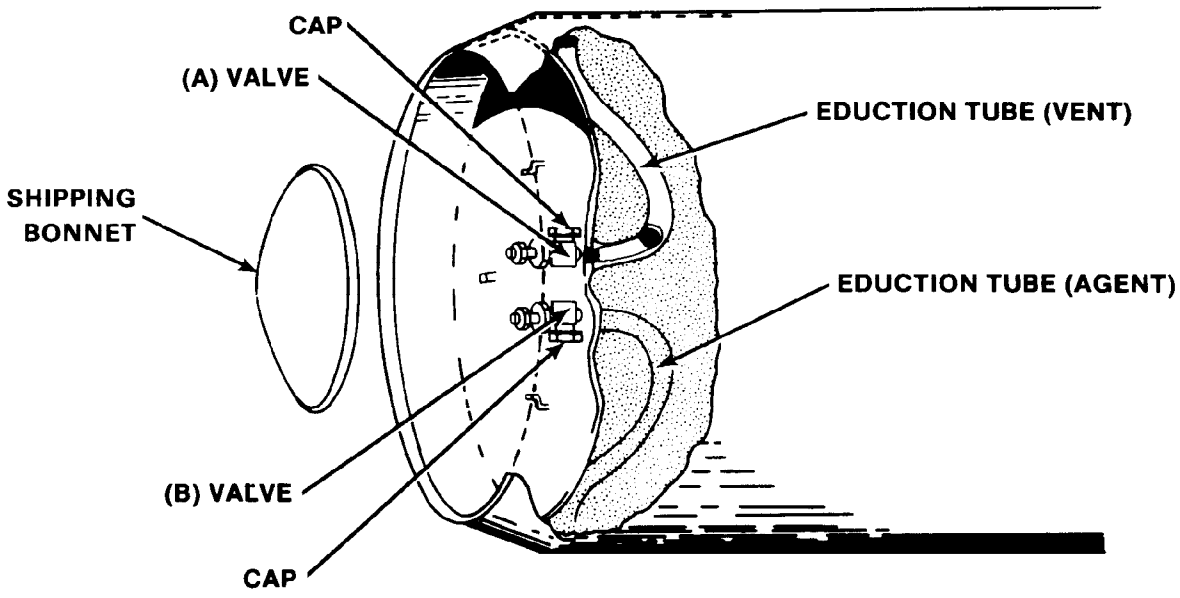


Figure 12-2.1. Types A, D, and E One-Ton Containers



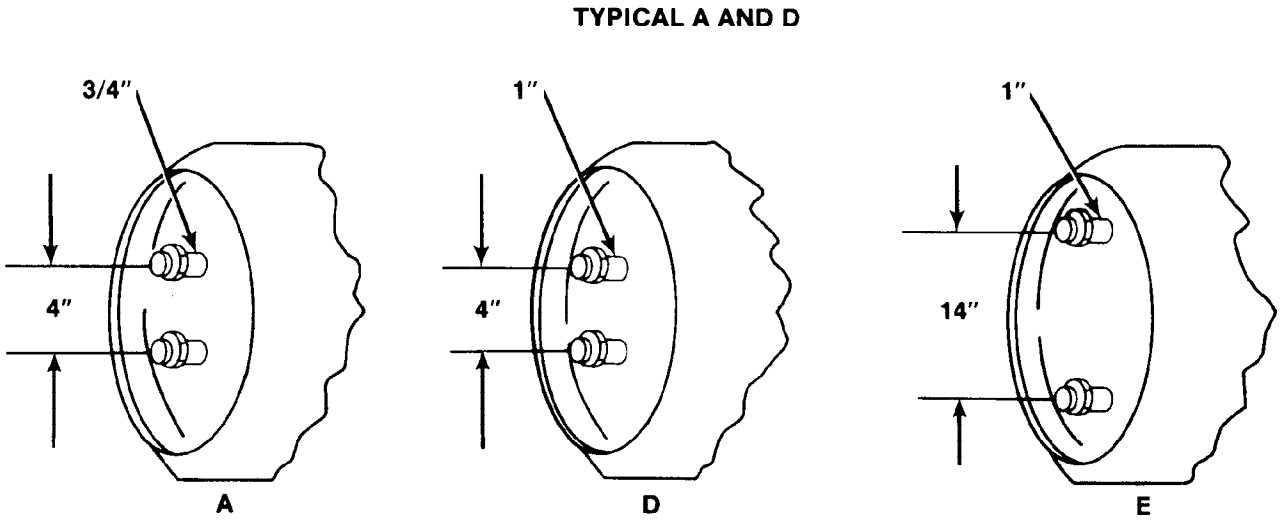


Figure 12-2.2. One-Ton Containers Typical Front View

12-2. CONTAINERS

12-2.1. CONTAINER, ONE-TON, TYPE A

12-2.1.1. Intended Use. The Type A One-Ton Container is used primarily for transporting and storing bulk quantities of dangerous chemical agents that are gaseous at atmospheric pressure.

12-2.1.2. Description. The Type A container, Figures 12-2.1 and 12-2.2, is a steel cylinder approximately 81.5 inches long and 30.5 inches in diameter. The side walls are approximately 0.41 inch thick and can withstand a maximum internal pressure of 500 psi The front head of the tank is a concave sheet of steel 3/4-inch thick. Two eduction tube outlets spaced 4 inches apart and threaded to receive 3/4-inch valves are located in the middle of the front head. Three tapered plugs are located in the middle of the front head as safety devices. The plugs are screwed into 3/4-inch holes. When the container is to be filled with chlorine, fusible plugs that melt at 175°F are installed. When the container is filled with any other chemical agent, nonfusible plugs that will blow out at an internal pressure of 375 psi are installed. For protection during shipment, a metal shipping bonnet similar to an auto hub cap is fastened over the valves by three bonnet clips and a bonnet-locking clip. A 3/4-inch Chlorine Institute valve is screwed into each eduction tube outlet. A cap covered with a gasket covers the valve outlet when the valve is not in use. A valve-opening wrench is used to open and close the valves. The wrench is attached to one of the valves when the container is being transported or stored. The rear head of the type A container is of the same construction as the front head, but the rear head has no eduction tube outlets and no shipping bonnet or bonnet clips. The front rim of the container is marked with the nomenclature of the container, the water capacity in pounds, the drawing number, serial number, lot number, the symbol of the agent in the container, and the date the container was tested.

12-2.1.3. Operation. A pressure gauge can be used to check stored containers for excessive internal pressure. The container can be vented if necessary to relieve the pressure. Venting devices are supplied with the associated filling systems. In operation, the container is placed on a stand that is higher than the receptacle being filled. The vehicle on which the container was transported or an improvised stand can be used for this purpose. A stand used for holding a filled 1-ton container must be capable of supporting 2 tons. The shipping bonnet is removed, and the container is rolled until the valves are aligned vertically, and is then choked to prevent further rolling. When the valves are aligned one above the other, the end of the eduction tube leading to the upper valve is out of the liquid in the container and can be used for venting. The end of the other eduction tube is in the liquid, and the contents can be withdrawn through the lower valve. Instructions for the use of 1-ton containers are included with the specific item.

WARNING

CONTAINERS FILLED WITH TOXIC AGENTS MUST NOT BE VENTED DIRECTLY TO THE ATMOSPHERE, BUT MUST BE PROPERLY FILTERED THROUGH AN APPROPRIATE VENT-EQUIPPED CANISTER.

12-2.1.4. Maintenance. Valves should be lubricated with engine oil (OE) monthly and before and after each use. In the continental United States, the container is painted with heat-proof aluminum paint if made necessary by weather conditions. In overseas bases and combat zones, it is painted with olive-drab enamel. Do not

paint the valves. Use an M1 valve replacement mechanism (NSN 4940-00-368-6190) to replace Chlorine Institute valves in a filled Type A container when the pressure in the container exceeds 50 psi The valve replacement mechanism can also be used on the type A container when the pressure is lower than 50 psi This operation is to be performed by a trained crew.

12-2.1.5. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. The filled container is designated as a Group A Chemical Ammunition for handling and storage purposes.

12-2.1.6. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this container.

12-2.1.7. General Data. The following table provides general data on the type A container:

Maximum gross weight	3500 pounds
Weight empty	1600 pounds
Length	81.5 inches
Diameter	30.5 inches
Wall thickness	0.406 inch
Capacity	170 gallons
Maximum internal pressure	500 psi
Eduction tubes	Two 1/2-inch diameter, on front
Eduction tube spacing	4 inches apart
Cubage	42.7 cubic feet
Valve type	3/4-in. Chlorine Institute type valve
Maximum agent stored	
AC	1000 pounds
CG	1600 pounds
CK	1600 pounds
C1	1600 pounds
Safety plug limits	
For chlorine	Plugs fusible at 176°F
For other agents	Nonfusible plugs blowing out at 375 psi

12-2.2. CONTAINER, ONE-TON, TYPE D

12-2.2.1. Intended Use. The Type D One-Ton Container is used primarily for transporting and storing bulk quantities of chemical agents that are either liquid or gaseous at atmospheric pressure.

12-2.2.2. Description. The type D container, Figures 12-2.1 and 12-2.2, is a steel cylinder approximately 81.5 inches long and 30.5 inches in diameter. The type D container is 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 is 1.0 inch. The two curved eduction tubes are welded inside the front head. Each tube is connected to its separate valve and the other ends of both tubes go in opposite directions to the side wall. The ends come within approximately 1/4 inch of the side walls.

Chlorine Institute 1-inch valves or 1-inch angle valves are screwed into the eduction tube outlets. Angle valves are used only in containers under low internal pressure. Chlorine Institute valves are used in containers under high pressure.

When this container is being transported, both valves are protected and covered by a snap-on shipping bonnet like an auto hub cap.

Three tapered safety plugs are spread evenly around the outer edge.

12-2.2.3. Operation. The operation of the type D container is the same as that for the type A, except that there is a choice of Chlorine Institute 1-inch valves or 1-inch angle valves. Type M1 valve-removing wrench is used to replace angle valves on type D containers. Anti-seize compound must be applied to the threads on the valves before screwing them into the container.

Empty containers should be stored with both valves closed and with protective bonnets in place. Filled containers should be stored out of the hot sun in a cool ventilated place. Vent containers as required. Inspect periodically for leakage.

WARNING

CONTAINERS FILLED WITH TOXIC AGENTS MUST NOT BE VENTED DIRECTLY TO THE ATMOSPHERE, BUT MUST BE PROPERLY FILTERED THROUGH AN APPROPRIATE VENT-EQUIPPED CANISTER.

12-2.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This container is designed as a Group A Chemical Ammunition for handling and storage purposes.

12-2.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this container.

12-2.2.6. General Data. The following table provides general data on the type D container:

Maximum gross weight	3500 pounds
Weight empty	1600 pounds
Length	81.5 inches
Diameter	30.5 inches
Wall thickness	0.406 inch
Capacity	170 gallons
Maximum internal pressure	500 psi
Eduction tubes	Two 1-in. diameter, on front
Eduction tube spacing	4 in. apart
Cubage	42.7 cubic feet
Valve	1 in. Chlorine Institute type valve, or, 1 in. angle type
Maximum agent stored	
Chlorine valve	
AC	1000 pounds
CG	1600 pounds
CK	1600 pounds
C1	1600 pounds
Angle valve	
GB	1600 pounds
H	1800 pounds
HD	1800 pounds
HNI	1800 pounds
HT	1800 pounds
VX	1500 pounds
Use	Any liquid or gaseous chemical agent
Safety plug limits	
For chlorine	Plugs fusible at 175°F
For other agents	Nonfusible plugs blowing out at 375 psi

12-2.3. CONTAINER, ONE-TON, TYPE E

12-2.3.1. Intended Use. The Type E One-Ton Container is used as a substitute for either Type A or Type D containers for the transport and storage of gaseous agents or liquid chemical agents in bulk quantities.

12-2.3.2. Description. The type E container, Figures 12-2.1 and 12-2.2, is a steel cylinder approximately 82.5 inches long and 30.0 inches in diameter. The walls of this container are 0.28 inch thick. Protective housings are welded to the front and rear ends of the container and project beyond the front and rear heads.

The front head is a convex dome welded to the front end of the container. Two eduction tube outlets, 14 inches apart, are located in the front head. Each outlet is threaded to receive a 1-inch valve. Three tapered plugs are screwed into 3/4-inch holes spaced equally around the outer edge of the front head. The plugs will blow out when the internal pressure becomes too high. Fusible plugs are installed when the container is filled with chlorine; nonfusible plugs are installed when it is filled with other chemical agents. A circular protective cover bolted to the front protective housing by sixteen 3/8-inch bolts, protects the front head during shipment.

The rear head is identical with the front head except that it has no eduction tube outlets. It is protected by the rear protective housing which protrudes approximately 1 inch beyond the rear head. A steel angle welded around the inside of the rear protective housing adds support to the rear head.

Two 1-inch inside-diameter steel eduction tubes extend into the container from the front head.

One-inch Chlorine Institute valves or 1-inch angle valves are screwed into the eduction tube outlets. Angle valves are used only in containers under low internal pressure. Chlorine Institute valves are used in containers under high pressure.

A valve-opening wrench is furnished with the type E container.

12-2.3.3. Operation. 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. The only difference in procedure is the removal of protective covers to gain access to the valves. M1 valve-removing wrench (NSN 5120-00-368-6191) is used for removing or replacing angle valves on Type E containers.

12-2.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This container is designated as a Group A Chemical Ammunition for handling and storage purposes.

12-2.3.5. Safety Precaution. The general safety precautions contained in Chapter 2 apply to this container.

12-2.3.6. General Data. The following table provides general data on the type E container:

Maximum gross weight	3500 pounds
Weight empty	900 pounds
Length	82.5 inches
Diameter	30.0 inches
Wall thickness	0.281 inch
Capacity	170 gallons
Maximum internal pressure	500 psi
Eduction tubes	Two 1-in. diameter, on front
Eduction tube spacing	14 in. apart
Cubage	42.7 cubic feet
Valve	1 in. Chlorine Institute type valve
Maximum agent stored	
Chlorine valve	
AC	1000 pounds
CG	1600 pounds
CK	1600 pounds
C1	1600 pounds
Angle valve	
GB	1600 pounds
H	1800 pounds
HD	1800 pounds
HN1	1800 pounds
HT	1800 pounds
VX	1500 pounds
Use	Any liquid or gas; substitute for Type A or D
Safety plug limits	
For chlorine	Plugs fusible at 175°F
For other agents	Nonfusible plugs blowing out at 375 psi

CHAPTER 13

CHEMICAL FILLING EQUIPMENT

13-1. INTRODUCTION

This chapter describes equipment required for filling chemical spray tanks with liquid chemical agents.

13-1.1. GENERAL. The equipment makes it possible to transfer stored chemical agents from their one-ton containers or 55-gallon drums to the devices from which they will be disseminated without contaminating the atmosphere or injuring personnel. Smoke agent may be transferred in a closed system from its storage container without contacting the atmospheric moisture that turns smoke agent liquid into a screen of smoke droplets.

Table 13-1. Chemical Filling Equipment

Item	Paragraph	Use With
Filling Unit, Vacuum, Chemical, Mk 1 Mod 0	13-2.1	Mk 12 Chemical Tank
Filling Unit, Tank, Chemical, Mk 3 Mod 0	13-2.2	Aero 14B Spray Tank
Filling Unit, Tank, Chemical, Mk 4 Mod 0	– – –	Aero 14B Spray Tank

13-2. FILLING UNITS

13-2.1. FILLING UNIT, VACUUM, CHEMICAL, MK 1 MOD 0

13-2.1.1. Intended Use. The Mk 1 Mod 0 Vacuum Chemical Filling Unit is an electric motor driven vacuum system designed for filling smoke or toxic agent spray tanks. The unit is primarily used for filling in Mk 12 Mod 0 Aircraft Chemical Tank (paragraph 11-2.3). The filling unit can be used to evacuate air from the Mk 12 tank and fill the evacuated reservoir with smoke agent.

13-2.1.2. Description. This filling unit, Figure 13-2.1, is portable and is contained within a welded tubular steel frame which both protects the equipment and provides a hand hold for carrying. The filling unit consists of a vacuum reservoir, electric motor, vacuum pump, particulate filter, gas filter, vacuum gauge, evacuation valve and hose, and air inlet valve and hose lines. The vacuum reservoir provides a volume reserve as well as enabling proper maintenance and testing of the filling unit.

A vacuum-controlled lubricator mounted on top of the vacuum pump functions only under vacuum and must never be operated under free atmospheric conditions. The oil level is never permitted to fall below one-third lubricator capacity.

Two cartridge type filters are mounted one on top of the other. The top filter is a particulate filter which removes solid particles and gross liquid smoke particles from the air. The lower filter removes chemical fumes.

The vacuum gauge is provided to indicate optimum filling vacuum and to serve as a means of detecting leaks. A 1200-pound capacity platform scale is required to measure the amount of smoke agent entering the evacuated chemical tank. All hose lines are teflon, sheathed in flexible stainless steel mesh. The unit draws 28 inches of vacuum to fill the Mk 12 spray tank in 10 minutes.

13-2.1.3. Operation. The filling operation is preferably performed out of doors and downwind of personnel and equipment. If the filling site must be an indoor area, adequate ventilation including fans and blowers must be provided. A hose or running water supply must be available for decontamination. Protective rubber clothing and plastic face masks must be worn. The Mk 12 tank to be filled is cradled on a platform scale.

The evacuation hose is attached to the vacuum gauge and the gauge installed in the threaded nose filling hole of Mk 12 spray tank. The supply hose is connected to the supply valve and the suction pipe of the supply valve is lowered into the bung hole of the 55-gallon drum of agent.

First the spray tank is evacuated by closing the supply valve. The pump motor is operated and the air is withdrawn from the spray tank and passes through the vacuum pump air inlet valve and into the two filters where the particulate filter removes solid particles and smoke droplets and the gas filter absorbs chemical fumes. The filtered air travels through the vane type vacuum pump and exhausts into the atmosphere at the air outlet line.

When sufficient vacuum has been attained, the vacuum pump air inlet valve is closed and the pump shut off.

The filling operation is started slowly by opening the supply valve. Smoke agent is forced into the Mk 12 tank through the supply valve, supply hose and the fitting adapting the hose to the chemical tank by atmospheric pressure. When the weight of the agent being transferred to the Mk 12 tank reaches 600 pounds, the filling operation is complete.

13-2.1.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item.

13-2.1.5. Safety Precaution. The general safety precautions contained in Chapter 2 apply to this filling unit.

13-2.1.6. Identification Data. The Mk 1 filling unit is listed under Drawing LD 586320 and NSN 1040-00-858-0953.

13-2.1.7. General Data. The following table provides general data on the Mk 1 filling unit:

Weight	110.0 pounds
Length	33.25 inches
Height	20.00 inches
Width	25.25 inches
Filling time	10 minutes
Vacuum drawn	28 in. of mercury
Shipping weight	225.0 pounds
Shipping cubage	20.5 cubic feet
Pump rating	1 h.p., 115 volts a.c., 60 cycles
Frame material	Tubular aluminum
Hose lines	Teflon
Filter limits	10 fillings

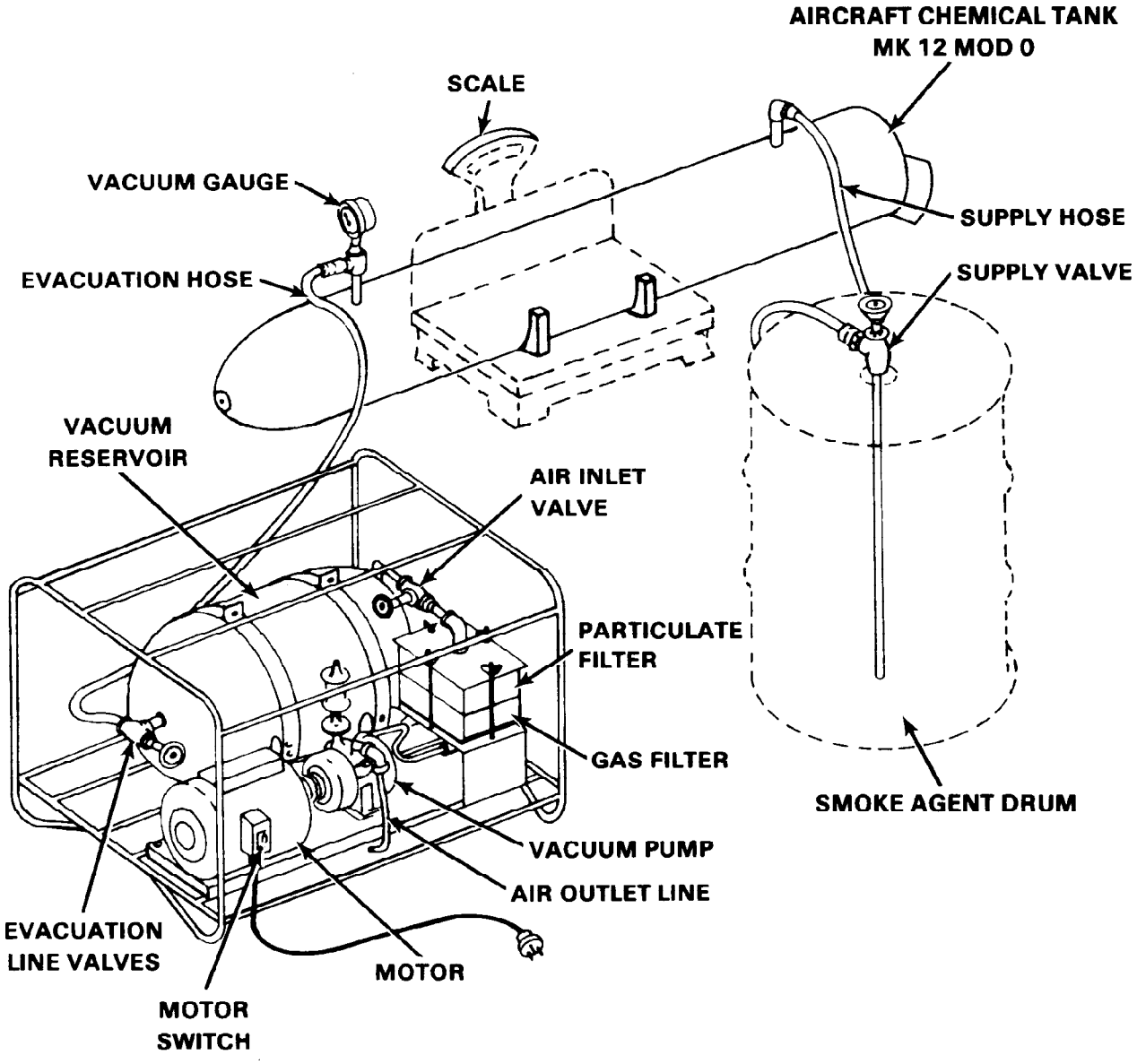


Figure 13-2.1. Mk 1 Mod 0 Chemical Vacuum Filling Unit

13-2.2. FILLING UNIT, TANK, CHEMICAL MK 3 MOD 0

13-2.2.1. Intended Use. The Mk 3 Mod 0 Chemical Tank Filling Unit is a portable unit for field-filling the Aero 14B Liquid Aircraft Spray Tank (paragraph 11-2.1) with either VX, GB, or thickened GB agent.

13-2.2.2. Description. The Mk 3 Filling Unit, Figure 13-2.2, comprises a pump and motor assembly, a portable platform scale, a stand mounting a 1-ton container, a reactor (mixing unit) and a cradle designed to support 55-gallon liquid drum, and the associated interconnecting lines.

The reactor is used to mix the GB agent with a non-toxic thickener called UCON to reduce the evaporation and loss of agent after it is released from an aircraft during its fall to the ground. A wind vane indicator is provided to warn personnel working downwind of the filling unit if there is a sudden change in the wind direction.

The reactor is a portable self-contained 100-gallon stainless steel mixing unit. It is supported by four pipe legs, and three lifting loops are provided on the outside and around the unit for ease of lifting and movement. The cover assembly is bolted into place with 42 clamps that can be removed when it becomes necessary to remove the cover and attached parts. Three cover lifting loops are provided. The cover contains four flanged openings to attach piping. The gauge with pigtail and the UCON transfer line are connected to the 4-inch flanges; the agent supply and vent lines connect to the 2-inch flanges. A 2 horsepower, 1800 rpm motor is mounted on a pedestal assembly on top of the cover. This motor drives the three-blade propeller inside the reactor through a gear shaft at the rate of 350 rpm. A start and stop switch is mounted on the motor. A sight glass on the side of the pedestal assembly provides a check on the oil level inside the housing assembly.

The bottom of the reactor provides an outlet and an outlet ball valve for draining the mixed contents of the reactor into the spray tank.

The pump and motor assembly used to withdraw thickener from the 55-gallon drum is mounted on a platform with four carrying handles. The pump and motor are interconnected by a moduline and drive shaft which reduces pump rotation to 45 rpm. A switch starts and stops operation of the pump.

13-2.2.3. Operation. To fill the Aero 14B spray tank with GB agent of the desired viscosity, the reactor is placed on the platform scale and GB agent is discharged under pressure through the transfer line into the reactor. UCON is pumped from a 55-gallon drum into the reactor. Both compounds are weighed on entering the reactor. When the desired amounts of each have been recorded, they are mixed and agitated by the reactor gear-driven, three-bladed propeller. The mixture is then transferred under pressure through the agent filling line into the Aero 14B spray tank. The interconnecting vent system between the unit components allows the vapors to return to the 1-ton container and filter assembly. The filter assembly removes toxic agents before releasing the displaced air into the atmosphere.

In filling the Aero 14B spray tank with VX agent, the reactor and transfer pump are not used. The piping and flexible hoses are connected directly between the VX 1-ton container and the spray tank. Methods are also provided in the system to pressurize the 1-ton container. The spray tank is set on a cradle and positioned on a platform scale.

The agent is transferred to the tank through the agent transfer line by gravity flow; and when the desired amount of agent has been

transferred to the spray tank, the agent flow is closed off at the tank by a hand operated valve. The displaced air and vapor from the spray tank returns to the 1-ton container through the vent system during this operation.

13-2.2.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item.

13-2.2.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this filling unit.

13-2.2.6. Identification Data. The Mk 3 filling unit is listed under Drawing LD 2486429.

13-2.2.7. General Data. The following table provides general data on the Mk 3 filling unit:

Reactor dimensions	
Outside diameter	34.0 inches
Height	51.4 inches
Weight	1500 pounds
Stand dimensions	
Length	100.0 inches
Width	52.0 inches
Height	77.0 inches
Cradle dimensions	
Length	24.0 inches
Width	26.0 inches
Height	6.0 inches
Reactor capacity	100 gallons
Reactor motor rating	20 h.p., 1800 r.p.m.
Reactor motor input	220-440 volts, 60 cycles, 3 phase
Reactor speed	350 r.p.m.
Scale capacity	3000 pounds
Pump motor gearbox speed	45 r.p.m.
Container Pressure	5 to 8 psi pressure in 1-ton container

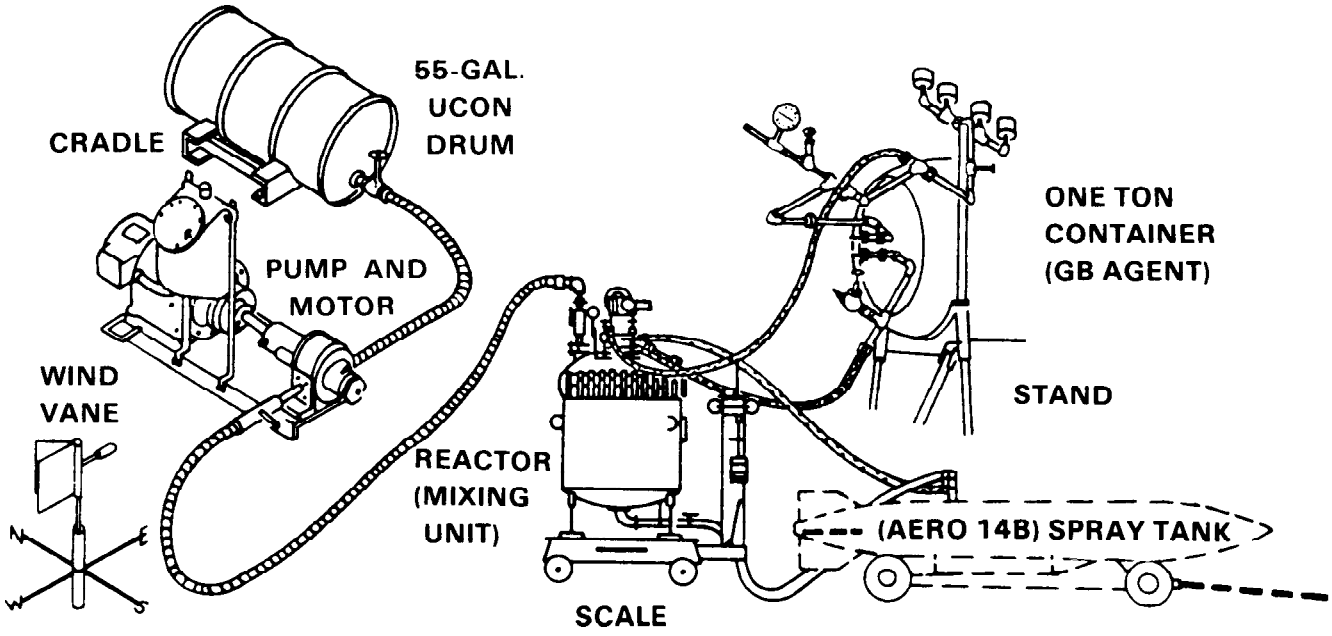


Figure 13-2.2. Mk 3 Mod 0 Chemical Tank Filling Unit

CHAPTER 14

CHEMICAL TRAINING DEVICES

14-1. INTRODUCTION

This chapter describes various training devices used to familiarize trainees with chemical agents and protective equipment.

14-1.1. GENERAL. Chemical training devices are instructional items used to train personnel in the use of protective masks and in detecting the presence of riot agents and of biological agents. This chapter describes methods of distributing authentic riot control agents in low concentrations. This chapter also contains data on an aerosol disperser which sprays a simulant biological agent to give personnel training in detecting the presence and growth of a live but harmless biological agent.

Table 14-1. Chemical Training Devices

Item	Paragraph
Spray Gun, Training, CN, Mk 1 Mod 0	14-2.1
Agent Disperser, BG-1, Simulated, AN-M1	14-2.2
Chemical Agent Identification Set, Training, Simulant, M72A1	14-2.3
Capsule, Riot Control Agent, CN	14-2.4
Capsule, Riot Control Agent, CS	14-2.5
Chemical Agent, Mustard Gas, MR, Simulated	14-2.6
Pellet, CN, M2	14-2.7
Detector Kit, Chemical Agent, M18A2	14-2.8
Detector Kit, Chemical Agent, M256	14-2.9

14-2. TRAINING DEVICES

14-2.1. SPRAY GUN, TRAINING, CN, MK 1 MOD 0

NOTE

The Mk 1 Mod 0 CN Training Spray Gun is no longer authorized for training by the Navy.

14-2.1.1. Intended Use. The Mk 1 Mod 0 CN Training Spray Gun is used aboard ship for training personnel in the detection of the presence of tear gas and in the technique of masking. It also has considerable value in riot control.

14-2.1.2. Description. The Mk 1 spray gun, Figure 14-2.1, is approximately 16.0 inches long and 2.0 inches in diameter. The spray gun completely assembled consists of a flask, a valve assembly, an eduction tube and a nozzle.

The flask contains the chemical filling and the expellent charge. It is a small size commercial CO_2 cylinder, ICC-3E, having a total capacity of 26.5 cubic inches (420 cc), and an empty weight of approximately 3 pounds.

The valve assembly consists of a threaded closing valve, a valve body, and a packing gland. The threaded valve has a series of orifices around its lower circumference which open into a central outlet hole, and a composition sealing disc at its lower end. The valve body, which secures the valve assembly in place in the cylinder, as a port in its lower section which is opened or closed by rotation of the threaded valve. The packing gland secures this valve in place in the valve body and holds it tight against leakage. A wire valve handle is hinged to the valve to facilitate its turning.

The eduction tube is a small internal pipe attached to the inner end of the valve body. It extends nearly to the bottom of the cylinder and provides a means of delivering the solution to the nozzle when the valve is opened.

The nozzle is a curved member attached to the valve and provided with a spiral in its outlet hole to increase atomization of the solution.

14-2.1.3. Functional Description. Lacrimation from this spray gun is produced by the atomization of a solution of CN in trichlorethane through a spray tip by means of pressure from liquid carbon dioxide contained within the cylinder. The release of the solution from the cylinder is accomplished by rotating the valve contained in the head of the cylinder.

To operate the training spray gun, hold the flask in the right hand in a vertical or nearly vertical position with the nozzle pointing forward and the valve handle held securely in the left hand.

Rotate the flask, rather than the handle, to release the spray. This permits the nozzle to be held in the forward direction at all times. After use, close the valve by turning the flask in the opposite direction.

14-2.1.4. Applications. In damage-control practices, or during protective mask drill, the spray gun can be carried about the ship and small quantities of gas released when and where desired. The discharge is silent and invisible, thus providing a surprise element. This surprise factor can be further exploited by attaching a rubber hose to the nozzle and releasing gas from some distance away.

A 1/2-second discharge sets up a concentration sufficient for drill purposes in the average size compartment. The spray gun projects the vapor in still air for a distance of about 5 feet. The gas is not persistent and can be cleared by the use of the ventilation system within 1/2 to 2 hours, depending upon the size

of the compartment, the amount of gas released, and the amount of ventilation. The contents of the flask are sufficient for releasing small quantities of tear gas in approximately 20 compartments.

If the entire flask is released accidentally in an average size compartment, a very powerful concentration of tear gas will result which will cause considerable itching of the skin for about 1/2 hour. In such an event, the solution will mix with the air until the saturation point is reached, after which the CN will precipitate and evaporate only as more air is supplied. Air saturated with CN is not lethal in ordinary temperatures unless it is breathed for more than about 45 minutes. The small amount of CN used in this gun makes such an occurrence virtually impossible. Carbon tetrachloride was used as a vehicle in the CNB solution in some spray guns loaded in the past, and in the case of accidental release of an entire flask, the initial concentration of carbon tetrachloride will be high for small and average sized rooms. Such a concentration of carbon tetrachloride can be lethal if breathed over an extended period of time. Therefore, if a substantial portion of a flask or an entire flask is released in an enclosed area, the area should be evacuated until it is ventilated, or protective masks should be worn by personnel in the area. The former carbon tetrachloride type solutions should not be brought aboard ship.

The solution used in the gun will remain stable in storage for indefinite periods, particularly if kept at room temperature. The solution will probably not be satisfactory at temperatures below 40°F.

14-2.1.5. Filling Equipment. The following items and equipment are needed for filling the spray gun:

1. CN Solution. The lacrimatory charge used in this spray gun consists of 200 cc of a solution of 1 part CN and 10 parts $C_2H_3G1_3$ (by weight)

2. Expelling Charge. The expellent charge which forces the solution from the spray gun consists of 5.5 to 6.5 ounces of liquid CO_2. This is obtained from a commercial-type cylinder containing about 50 pounds of liquid CO_2.

3. Charging Device. The charging device used for transferring liquid CO_2 from the 50 pound cylinder to the flask on the spray gun is specially designed for this operation. It consists of a flask clamp lever, clamping brackets, charging valve body, charging head screw, and a CO_2 charging valve and handle. These components are attached to a mounting plate.

4. Filling Nozzle. The filling nozzle is used as a connection to the vacuum line and as a means of drawing the lacrimatory solution into the evacuated cylinder when the vacuum method of filling is employed.

5. Scales. A small set of spring scales is needed to weigh the material used in preparation of the lacrimatory solution and to control the amount of CO_2 used in charging the filled cylinder. The scales should be of about 25-pound capacity with an accuracy of 1/2 ounce.

14-2.1.6. Preparation of the CN Solution. The lacrimatory solution should be made up in a location where the temperature is above 60°F, and preferably warmer. The operation can be performed without a protective mask in an interior compartment, provided that the ventilation is turned on and suitable precautions are taken against breathing vapors from the solvent or the CN solution. The operation can be done more comfortably in the open, however, while

wearing a mask and rubber gloves. The solution should be prepared as follows:

1. Determine in advance the number of cylinders to be filled; make up the solution accordingly.

2. Fill each cylinder with 200 cc (12.2 cu. in.) of solution. This allows space for the liquid CO_2 with a final void of about 13.5 percent. On the basis of 12.2 cubic inches per cylinder, one gallon of solution is enough for 18 cylinders. These are considered satisfactory multiples of measure and quantity. The solution has a specific gravity of 1.53 and weighs 12 pounds 12 ounces per gallon.

3. Dissolve in a wide-mouthed, well-stoppered, glass bottle 1 pound 2-1/2 ounces finely pulverized CN in 11 pounds 9-1/2 ounces of 1.1.1 trichlorethane (free of sediment or suspended matter).

4. Agitate the bottle vigorously until there is little or no undissolved material on the surface of the liquid.

14-2.1.7. Filling the Flasks. Flasks may be filled with lacrimatory solution by one of two methods: the vacuum method, which does not generally require the removal of the valve assembly; and the direct method, which requires the removal of the valve assembly so that the solution can be introduced directly into the flask.

14-2.1.8. Vacuum Method. This method requires a source of vacuum equivalent to about 25 inches of mercury (12.25 psi). This may be supplied by a vacuum pump, a steam aspirator, or a simple filter pump adaptable to an ordinary water supply. The filter pump is recommended only where other means are not available because it involved the removal of the valve body from the flask. Continued loosening and tightening of the valve body will cause undue wear of machined parts with resultant looseness and leakage. The following items are also needed:

1.	Graduated glass measuring cylinder	255 cc
2.	Breaker	250 cc
3.	Rubber tubing	
	Length	6 in.
	Bore	3/16 in.
	Wall thickness	3/32 in.

To fill the flask by the vacuum method, proceed as follows:

1. Remove the nozzle.

2. Install the filling nozzle; screw it tightly in place and secure it with the locknut.

3. Connect the filling nozzle to the source of vacuum with rubber tubing.

4. Open the valve of the spray gun by two full turns of the flask. About 15 seconds are required to produce vacuum.

5. Close the valve tightly.

6. Measure 200 cc of the lacrimatory solution and put it in the beaker.

7. Tilt the beaker slightly.

8. Invert the spray gun and introduce the filling nozzle into the solution to the maximum depth of the liquid.

9. Open the valve two full turns; close the valve gradually as the liquid is drawn into the flask. Take care that no sediment or air is admitted into the flask at the end of this operation.

10. Remove the filling nozzle preparatory to charging the flask with CO_2.

14-2.1.9. Direct Method. To fill the flask by the direct method, proceed as follows:

1. Unscrew the valve body from the flask.

2. Inspect for defective valve packing, valve gaskets and sealing discs. If defective, set aside and use a new valve assembly.

3. Measure 200 cc of the lacrimatory solution very carefully. Be sure it is free of sediment or undissolved CN.

4. Pour the solution directly into the flask.

5. Replace the valve assembly immediately. Care must be taken when removing and replacing the valve body so that no damage is done to the threads or the metal sealing washer.

6. As a precautionary measure to prevent leakage, it is advisable to cover the threads with shellac or other suitable sealing medium.

7. Remove the nozzle preparatory to charging the flask with CO_2.

14-2.1.10. Charging With CO_2. Follow the steps below to charge the training gun flask with carbon dioxide:

1. Clamp the CO_2 supply cylinder rigidly in an inverted position to permit the flow of liquid rather than gaseous CO_2.

2. Mount the charging device rigidly in a vertical position so as to accommodate the spray-gun flask in an inverted position. This will keep the end of the eduction tube out of the lacrimatory liquid and prevent the escape of anything but CO_2 in the event of a loose or broken connection.

3. Attach the charging device to the CO_2 cylinder by means of the copper tubing provided.

4. Remove the nozzle and valve handle from the valve assembly.

5. Weigh the flask.

6. Place the flask in the charging device so that the dowel pin in the clamping bracket enters one of the holes in the head of the valve assembly that normally accommodates the wire-valve handle.

7. Close the flask clamp lever.

8. Tighten the charging head screw to secure a leakproof joint between the flask valve and the charging valve body. Check that the gasket between these two members is always in place.

9. Test for tightness of all joints by opening the CO_2 cylinder valve and the CO2 charging valve.

10. Open the valve of the flask by rotating the flask two full turns in a counterclockwise direction.

11. Allow 45 to 60 seconds for the necessary 6 ounces (actually, 5-1/2 to 6-1/2 ounces) of liquid CO_2 to enter the flask. The time will vary with the temperature of the CO_2 and of the flask.

12. Close the CO_2 charging valve.

13. Close the flask valve by rotating the flask in a clockwise direction.

14. Loosen the charging head screw.

15. Loosen the flask clamp lever.

16. Remove the flask and weigh it to determine the amount of CO_2 charge, balancing the flask in an inverted position on the scales.

17. Replace the flask and repeat the charging procedure if the amount of CO_2 is insufficient.

18. Discharge the gun and recharge it if more than 6-1/2 ounces of CO_2 are admitted to the flask.

19. Assemble the flask and nozzle when charging is completed.

20. If charging is undertaken in hot weather, it may be difficult to introduce 5-1/2 to 6-1/2 ounces of CO_2 into the gun. This difficulty may be overcome by cooling the gun to about 45°F in a bucket of ice 35° or water after it has been filled with the lacrimatory solution prior to charging with CO_2. This is a temporary measure; the filled flask is not to be kept under refrigeration.

21. Close the valve of the CO_2 supply cylinder tightly if no other charging operation are contemplated. Leave the charging equipment in the standby condition.

22. As a final check for leaking valves, immerse filled spray gun in a tank of water.

14-2.1.11. Maintenance. No special care is required for the flask except to avoid denting it through the use of force when replacing the valve assembly. Observe the following precautions:

1. Close the valve with care to avoid damage to the sealing disc or the port in the valve body.

2. Keep the gland nut tightly screwed down to insure against leakage through the packing gland.

3. When the gun is not to be used again, remove the nozzle and wash it thoroughly with carbon tetrachloride to remove any accumulated CN. Remove CN from any other part of the gun in the same manner. Use carbon tetrachloride only in well ventilated areas and avoid breathing carbon tetrachloride vapors.

4. Liquid CO_2 has a pressure of 600 to 800 p.s.i. over the range of normal summer temperatures. Hence all filled and charged spray guns should be stored in a cool, dry place out of the direct rays of the sun.

5. Do not refrigerate the spray gun. This not only reduces pressure to a point where atomization is affected, but also causes CN to separate from the solution.

6. As a precaution, remove the valve handle from the valve during storage.

14-2.1.12. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. The filled spray gun is designated as a Group B Chemical ammunition for handling and storage purposes.

14-2.1.13. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this spray gun.

14-2.1.14. Identification Data. The Mk 1 training spray gun is listed under Drawing LD 58336. The charged gun is listed under NSN 1365-00-092-9975 and DODIC/NALC KW12. The empty gun is listed under NSN 1365-00-092-9974 and DODIC/NALC KW13.

14-2.1.15. General Data. The following table provides general data on the Mk 1 training spray gun:

Length	16.0 inches
Diameter	2.0 inches
Weight, filled	4.0 pounds
CN Spray Gun Charging Device	Mk 1 Mod 0
Flask	CO_2 cylinder ICC-3E
Capacity	26.5 cubic inches
Capacity	420 cc
Lacrimatory solution	CN in $C_2H_3C1_3$
Amount of solution	200 cc
CN (by weight)	1 part
1.1.1. Trichlorethane (by weight)	10 parts
Expellent charge	
Type	Liquid CO_2
Weight	5.5 to 6.5 ounces

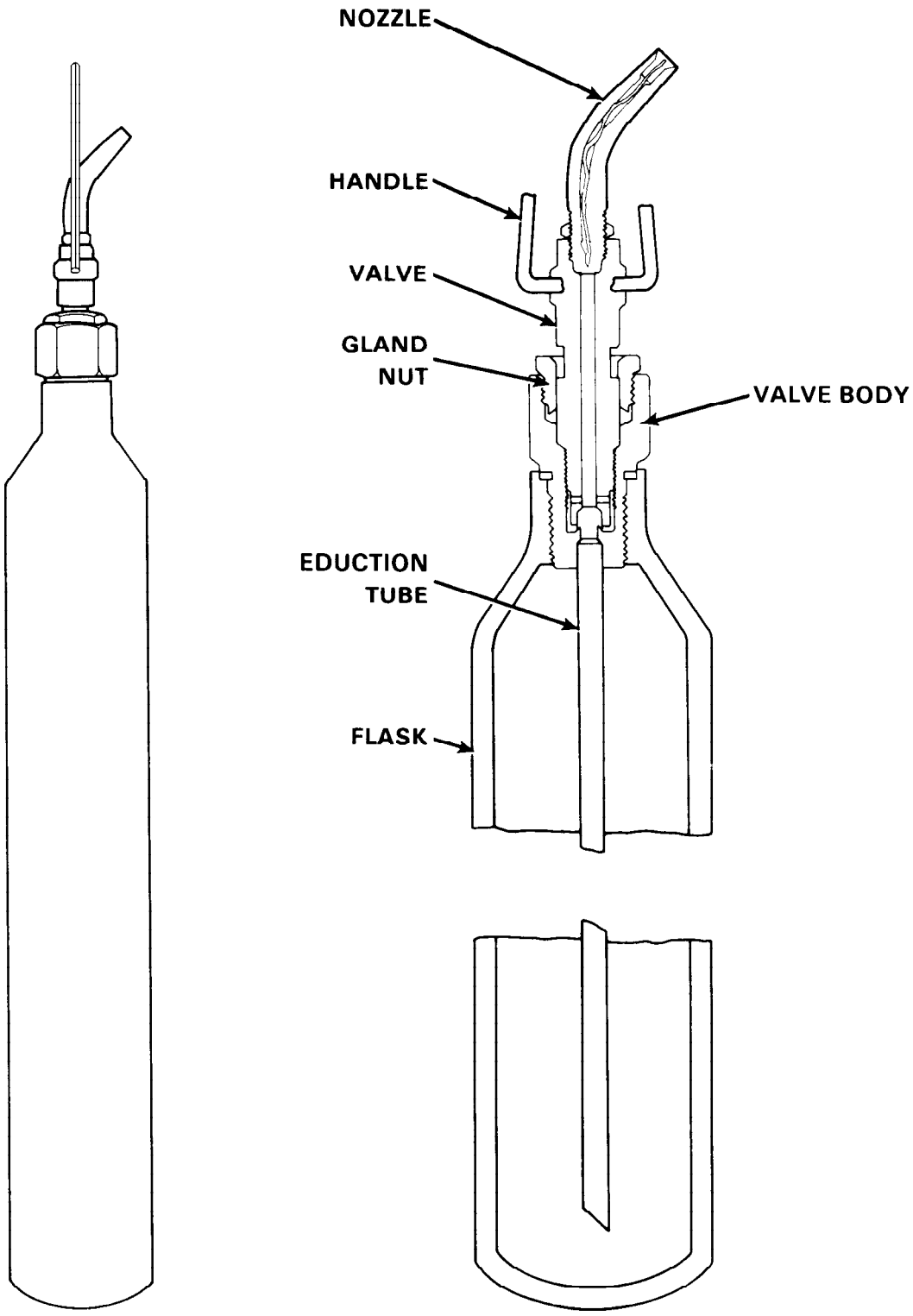


Figure 14-2.1. Mk 1 Mod 0 CN Training Spray Gun

14-2.2. SIMULANT AGENT DISPENSER, BG-1, 12-OUNCE, AN-M1

14-2.2.1. Intended Use. The AN-M1 12-Ounce BG-1 Simulant Agent Dispenser is designed to provide training in contamination and detection and to provide an evaluation of trainees' efforts to decontaminate.

14-2.2.2. Description. The simulant agent dispenser, Figure 14-2.2, is a commercial insecticide aerosol bomb-type container filled with live biological agents suspended in Freon. If live agents are not used in decontamination training, such exercises result in routine motions with no proof of whether or not the trainees have successfully removed the agents. The simulant is BG, Bacillus globigii, a micro-organism selected for its harmless nature, long life, and easy recognition.

BG grows readily and produces a characteristic red or orange coloration on the surface where it has established colony. The bacillus is a spore-forming, aerobic, facultative organism of rod form which is widely distributed in the soil and decomposing organic matter either as single units or short chains. These organisms have rounded ends, stain uniformity, and are motile and Gram-positive. Spores of the bacillus are 0.6 to 0.9 microns in size. As used in the simulant agent dispenser, dry spores are ground to a uniform 5 micron diameter to provide suspension in Freon when the container is shaken up.

14-2.2.3. Operation. The simulant agent dispenser is used in training schools and field exercises involving sampling and decontamination techniques. The device is usually considered as supplementary equipment for use with BW field sampling kits, formalin dispensers, ethylene oxide decontaminants and protective tarpaulins. The dispenser is shaken vigorously and the agent is then released by pressing the finger pressure aerosol valve and spraying the agent into the area or onto the surfaces where the students are to perform the decontamination exercises.

An organism can be classified as Gram-positive if, when stained with a violet test stain and fixed with iodine, the violet color can not be discolored by further testing with alcohol and acetone solution. Organisms which do not retain the violet stain after alcohol-acetone test, are classified as Gram-negative. These tests help toward the identification of unknown micro-organisms and bacteria.

14-2.2.4. Handling and Storage. No special handling or storage is required since BG-1 has proved to be a non-pathogenic agent to man and is suspended in Freon (dichlorodifluoromethane) which is harmless to personnel except for high concentrations that can cause suffocation. However, Freon, while non-flammable decomposes on contact with flames or heated electric elements to form toxic products which even in low concentrations may cause fatalities among personnel exposed for even less than half an hour. Any room where Freon has contacted flame should be well ventilated before personnel are permitted to enter.

14-2.2.5. Safety Precaution. The general safety precautions contained in Chapter 2 apply to this simulant agent dispenser.

14-2.2.6. Shipping Containers. This dispenser is packaged 24 per fiberboard container.

14-2.2.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this dispenser is approximately 2.0 grams.

14-2.2.8. Identification Data. The AN-M1 dispenser is listed under Specification MIL-B-9978 and NSN 1380-00-025-3274.

14-2.2.9. General Data. The following table provides general data on the AN-M1 BG-1 dispenser:

Weight	12 ounces
Agent weight	2.0 grams
Freon weight	300 grams
Filled weight	393 grams
Diameter	2.87 inches
Internal pressure	84.82 p.s.i.
Color code	Blue with white lettering
Void	20%
Organism size	0.7 to 0.8 by 2 to 3 micron rods
Spore size	0.6 to 0.9 micron
Valve orifice	0.016 inch

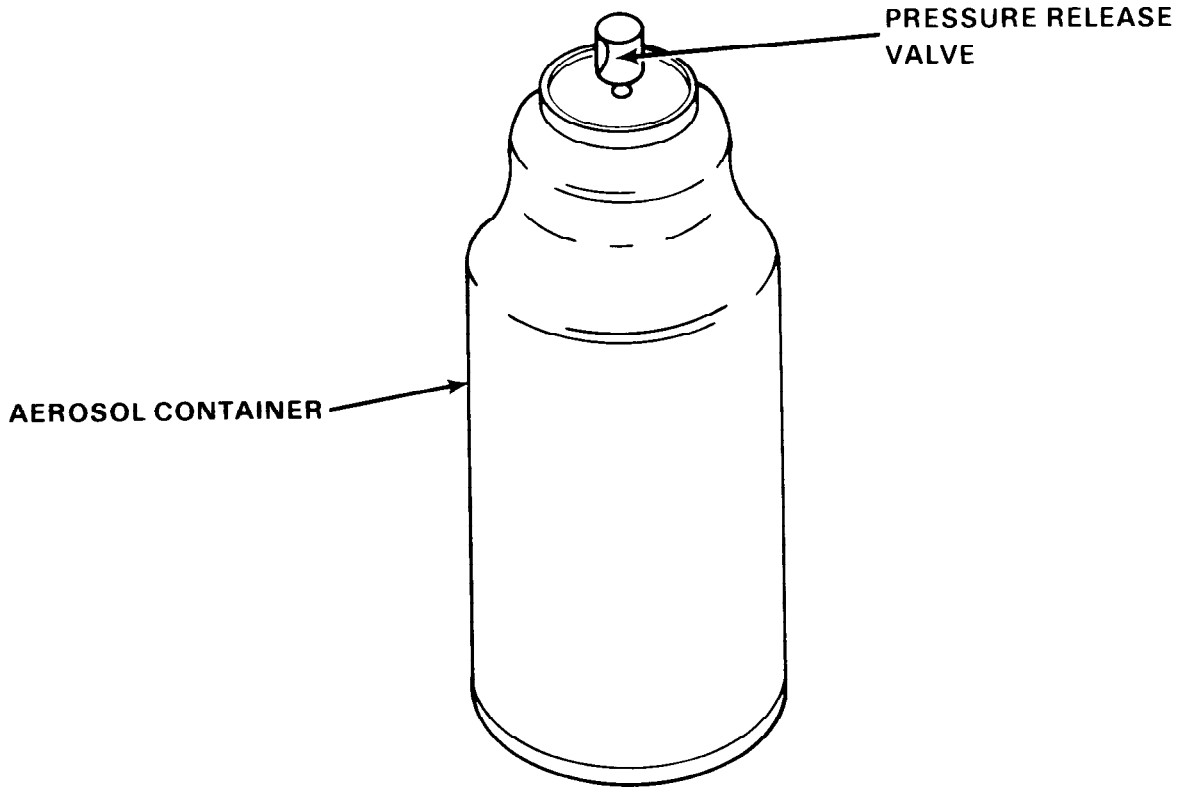


Figure 14-2.2. AN-M1 BG1 Simulated Agent Disperser

14-2.3. TRAINING SET, CHEMICAL AGENT IDENTIFICATION, SIMULANT, M72A1

14-2.3.1. Intended Use. The M72A1 Simulant Chemical Agent Identification Training Set (SCAIT) is 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 M72A1 SCAIT set contains only agent simulants, color changes produced are the same as those obtained with toxic chemical agents under field conditions. (See TM 3-6910-227-10 for additional information.)

14-2.3.2. Description. The M72A1 SCAIT set, Figure 14-2.3, consists 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 TM 3-6910-227-10. The test bottles and vials containing ampoules of vapor simulants have corresponding colored markings to assure proper matching during use. The sampling adapter assembly is provided with a rubber squeeze bulb and is threaded to receive a test bottle when performing tests.

14-2.3.3. Operation. When using the M72A1 SCAIT set, small quantities of the agent simulants are used with detectors to demonstrate color changes associated with surface contamination. The color changes produced by the detectors by using this training set are the same as those obtained with chemical agents under field conditions.

14-2.3.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This training set is designated as a Group B Chemical Ammunition for handling and storage purposes.

14-2.3.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this training set.

WARNING

THE AGENT SIMULANTS ARE HARMFUL IF INHALED OR SWALLOWED. AVOID CONTACT WITH EYES, SKIN, AND CLOTHING. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING.

14-2.3.6. Shipping Containers. This training set is packaged one per steel pail. The filled pail weighs approximately 14 pounds.

14-2.3.7. Identification Data. The M72A1 SCAIT set is listed under NSN 6910-00-106-4800.

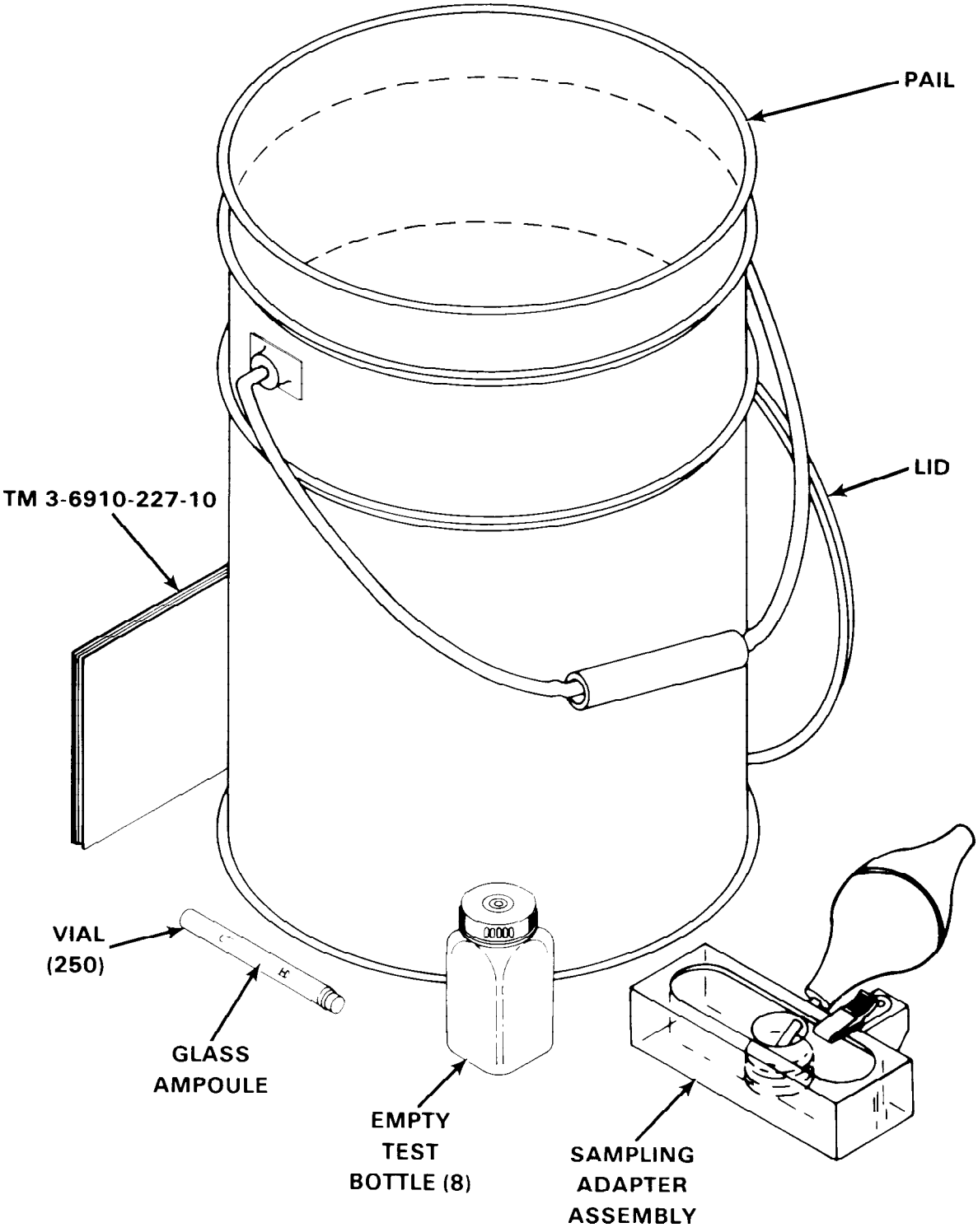


Figure 14-2.3. M72A1 Simulant Chemical Agent Identification Training Set

14-2.4. CAPSULE, RIOT CONTROL AGENT, C N

N O T E

CN Riot Control Agent Capsules are no longer authorized for training purposes by the Navy.

14-2.4.1. Intended Use. The CN Riot Control Agent Capsule is a training item designed to familiarize personnel with the effects and characteristics of CN riot control agent, a tear producing powder. The capsule can be used to simulate chemical warfare toxic agent attacks and to test the fit and effectiveness of the protective mask.

14-2.4.2. Description. The CN capsule, Figure 14-2.4, is a number 00 pharmaceutical type gelatin capsule filled with approximately one gram of CN or chloroacetophenone.

14-2.4.3. Operation. The CN agent is disseminated through the test chamber or training area by placing the capsule or capsules on an upended empty tin can over a burning candle. When the test chamber is filled with the agent, masked trainees are brought into the chamber to gain confidence in their masks and test the fit of their masks. The trainees are required to unmask to become familiar with the effects of the CN agent.

14-2.4.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this manual. This capsule is designated as a Group B Chemical Ammunition for handling and storage purposes.

14-2.4.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this capsule.

14-2.4.6. Shipping Containers. This capsule is packaged 50 per metal can with 5 cans per fiberboard box. Ten fiberboard boxes (2,500 capsules) are packed in a wooden box. The filled box weighs approximately 42.0 pounds.

14-2.4.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this capsule is approximately 1.0 gram.

14-2.4.8. Identification Data. The CN capsule is listed under Specification MIL-C-10777, NSN 1365-00-277-3049, and DODIC/NALC K505.

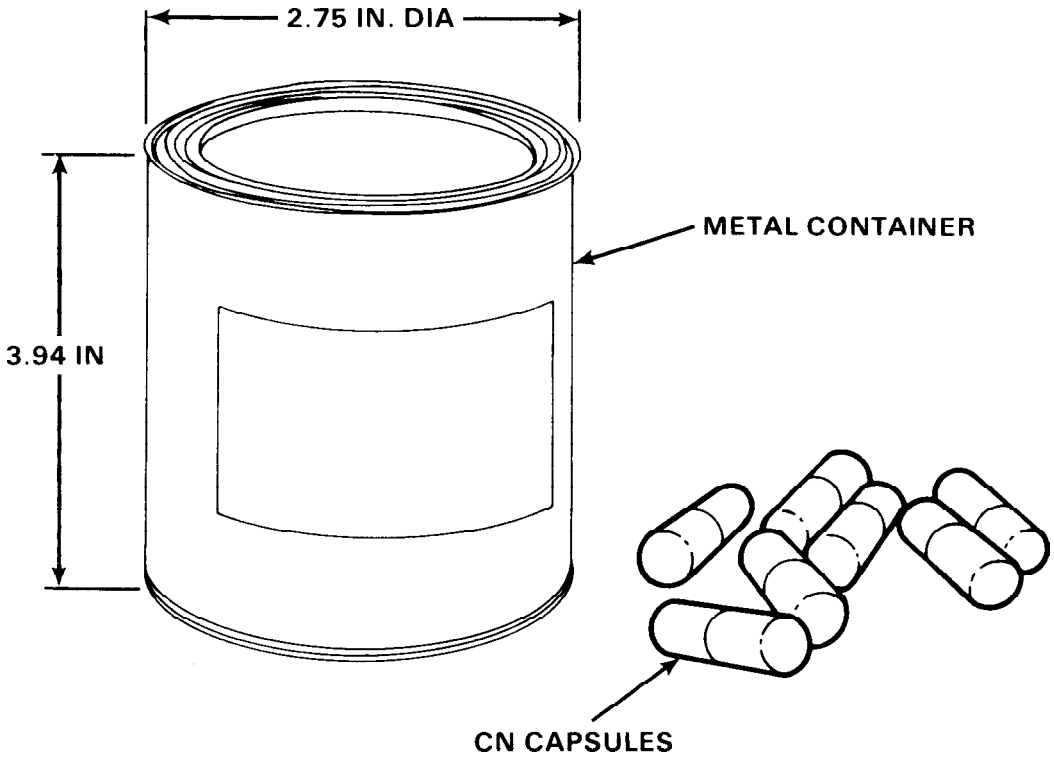


Figure 14-2.4. CN Riot Control Agent Capsule

14-2.5. CAPSULE, RIOT CONTROL AGENT, CS

14-2.5.1. Intended Use. The Riot Control Agent CS Capsule is designed to familiarize trainees with the effects of CS riot control agent. The capsule can be used to simulate chemical warfare toxic agent attacks and to test the fit and effectiveness of the protective mask.

14-2.5.2. Description. The CS capsule, Figure 14-2.5, is a number 00 pharmaceutical type gelatin capsule filled with approximately 0.82 gram of CS agent. The CS is ground to a particle size of less than 840 microns.

14-2.5.3. Functional Description. The CS Capsule is aerosolized by placing the capsule on an upended empty tin can that is placed over a burning candle. When the test chamber is filled with the CS agent, masked trainees are brought into the chamber to gain confidence in their masks and test the fit of their masks. The trainees are required to unmask to become familiar with the effects of the CS agent.

14-2.5.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This capsule is designated as a Group B Chemical Ammunition for handling and storage purposes.

14-2.5.5. Safety Precaution. The general safety precautions contained in Chapter 2 apply to this capsule.

14-2.5.6. Shipping Containers. This is packaged 50 per metal can with 5 cans per fiberboard box. Ten fiberboard boxes (2,500 capsules) are packed per wooden box. The filled box weighs approximately 42 pounds.

14-2.5.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this capsule is approximately 0.82 gram.

14-2.5.8. Identification Data. The CS capsule is listed under Specification MIL-R-51015, NSN 1365-00-690-8656 and DODIC/NALC K765.

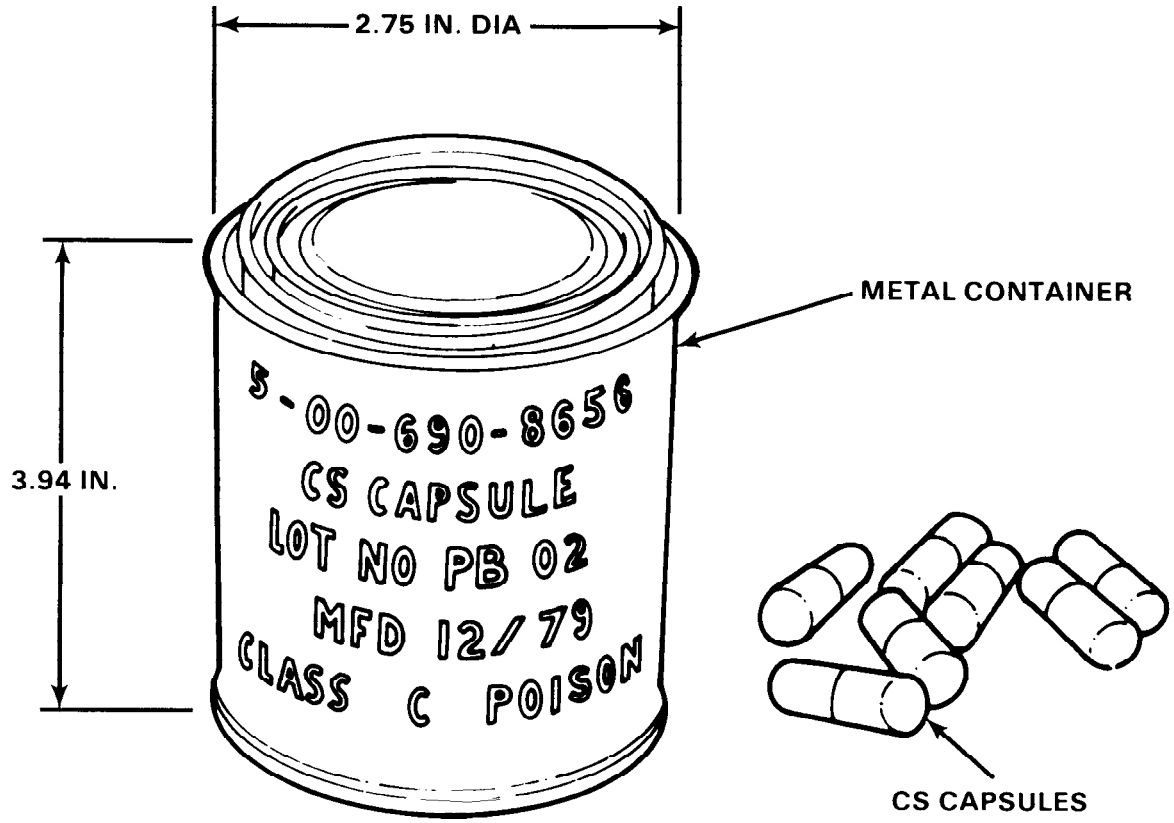


Figure 14-2.5. CS Riot Control Agent Capsule

14-2.6. CHEMICAL AGENT, MUSTARD, SIMULANT, MR

14-2.6.1. Intended Use. The MR Mustard Simulant Chemical Agent is used in defense training exercises to simulate liquid chemical agents such as HD mustard. The MR Mustard Simulant is used to train toxic agent handlers in the use of toxic chemical agent handling equipment, and to train personnel in the employment of the M1 Chemical land mine (paragraph 9-2.2).

14-2.6.2. Description. The MR Mustard Simulant, Figure 14-2.6, is a mixture consisting of a 25 percent solution by volume of molasses residuum in water. The mixture forms a dark-brown liquid of thin, syrupy consistency and has a distinctive molasses odor.

14-2.6.3. Functional Description. MR is used as a simulant for filling M1 chemical land mines using the M2 land mine field-filling apparatus. The M1 land mines filled with MR are detonated to simulate chemical land mine fields. After the MR solution has been poured, detonated, or sprayed, its molasses odor can be detected on the contaminated area for about one hour. The patterns obtained by dispersion from airplane spray tanks, chemical land mines, and thin-case bombs are similar to those produced by HD.

14-2.6.4. Safety Precautions. MR solution is harmless unless swallowed. The cresol used as a stabilizing agent is poisonous.

14-2.6.5. Shipping Containers. The MR solution is packaged 50 gallons per metal drum. The filled drum weighs approximately 590 pounds.

14-2.6.6. Identification Data. The MR mustard simulant is listed under Specification MIL-M-10856, NSN 1365-00-277-3044, and DODIC/NALC K660.

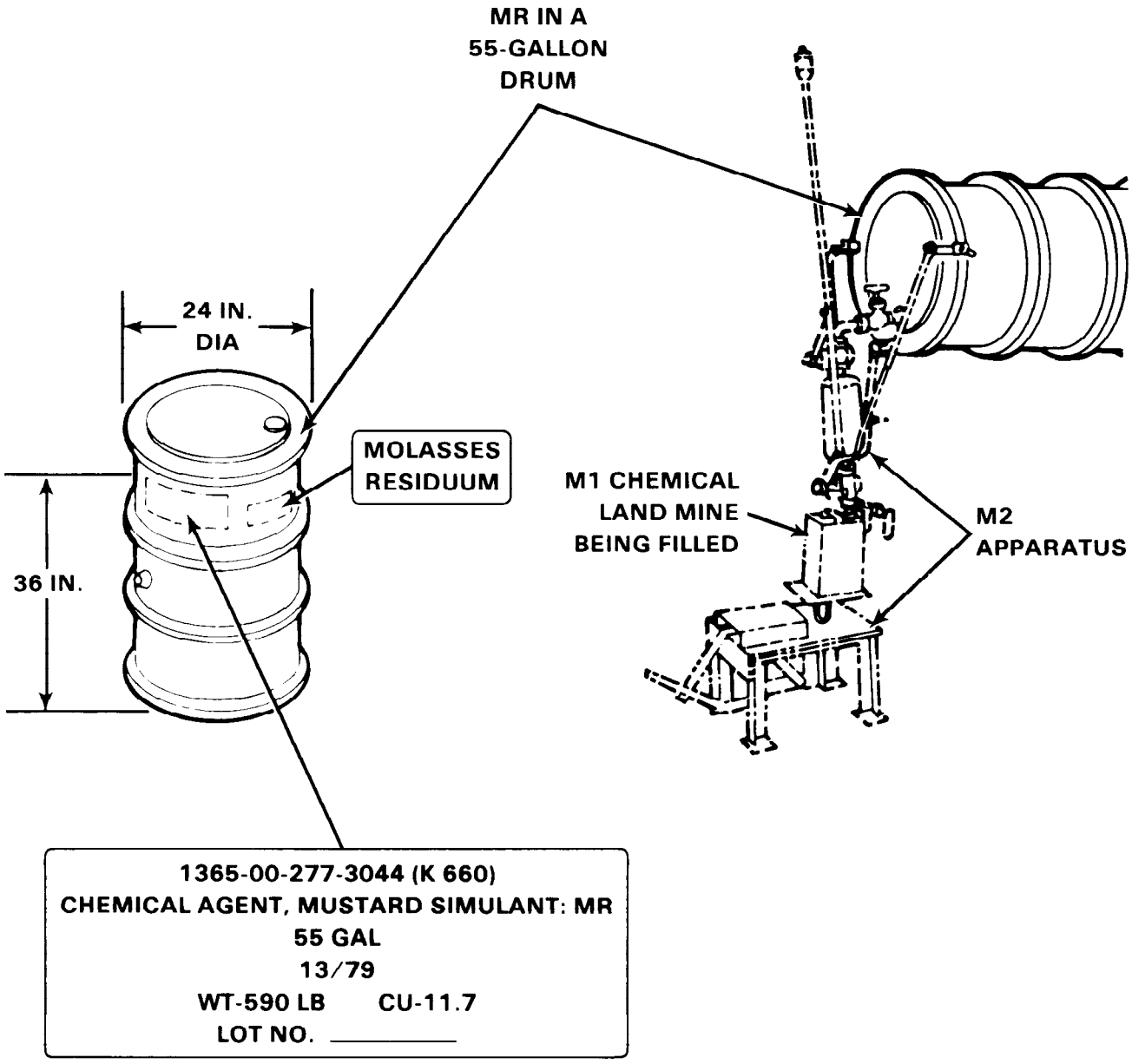


Figure 14-2.6. MR Simulant Chemical Agent Mustard

14-2.7. PELLET, CN, M2

N O T E

The M2 CN Pellet is no longer authorized for training purposes by the Navy.

14-2.7.1. Intended Use. The M2 CN Pellet is used in training exercises to familiarize personnel with the characteristics of CN tear gas, to test the fit of a protective mask, and to simulate chemical warfare agents.

14-2.7.2. Description. The M2 Pellet, Figure 14-2.7, is a 1-gram tablet approximately .50 inch in diameter and containing 93 percent CN and 7 percent zinc oxide which is used as a binder.

14-2.7.3. Functional Description. The M2 CN Pellet is aerosolized by placing the pellet on an upended empty can that is placed over a burning candle. Then the test chamber is filled with the CN agent, masked trainees are brought into the chamber to gain confidence in their masks and test the fit of their masks. The trainees are required to unmask to become familiar with the effects of the CN agent.

14-2.7.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This pellet is designated as a Group B Chemical Ammunition for handling and storage purposes.

14-2.7.5. Safety Precautions. The general safety standards contained in Chapter 2 apply to this pellet.

14-2.7.6. Shipping Containers. This pellet is packaged 50 per metal can with 25 cans (1,250 pellets) per box. The filled box weighs approximately 16 pounds.

14-2.7.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical compounds in this pellet is approximately 1.0 gram.

14-2.7.8. Identification Data. The M2 CN Pellet is listed under Specification MIL-P-14240, NSN 1365-00-383-3909, and DODIC/NALC K515.

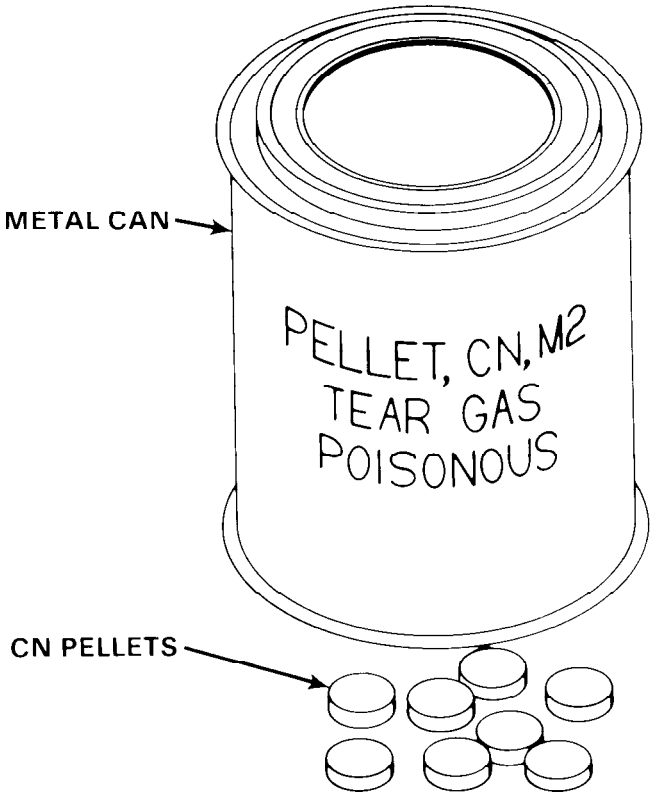


Figure 14-2.7. M2 CN Pellet

14-2.8. DETECTOR KIT, CHEMICAL AGENT, M18A2

14-2.8.1. Intended Use. The M18A2 Chemical Agent Detector Kit is used in training and field operations for detecting dangerous concentrations of vapors, aerosols, and liquid droplets of chemical agents. (See TM 3-6665-254-12 for additional information.)

14-2.8.2. Description. The M18A2 Detector Kit, Figure 14-2.8, consists of a portable plastic carrying case approximately 7.0 inches long, 5.0 inches high, and 3.0 inches wide containing the following components:

1. Instruction cards (2)

2. Detector tubes (5 clips of 25 each)

   a. Blue-band tube (2 clips)

   b. Red-band tubes (1 clip)

   c. Green-band tubes (1 clip)

   d. Yellow-band tubes (1 clip)

3. M8 VGH chemical agent detector paper (1 book of 25 papers)

4. Inspection date record card

5. Detector tickets (1 belt of 40 each)

6. Sampling tubes, white-band (1 clip of 25 each)

7. Color coded plastic squeeze bottles with matching colored caps (3)

   a. Blue-marked bottle of sodium hydroxide

   b. White-marked bottle of buffered water

   c. Green-marked bottle, empty

8. Aspirator bulb assembly

9. Glass vial, green-marked, containing 14 tablets (compound 34)

10. Packets (straws) containing powder reagent (sodium pyrophosphate peroxide) (14)

11. Plastic container for glass vial and packets

12. Report cards in envelopes (5)

13. Red-marked dispenser (substrate solution)

The hinged carrying case has an adjustable shoulder strap and waist belt attachment strap. A pencil is attached to the carrying case by a cord. The carrying case with contents weighs approximately 2.5 pounds.

14-2.8.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this kit.

14-2.8.4. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this item.

14-2.8.5. Identification Data. The M18A2 detector kit is listed under Drawing E5-77-2092 and NSN 6665-00-903-2092.

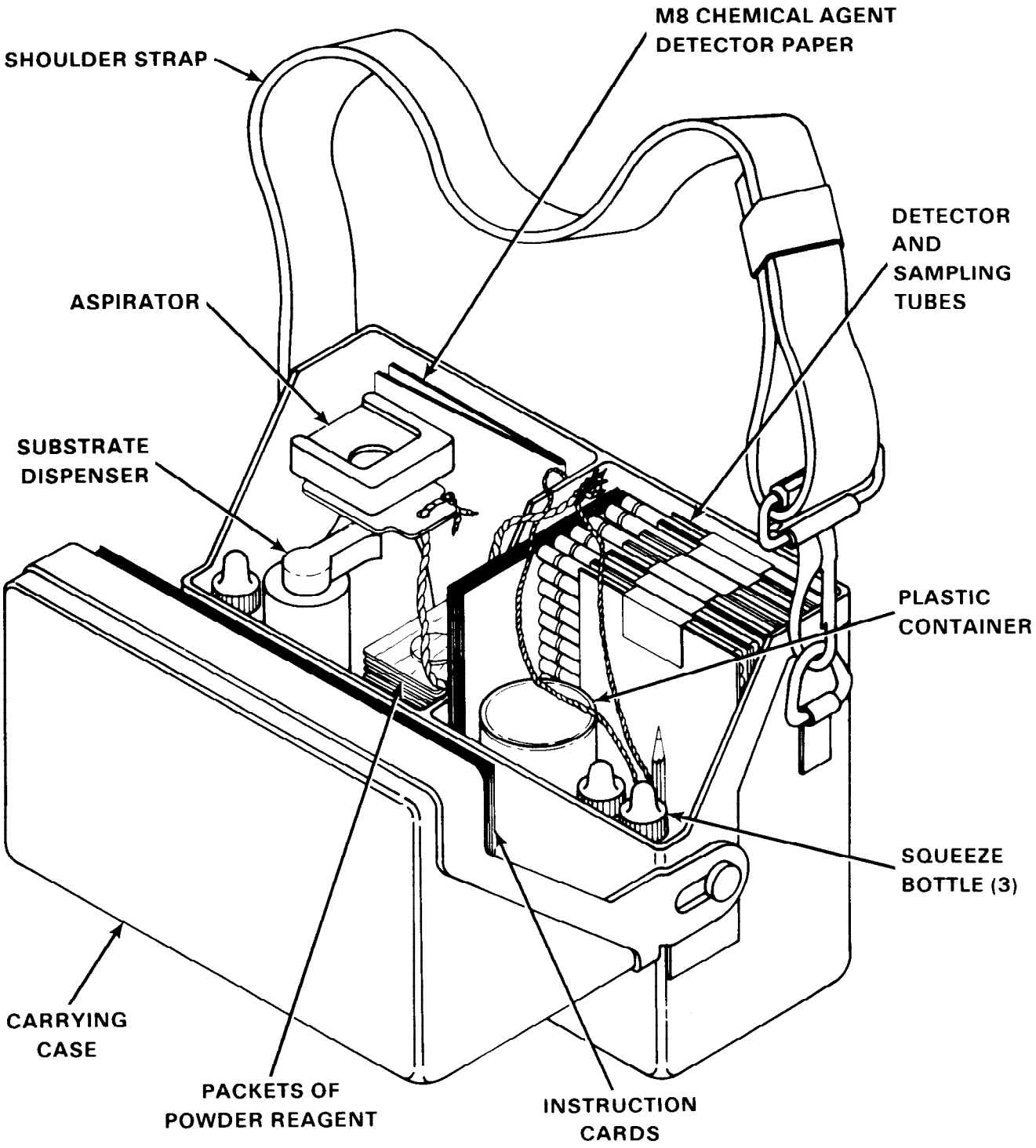


Figure 14-2.8. M18A2 Chemical Agent Detector Kit

14-2.9. DETECTOR KIT, CHEMICAL AGENT, M256

14-2.9.1. Intended Use. The M256 Detector Kit is used in training and field operations for detecting and classifying chemical agents present in the air and in liquid form. (See TM 3-6665-307-10 for additional information.)

14-2.9.2. Description. The M256 Detector Kit, Figure 14-2.9, consists of a portable plastic carrying case approximately 7.0 inches long, 5.0 inches high, and 3.0 inches wide containing 12 sampler-detectors, one book (25 sheets) of M8 VGH chemical agent detector paper, and a set of operational instruction cards.

The hinged carrying case is provided with an adjustable shoulder strap and a waist belt attachment strap.

There are 12 individually wrapped sampler detectors in each kit. Each sampler-detector consists of eight glass ampoules each filled with chemical reagent, three test spots, a chemical heater, protective strips, and tabs. Instructions for use are printed on the outer sides of each sampler-detector protective bag. A lewisite tablet rubbing tab uses a lewisite detecting tablet for detection of lewisite. Formed channels in the plastic sheets direct the flow of reagents from the finger crushable ampoules to wet the test spots at the time of testing. SAFE/DANGER observations are printed on each sampler-detector. They show the approximate color that each test spot develops if agent is/is not present.

One book of M8 paper is packed in each kit inside a protective bag. The book contains 25 sheets of M8 paper. The paper detects presence of liquid nerve and blister agents by changing color. A color comparison chart is located on the inside of the front cover. Instructions for using the M8 paper are printed on both sides of the back cover. Some books of M8 paper have perforations down the center of each page and some do not. Books with perforations down the center of each page allow for 50 tests.

One set of operational instruction cards is attached to the case by a lanyard. The cards contain instructions for use of the kit.

14-2.9.3. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this kit.

14-2.9.4. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this item.

14-2.9.5. Identification Data. The M256 Detector Kit is listed under Drawing C5-77-2001 and NSN 6665-01-016-8399.

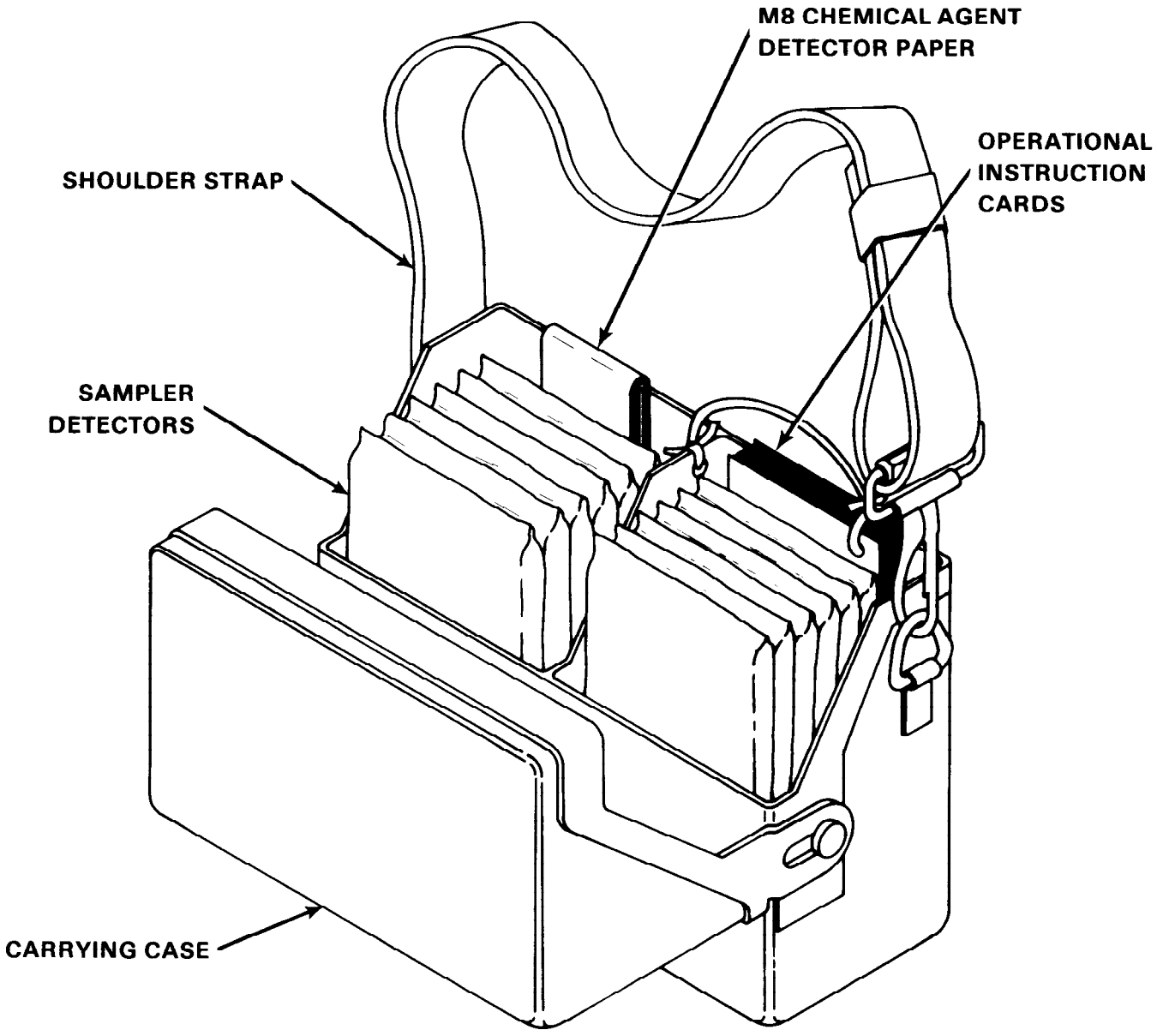


Figure 14-2.9. M256 Chemical Agent Detector Kit

CHAPTER 15

OBSOLETE AND UNSERVICEABLE ITEMS

15-1. INTRODUCTION

This chapter contains information on chemical agents, munitions, and training devices which have been declared obsolete and unserviceable.

NOTE

If any of the items listed in this chapter are found in the supply system, they MUST NOT BE USED. Instead, an ammunition disposition request should be submitted to the inventory manager at SPCC Mechanicsburg, Code 73, for disposition instructions.

15-1.1. GENERAL. Table 15-1 lists all obsolete and unserviceable items, present paragraph location, and previous chapter location that contains general information on the item.

Table 15-1. Obsolete and Unserviceable Items

Item	Paragraph	Previous Chapter
Bomb, Gas, 115-Pound, HD, Persistent, M70A1	15-2.1	Chapter 10
Bomb, Gas, 500-Pound, CG-CK, Nonpersistent, AN-M78	15-2.2	Chapter 10
Bomb, Gas,1000-Pound, CG-CK or AC, Nonpersistent, AN-M79	15-2.3	Chapter 10
War Gas Identification Set, Instructional, M1	15-2.4	Chapter 14
War Gas Identification Set, Detonation, M1	15-2.5	Chapter 14
War Gas Identification Set, Detonation, AN-M1A1	15-2.6	Chapter 14
Toxic Gas Set, Training, M1	15-2.7	Chapter 14
Toxic Gas Set, Training, M2	15-2.8	Chapter 14
Chemical Agent Identification Set, M72, Training	15-2.9	Chapter 14

15-2. ITEM DESCRIPTIONS

15-2.1. BOMB, GAS, 115-POUND, PERSISTENT, HD, M70A1

15-2.1.1. Intended Use. The M70A1 115-Pound HD Persistent Gas Bomb is designed for use with propeller-driven aircraft. It is used primarily for antipersonnel effects. This bomb is no longer in use by the Navy.

15-2.1.2. Description. The M70A1 bomb, Figure 15-2.1, is approximately 51.50 inches long and weighs 128 pounds when assembled into a complete round. It is 8.09 inches in diameter and has an ogival nose and a truncated conical tail section. The complete round consists of a bomb body, filling, a tail fin, a burster, a fuze, and an arming wire. Double green bands identify the bomb as a persistent gas bomb. Bomb nomenclature and lot number are stenciled on the body in green.

BODY. The bomb body is made of seamless steel tubing. A tubular burster well extends the length of the interior of the bomb from a threaded hole in the nose to the tail. A fuze adapter is screwed into the opening of the burster well. The tail end of the bomb is threaded and provided with a locknut for locking the tail fin in place. During shipment, the hole in the bomb nose is closed by a nose plug. Suspension lugs welded to the body are used for carrying the bomb in an aircraft.

FILLING. The bomb is filled during manufacture with 60 pounds of HD (distilled mustard).

TAIL FIN. An M102, M102A2, or AN-M103A1 standard box-type tail fin is used with the M70A1 persistent gas bomb. The tail fin is shipped separately from the bomb and is installed in the field and secured by a fin locknut.

BURSTER. The M10 burster is installed in the burster well before the bomb is loaded in an aircraft. The burster well tube runs the entire length of the body and fits into a positioning cup at the rear. The forward end of the burster is threaded to receive a nose fuze. The burster is shipped separately from the bomb.

FUZE. The preferred fuze is an AN-M158 nose bomb fuze which is installed in the bomb nose. The M110A1 nose bomb fuze is an authorized alternate fuze. The fuze is shipped separately from the bomb.

ARMING WIRE. An M2 type D arming wire is used with this bomb.

15-2.1.3. Bomb Assembly.

WARNING

WHEN HANDLING THE M70A1 PERSISTENT GAS BOMB, PERSONNEL SHOULD WEAR PERMEABLE PROTECTIVE CLOTHING, RUBBER APRONS, GLOVES, BOOT COVERS, AND PROTECTIVE MASKS TO GUARD AGAINST POSSIBLE LEAKING HD. CHECK FOR THE AGENT IN THE BURSTER WELL WHEN REMOVING THE NOSE PLUG.

1. Before Loading in Aircraft. Remove shipping bands or lug protectors, unscrew the nose plug, and unscrew the fuze adapter from the bomb nose. Remove the fin locknut, and install the tail fin over the threaded portion at the tail end of the bomb. Align one vane of the tail fin with the suspension lugs, and install and tighten the fin locknut. Insert the burster in the burster well, and screw the fuze adapter into the hole in the bomb nose.

2. After Loading in Aircraft. Screw the fuze handtight into the fuze adapter. Install the arming wire, and place two safety clips on the end of the wire. Remove the fuze safety wire.

15-2.1.4. Functional Description. When the bomb is released from an aircraft, the arming wire is withdrawn and the fuze arming vane rotates in the airstream. After the required number of revolutions, the fuze is armed. When the bomb strikes, the fuze functions, causing the burster to detonate. The detonation of the burster ruptures the bomb body and releases the filling.

15-2.1.5. Defuzing. To defuze an M70A1 bomb, replace the safety wire in the fuze, remove the arming wire, and unscrew the fuze. Remove the burster and return it and the fuze to their original packing.

WARNING

DO NOT ATTEMPT TO DISARM AN ARMED FUZE. ONLY EOD PERSONNEL SHOULD UNDERTAKE DISARMING AND DISPOSAL OF FUZES.

15-2.1.6. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This bomb is designated as a Group A Chemical Ammunition for handling and storage purposes.

15-2.1.7. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this bomb.

15-2.1.8. Shipping Containers. The M70A1 bomb is protected for shipping by shipping bands. Some bombs may have lug protectors which protect the suspension lugs. With shipping bands, the bomb weighs approximately 135 pounds and displaces 3.9 cubic feet. With the lug protectors, the bomb weighs approximately 122 pounds and displaces 2.1 cubic feet. The tail fin, burster, fuze, and arming wire are packed separately.

15-2.1.9. Identification Data. The M70A1 bomb is listed under Drawing 82-0-83.

15-2.1.10. General Data. The following table provides general data on the M70A1 bomb:

Fin assembly model	AN-M103A1
Length of assembled bomb	51.50 inches
Body diameter	8.09 inches
Fin span	11.00 inches
Weight empty	55.00 pounds
Filling	Distilled mustard (HD)
Filling weight	60.60 pounds
Weight of an assembly	5.60 pounds
Weight assembled	128.10 pounds
Arming wire assembly	Mk 1 or AN-M6A2
Burster	M10
Nose fuze	AN-M158

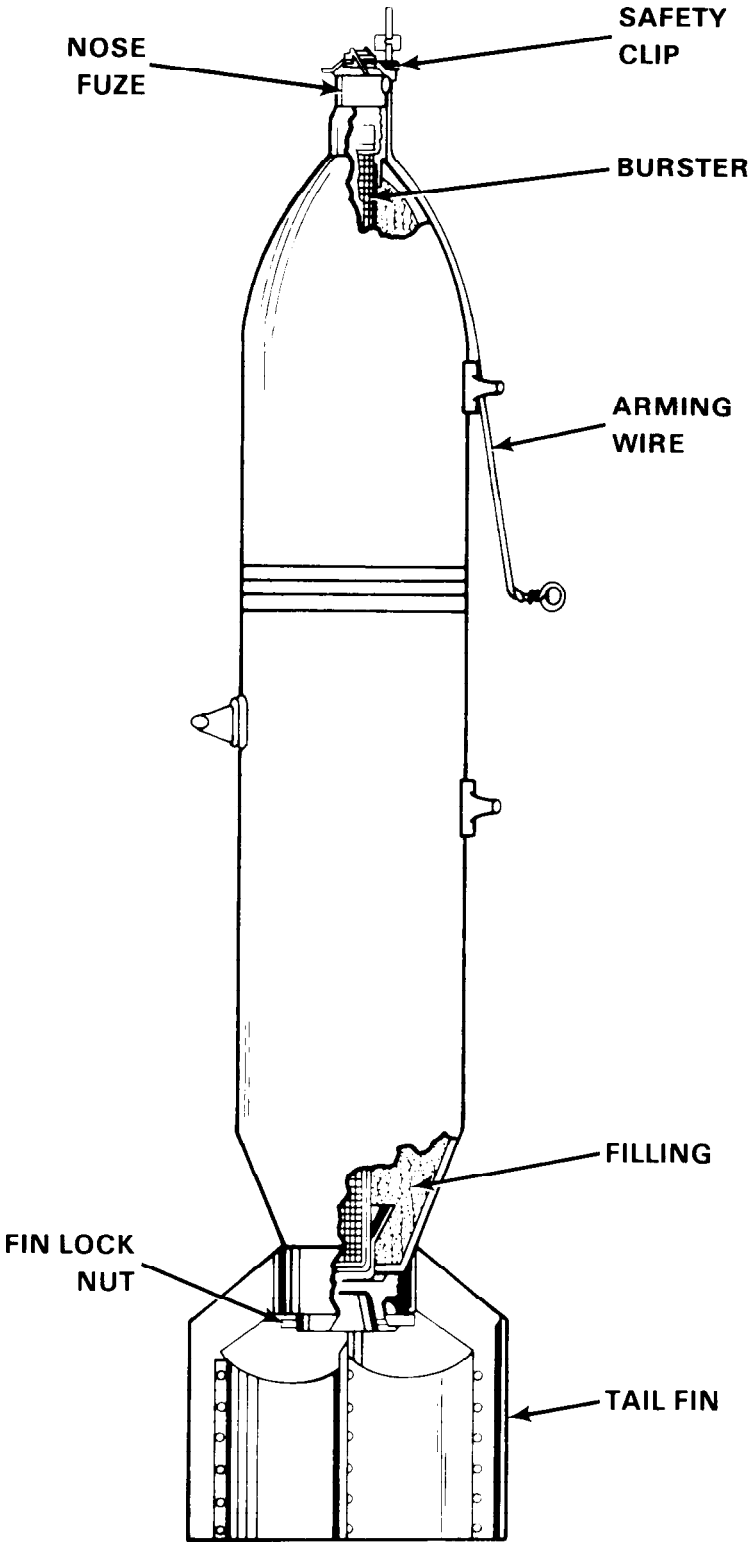


Figure 15-2.1. M70A1 115-Pound Persistent Gas Bomb

15-2.2. BOMB, GAS, 500-POUND, NONPERSISTENT, CG-CK, AN-M78

15-2.2.1. Intended Use. The AN-M78 500-Pound CG or CK Nonpersistent Gas Bomb is designed to provide a toxic chemical offensive capability using chemical agents phosgene (CG) or cyanogen chloride (CK). This bomb is no longer in use by the Navy.

15-2.2.2. Description. The AN-M78 bomb, Figure 15-2.2, is 59 inches long and when assembled into a complete round, weighs 496 pounds when filled with CG or 467 pounds when filled with CK. The bomb is 14.18 inches in diameter and has an ogival nose and truncated conical tail section. The complete round consists of bomb body, filling, a tail fin, a burster, an adapter-booster, a nose fuze, a tail fuze, and an arming wire.

Single green bands at the nose, one at the middle, and one at the tail end identify the bomb as a nonpersistent gas bomb. Bomb nomenclature and lot number are stenciled on the body in green.

BODY. The bomb body is of one piece steel construction. A tubular burster well extends the length of the interior of the bomb from a threaded hole in a base plate welded to the tail end of the body where the bomb has tapered down to an 8-inch diameter. A fuze-seat liner installed in the fuze adapter receives a nose fuze. The threaded hole in the base plate receives an adapter-booster and tail fuze. During shipment, the hole in the nose is closed by a nose plug, and a threaded hole in the base plate is closed by a tail plug. An AN-M1 needle valve is installed in the base plug for use when venting the bomb. Suspension lugs welded to the body are used for carrying the bomb in an aircraft. A single lug is attached to the underside at the approximate center of gravity.

FILLING. The bomb is filled during manufacture with either 205 pounds of CG choking agent or 176 pounds of CK blood agent.

TAIL FIN. An M109 or M109A1 standard box-type tail fin is used with the AN-M78 nonpersistent gas bomb. The tail fin is shipped separately from the bomb and is installed in the field.

Conical fin assembly M128A1 can also be used; it is secured with fin locknut, BuOrd Sketch 329153, and fin locking web, Drawing 135022. If used, the adapter-booster holder should be staked prior to assembly and, in this case, tail fuze M172 is required.

BURSTER. An AN-M15 burster is installed in the burster well before the bomb is loaded in an aircraft. The burster well runs the entire length of the bomb. The burster well assembly is threaded at its forward end to receive a nose fuze and at its rear to receive the adapter-booster. The burster is shipped separately from the bomb.

ADAPTER-BOOSTER. An M115 or M115A1 adapter-booster is screwed into the base plate before the bomb is loaded in an aircraft. The adapter-booster is shipped separately from the bomb.

Adapter-Booster M117 may be used in conjunction with AN-M145A1 and AN-M146A1 type mechanical time fuzes for aerial burst when the bomb is filled with persistent gas.

NOSE FUZE. The preferred non-delay nose fuze is an M163 nose bomb fuze. Authorized alternate fuzes are AN-M103, AN-M103A1, AN-M139A1, AN-M140A1, M164, and M165 nose bomb fuzes.

TAIL FUZE. The preferred tail fuze is an M161 tail bomb fuze. Authorized alternate fuzes are the M101A1 and AN-M101A2 tail bomb fuzes.

ARMING WIRE. An M5, M7, or AN-M7A1 type E arming wire is used with the bomb.

15-2.2.3. Bomb Assembly.

WARNING

WHEN HANDLING THE AN-M78 GAS BOMB, PERSONNEL SHOULD WEAR PROTECTIVE MASKS TO GUARD AGAINST POSSIBLE LEAKING CG OR CK.

1. Before Loading in Aircraft. Remove shipping bands and unscrew the nose and tail plugs. Remove the fin locknut, place the tail fin over the tail of the bomb with one vane in alignment with the suspension lugs, and install and tighten the fin locknut. Tighten the fuze-seat liner snugly in the threads in the bomb nose. Working from the tail end of the bomb, insert the AN-M15 burster in the burster well and screw the adapter-booster into the threaded hole in the base plate of the tail end of the burster well.

2. After Loading in Aircraft. Adjust the nose and tail fuzes for instantaneous or delay action as desired. Remove the closure plug from the adapter-booster and screw the tail fuze handtight into the adapter-booster. Screw the nose fuze handtight into the fuze-seat liner. Install the arming wire with one branch to each fuze and place two safety clips on the end of each branch. Remove the fuze safety wires.

15-2.2.4. Functional Description. When the bomb is released from an aircraft, the arming wire is withdrawn and the fuze arming vanes rotate in the airstream. After the required number of revolutions, the fuzes are armed. When the bomb strikes, the fuzes function, causing the burster to detonate. The detonation of the burster ruptures the bomb body and releases the filling.

15-2.2.5. Defuzing. To defuze an AN-M78 gas bomb, replace the safety wires in the fuzes, remove the arming wire, and unscrew the fuzes. Remove the burster and return it and the fuzes to their original packing.

WARNING

DO NOT ATTEMPT TO DISARM AN ARMED FUZE. ONLY EOD PERSONNEL SHOULD UNDERTAKE DISARMING AND DISPOSAL OF FUZES.

15-2.2.6. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This bomb is designated as a Group A Chemical Ammunition for handling and storage purposes.

15-2.2.7. Safety Precautions. The general safety precautions in Chapter 2 apply to this bomb.

15-2.2.8. Shipping Container. The AN-M78 bomb is protected for shipping by shipping bands. The bomb, with shipping bands installed, weighs 492 pounds when filled with CG and 463 pounds when filled with CK and displaces 10.1 cubic feet. The tail fin, burster, fuzes, and arming wires are packed separately.

15-2.2.9. Identification Data. The AN-M78 bomb is listed under Drawing 82-0-115.

15-2.2.10. General Data. The following table provides general data on the AN-M78 bomb:

Fin assembly model	AN-M109A1
Length of assembled bomb	59.25 inches
Body diameter	14.18 inches
Fin span	18.94 inches
Weight empty	260.0 pounds
Filling	Phosgene (CG) or cyanogen chloride (CK)
Filling weight	
C G	205.0 pounds
C K	176.0 pounds
Weight of fin assembly	18.6 pounds
Weight assembled	
Filled with CG	495.0 pounds
Filled with CK	466.0 pounds
Arming wire assembly	Mk 1, AN-M6A2, or M13
Adapter-booster (holder assembly)	M115 or M115A1
Burster	AN-M15
Nose fuze	M163, M164, M165, AN-M103A1, AN-139A1, AN-M140A1, AN-M166 (VT)
Tail fuze	AN-M101A2

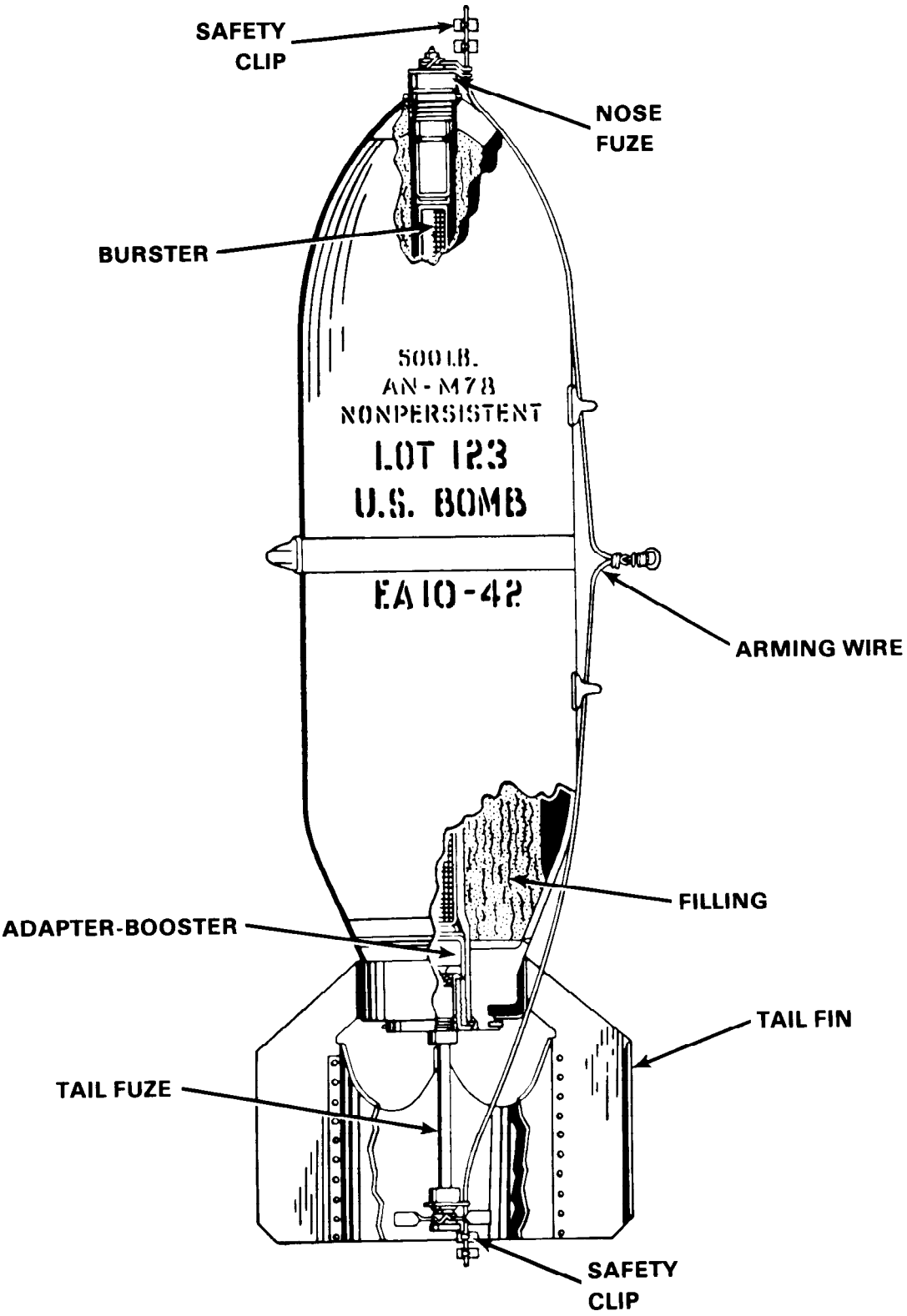


Figure 15-2.2. AN-M78 500-Pound CG or CK Nonpersistent Gas Bomb

15-2.3. BOMB, GAS, 1000-POUND, NON-PERSISTENT, CG, CK or AC, AN-M79

15-2.3.1. Intended Use. The AN-M79 1000-Pound CG, CK, or AC Nonpersistent Gas Bomb is designed to provide a toxic chemical offensive capability using chemical agents phosgene (CG), cyanogen chloride (CK), or hydrocyanic acid (AC). This bomb is no longer in use by the Navy.

15-2.3.2. Description. The AN-M79 Bomb, Figure 15-2.3, is 69.5 inches long and, when assembled into a complete round, weighs 948 pounds when filled with CG, 884 pounds when filled with CK, and 728 pounds when filled with AC. The bomb is 18.75 inches in diameter and has an ogival nose and truncated conical tail section. The complete round consists of a bomb body, filling, a tail fin, a burster, an adapter-booster, a nose fuze, a tail fuze, and an arming wire.

A single green band at the bomb nose, one at the middle, and one at the tail end identify the bomb as a nonpersistent gas bomb. Bomb nomenclature and lot number are stenciled on the body in green.

BODY. The bomb body is of one piece cast-steel construction. A tubular burster well extends the length of the interior of the bomb from a threaded fuze adapter in the nose to a threaded hole in a base plate welded to the tail end of the body where the bomb body is tapered down to a small diameter. The base plate differs from that of the standard GP bomb in that it is a special forging welded to the case, having a filling hole, a hole for a venting and sampling, Needle Valve M1, and a threaded center hole for an adapter-booster. The filling hole is closed by a soft iron gasket, a hard steel gasket plug, and a threaded closing plug. Horizontal suspension is accomplished by two lugs, 14 inches apart or a single lug 180 degrees removed from these two at the center of gravity; all are welded to the bomb body. A fuze-seat liner installed in the fuze adapter receives a nose fuze. During shipment, the hole in the bomb nose is closed by a nose plug, and the threaded hole in the base plate is closed by a tail plug. Suspension lugs welded to the bomb body are used for carrying the bomb in an aircraft.

FILLING. The bomb is filled during manufacture with either 415 pounds of CG choking agent or 351 pounds of CK or 195 pounds of AC blood agents.

TAIL FIN. An M113 or M113A1 standard box-type tail fin is used with the AN-M79 nonpersistent gas bomb. The tail fin is shipped separately from the bomb and is installed in the field.

Conical fin assembly M129 also can be used; secure it with fin locknut BuOrd Sketch 329153 and fin locking web Drawing 1350522. Tail Fuze AN-M184 is required for use with M129 fins.

BURSTER. An AN-M16 burster is installed in the burster well extends the entire length of the bomb and is threaded at each end to receive the nose fuze and adapter-booster. The burster well is expanded both in the nose and in the base plate before welding in order to eliminate possibilities of decomposition of the chemical agent due to the presence of crevices. The burster is shipped separately from the bomb.

ADAPTER-BOOSTER. An M115 or M115A1 adapter-booster is screwed into the base plate before the bomb is loaded in an aircraft. The adapter-booster is shipped separately from the bomb.

Adapter-booster M117 may be used in conjunction with AN-M145A1 and AN-M146A1 type mechanical time fuzes for aerial burst when the bomb is filled with persistent gas.

NOSE FUZE. The preferred nose fuze is a non-delay impact type, M163 nose bomb fuze. Authorized alternate fuzes are the AN-M103, AN-M103A1, AN-M139A1, AN-M140A1, M164, and M165 nose bomb fuzes.

TAIL FUZE. The preferred tail fuze is an M162 tail bomb fuze. Authorized alternate fuzes are the M102A1 and AN-M102A2 tail bomb fuzes.

ARMING WIRE. An M7 or AN-M7A1 type E arming wire is used with this bomb.

15-2.3.3. Bomb Assembly.

WARNING

WHEN HANDLING THE AN-M79 NONPERSISTENT GAS BOMB, PERSONNEL MUST WEAR PROTECTIVE MASKS TO GUARD AGAINST POSSIBLE LEAKING CG, AC, OR CK.

1. Before Loading in Aircraft. Remove shipping bands and unscrew the nose and tail plugs. Remove the fin locknut from the tail end of the bomb, place the tail fin over the tail with one vane in alignment with the suspension lugs, and install and tighten the fin locknut. Tighten the fuze-seat liner snugly in the threads in the bomb nose. Working from the tail end of the bomb, insert the AN-M16 burster in the burster well and screw the adapter-booster into the threaded hole in the base plate.

2. After Loading in Aircraft. Adjust the nose and tail fuzes for instantaneous or delay action as desired. Remove the closure plug from the adapter-booster and screw the tail fuze handtight into the nose fuze-seat liner. Install the arming wire with one branch to each fuze and place two safety clips on the end of each branch. Remove the fuze safety wires.

15-2.3.4. Functional Description. When the bomb is released from an aircraft, the arming wire is withdrawn and the fuze arming vanes rotate in the airstream. After the required number of revolutions, the fuzes are armed. When the bomb strikes, the fuzes function, causing the burster to detonate. The detonation of the burster ruptures the bomb body into a few large pieces and releases the filling. The initial cloud formed by the burst of the bomb, when filled with CG, covers an area of 100 yards in diameter within approximately 8 to 10 seconds. The nose fuze normally detonates the burster but, in the event of malfunction, the tail fuze sets it off through the adapter-booster charge.

15-2.3.5. Defuzing. To defuze an AN-M79 gas bomb, replace the safety wires in the fuzes, remove the arming wire, and unscrew the fuzes. Remove the burster and return it and the fuzes to their original packing.

WARNING

DO NOT ATTEMPT TO DISARM AN ARMED FUZE. ONLY EOD PERSONNEL SHOULD UNDERTAKE DISARMING AND DISPOSAL OF FUZES.

15-2.3.6. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This bomb is designated as a Group A Chemical Ammunition for handling and storage purposes.

15-2.3.7. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this bomb.

15-2.3.8. Shipping Containers. The AN-M79 bomb is protected for shipping by shipping bands. The bomb, with shipping bands installed,

weighs 939 pounds when filled with CG, 87 pounds when filled with CK, 719 pounds when filled with AC, and displaces 17.5 cubic feet. The tail fin, burster, fuzes and arming wires are packed separately.

15-2.3.9. Identification Data. The AN-M79 bomb is listed under Drawing 82-9-98.

15-2.3.10. General Data. The following table provides general data on the AN-M79 bomb:

Fin assembly model	AN-M113A1
Length of assembled bomb	69.50 inches
Body diameter	18.75 inches
Fin span	25.40 inches
Weight empty	485.0 pounds
Filling	Phosgene (CG), cyanogen chloride (CK), or hydrocyanic acid (AC)
Filling weight	
C G	415.0 pounds
C K	315.0 pounds
A C	195.0 pounds
Weight of fin assembly	21.5 pounds
Weight assembled	
Filled with CG	927.0 pounds
Filled with CK	873.0 pounds
Filled with AC	717.0 pounds
Arming wire assembly	Mk 1, AN-M6A2, M13
Adapter-booster holder assembly	M115A1
Burster	AN-M16
Nose fuze	M163, M164, M165, AN-M103A1, AN-M139A1, AN-M104A1, AN-M168 (VT)
Tail fuze	M162, AN-M102A2

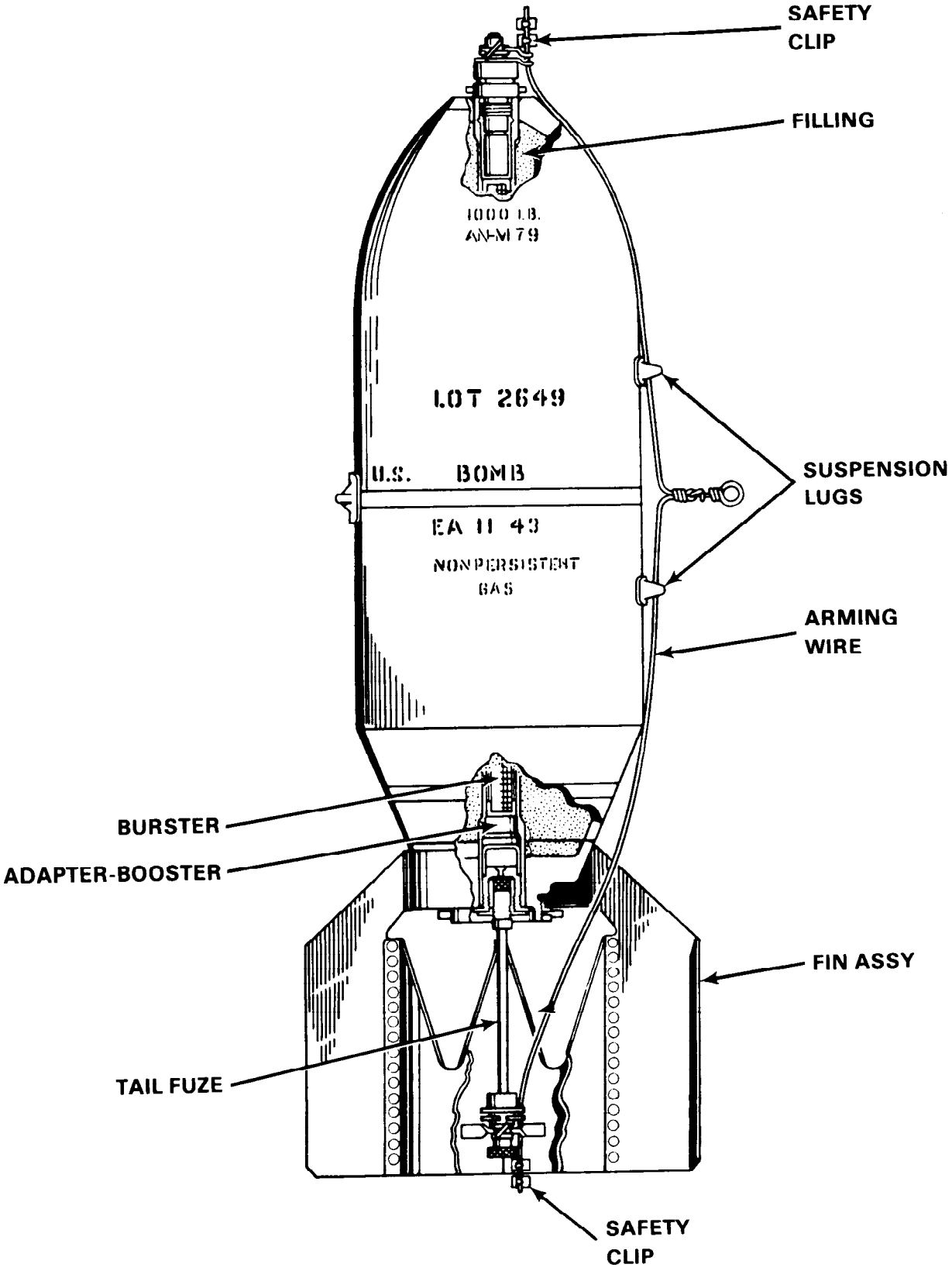


Figure 15-2.3. AN-M79 1000-Pound CG, AC or CK Nonpersistent Gas Bomb

15-2.4. GAS IDENTIFICATION SET, INSTRUCTIONAL, M1

15-2.4.1. Intended Use. The M1 Instructional Gas Identification Set is a training device for use by qualified instructors to identify chemical agents by their odors. The set is colloquially referred to as a "sniff set". The M1 identification set is no longer in use by the Navy.

15-2.4.2. Description. The M1 gas identification set, Figure 15-2.4, is a wooden packing box containing actual chemical agents in individual glass bottles with glass stoppers ground to make an air tight fit. Each bottle is etched on the side to show the symbol of the agent. There are seven bottles in all with agents as follows:

1. Two of mustard (H) (Each bottle contains 25 cc. of mustard absorbed by 90 cc. of activated charcoal.)

2. One of Phosgene (CG) (The bottle contains 3 grams of solid Triphosgene. Phosgene evaporates from this solid.)

3. One of Chlorpicrin (PS) (The bottle contains 25 cc. of Chlorpicrin absorbed by 90 cc. of activated Charcoal.)

4. One of Chloracetophenone (CN) (The bottle contains 15 grams of solid Chloroacetophenone.)

5. One of Lewisite (L) (The bottle contains 25 cc. of Lewisite absorbed by 90 cc. of activated charcoal.)

6. One of Adamsite (DM) (The bottle contains 15 grams of solid Adamsite in a cloth bag.)

Activated charcoal is used as an absorbent for the Mustard, Lewisite, and Chlorpicrin, which are liquids at ordinary temperatures. Adamsite in its solid state is placed in the bottle in a securely tied cloth bag. Chloracetophenone is placed in the bottle in its solid state and the bottle heated until the solid melts and forms an even coat on the bottom. The same thing is done to make the phosgene sample except that Triphosgene is used; this solid vaporizes and gives off Phosgene agent.

The stoppers are ground to fit in each bottle and should be kept in the bottles with which originally issued. Each bottle is packed in a metal can with a friction top. The symbol of the agent contained is etched on the bottle and marked on the lid of the can. In compliance with ICC regulations, each bottle is surrounded by sawdust or wool pulp within the can and each can is surrounded by 1 inch of wood pulp when placed in its section in the packing box.

15-2.4.3. Operation. Odors of chemical agents are the most readily available means of identification; however, in the case of some agents a concentration sufficient to produce an odor may be a lethal concentration. Also, the sense of smell tires very quickly and becomes confused from the odors of these chemical agents, some of which are violent poisons in addition to being irritants. It should be borne in mind that under battle conditions, the odors of a chemical agent will be blended with, and either partially or totally masked by, other odors present, such as, nitrogen oxide fumes from gun fire, marsh or swamp odors, or the stenches of putrefaction. It is very likely that two or more agents may be used simultaneously. For this reason, the effects on the body such as irritation of the eyes, nose, throat and prickling of the skin assist a trained observer in recognizing toxic chemical agents.

In testing for toxic agents, the air should never be inhaled deeply. The student should note exactly what the agent smells like to him. There is more variation in odor perception than in any other faculty. Naturally, it is to be expected that different men will describe the

same odor differently. As the concentration is increased, the odor will become stronger and more penetrating and will also change in characteristics. This, as well as the individual variation in perception, must be considered in identifying agents. Table 15-2 summarizes the characteristics of the different agents as they appear to the average person.

Table 15-2. Identifying Characteristics of Instructional Set of Agents

Common Name of Agent	Symbol	Odor	Odor Detectable At	Other Immediate Effect
Mustard	H	Garlic, Horse Radish	.001 Mg/1	None
Mustard (Purified)	HD	Garlic, Horse Radish	.001 Mg/1	None
Nitrogen Mustard	MN	Very Slight Fish Odor	High Concentrations Only	None
Lewisite	L	Geraniums	.0014 Mg/1 (Crude)	Sneezing; Nasal irritation
Phosgene	CG	Hay, Silage, or Green Corn	.004 Mg/1	Thin White Cloud Produced Coughing; Tightness in Chest; Eye irritation
Diphosgene	DP	Hay, Silage, or Green Corn	.009 Mg/1	Thin White Cloud Produced Coughing; Tightness in Chest, Eye irritation
Chlorpicrin	PS	Fly Paper	.007 Mg/1	Lacrimation; Vomiting
Hydrocyanic Acid	AC	Almond Flavoring or Peach Kernels	.034 Mg/1	None
Cyanogen Chloride	CK	Pungent	.007 Mg/1	Lacrimation
Arsine	SA	Faint Garlic-Like Odor	.1 Mg/1	None
Adamsite	DM	Irritating in Low Concentrations; Coal Smoke in High Concentrations	High Concentrations Only	Canary Yellow Smoke Haze; Headache; Vomiting; Nausea
Diphenyl Chlorarsine	DC	Irritating in Low Concentrations; Like Shoe Polish in High Concentrations	High Concentrations Only	Sneezing; Vomiting; Headache
Chloraceto-phenone	CN	Apple Blossoms	.0001 Mg/1	Lacrimation, Prickling of the skin.

When the instruction set is received, the stopper of each bottle is completely covered and the bottle sealed with a heavy coating of paraffin. Personnel opening a new set or opening bottles which have been closed for a long time should wear protective masks. Pressure can build up to considerable proportions in bottles that have been closed for a long time and may throw particles of contaminated charcoal into the opener's eyes. It is therefore advisable that bottles be opened by masked personnel some time before instruction is to begin. The agents in these bottles are actual agents and can cause serious injury to the handler. After the bottles have been opened, they should be immediately stoppered, after which no accumulation of pressure can be expected for another 24 hours. Bottles not in use should be kept stoppered at all times. Under no circumstances are the contents of any bottle ever to be transferred to another bottle or container, or dumped except in accordance with the instructions.

The sawdust and woodpulp may be removed but it is best to retain this material, if the set is to be transported from room to room or between buildings.

15-2.4.4. Removing Glass Stoppers. In case the glass stoppers are not readily removable from bottles, one or both of the following procedures is recommended:

1. Remove the paraffin coated cloth from the top of the bottle and carefully remove all paraffin at the junction of the stopper and the bottle. Use a small knife blade or sharp instrument. If the stoppers are not readily removed after the paraffin is taken off, hold the bottle in the left hand and apply strong pressures on one corner of the rectangular top of the stopper with the thumb, in a direction across the top of the bottle. At the same time pressure is applied, tap the stopper with a light object, such as the wooden handle of a small screwdriver, applying the stroke in the opposite direction to the force applied by the left thumb. Next, give the bottle a half turn so that the thumb pressure will be applied on alternate corners and in opposite directions. By repeating this procedure several times, the stoppers of all bottles should be easily removed.

2. A heavy twine string, about 3 feet long, is made fast to a stationary object and the string is wrapped once around the neck of the bottle, the loose end of the string being held taut in the left hand. The bottle, held in the right hand, is moved swiftly back and forth along the length of the string for about 30 seconds. The frictional heat produced by this method expands the neck of the bottle and allows the stopper to be easily removed.

When it is desired to smell the odor of any agent, the bottle should be placed in the left hand and brought near the nose, and the right hand used to fan the air across the mouth of the bottle toward the nose. At the same time air should be sniffed in and out of the nose, avoiding deep inhalations. If the odor is not obtained the first time, the bottle should be brought progressively closer until a distinct odor is obtained. The nitrogen mustards, HN1 and HN3, have a very slight odor which students may not immediately perceive. Extreme care must be exercised that these agents are not inhaled deeply, or for too long a period. If the odor is not immediately perceived, it is best to try again later.

Sniff bottles should be handled carefully at all times and not dropped or spilled. If a bottle containing H, L, HN1, or HN3, is spilled or broken, personnel in the immediate vicinity should make sure they have not been contaminated. If they have been contaminated, clothing should be removed and contaminated areas immediately treated with M5 protective ointment. The glass contents should be carefully gathered up by masked personnel wearing

rubber gloves (and protective clothing if readily available) and all precautions taken to prevent further contamination. The deck, bulkhead, and all brushes and brooms should be decontaminated immediately with DANC solution. It is advisable for the instructor to have a tube of M5 always available. If a bottle containing DM, PS, CG, is spilled or broken, it should be cleaned up in the same manner except that washing down with soap and water suffices. After such an accident, the room or compartment should be thoroughly aired before again being used by personnel.

The instructional (sniff) sets are intended for use in indoor instruction prior to the use in the field of the Set, Gas Identification, Detonation, M1, or for refresher training aboard ship. During the indoor training period the sniff set should be placed where men can test for toxic agent odors during intermissions of classroom exercises. After becoming familiar with the odors, the men should test their ability by covering the symbol, sniffing the odor, identifying it, and then checking. Lookouts or sentries should be given frequent opportunity to refresh their memory of the odors of the gases.

15-2.4.5. Handling and Storage. The stowage of instructional gas identification sets in quantities should conform where possible to the rules set forth for the stowage of chemical munitions in OP 5. However, since it is not expected that these sets will ever be on hand at any depot in full magazine quantities, and since they do not constitute an explosive hazard, it is permissible to stow them with other chemical munitions, with smoke pots, and with chemical and smoke grenades. Such magazines should be marked with a placard to warn personnel of the contents, in addition to the standard magazine marking. The sets must be segregated from the other material and proper aisle space maintained in accordance with good stowage procedure. For classroom use, the individual sets may be stowed in the classroom when not in use, provided they are not accessible to unauthorized personnel. The bottles must be stoppered and returned to the proper cans in the box. The sets may be stored aboard ship in any convenient place except magazines containing ammunition. Locations where there is excessive vibration or movement should be avoided.

The sets should be kept as cool as possible because the agents vaporize more rapidly with increased temperature. This may result in pressure being built up inside the bottles with the ensuing danger of contamination to the person opening the bottle. High temperature also shortens the life of the bottles. When stowed in classrooms, storerooms or ship's compartments, they should be placed away from the radiators and steam pipes. Do not allow sets to remain too long in brilliant sunshine.

When the bottles of an instructional identification set have reached a state of exhaustion, replacement should be requested from the nearest depot. Upon receipt of the replacement set, the exhausted bottle should be replaced by one of the new bottles, and the old bottle destroyed by burying with the stopper removed in a pit at least five feet deep located at least 200 yards away from any building or wellsite. A slurry of 5 parts by volume of chloride of lime bleach to 4 parts of water should be poured in over the bottles, and this covered with a layer of earth. An additional application of the slurry should then be made and the pit filled and marked. Rubber gloves should be worn, and every care must be taken that no contact is made with the contents of the bottles.

15-2.4.6. Safety Precautions. Observe the following precautions when using the M1 Instructional Gas Identification Set:

1. Use a protective mask when opening bottles of new sets or bottles that have been closed for a long time.

2. If the stopper sticks, follow the foregoing instructions for opening. Do not pry or pound the stopper loose with a hammer or other heavy object.

3. Never inhale deeply. Just sniff. If the odor is not immediately perceived try again later. This applies to all agents but in particular to the nitrogen mustards (HN1 and HN3).

4. Handle bottles carefully. If an accident does occur, decontaminate immediately.

5. Never transfer the contents of a bottle. When necessary to dispose of bottles follow specific instructions.

6. Always close bottles immediately after use and return to their containers.

7. Keep the box closed and away from unauthorized personnel when not in use.

8. Store the sets away from direct sunshine and heat.

9. If necessary to reship, ship only in the original or similar packing with sawdust.

15-2.4.7. Shipping Container. The packing box is a sectioned wooden box with a hinged top. The complete unit weighs 72 pounds.

15-2.4.8. Identification Data. The M1 instructional gas identification set is listed under Specification MIL-S-10333, NSN 1365-00-025-3273, and DODIC/NALC K951.

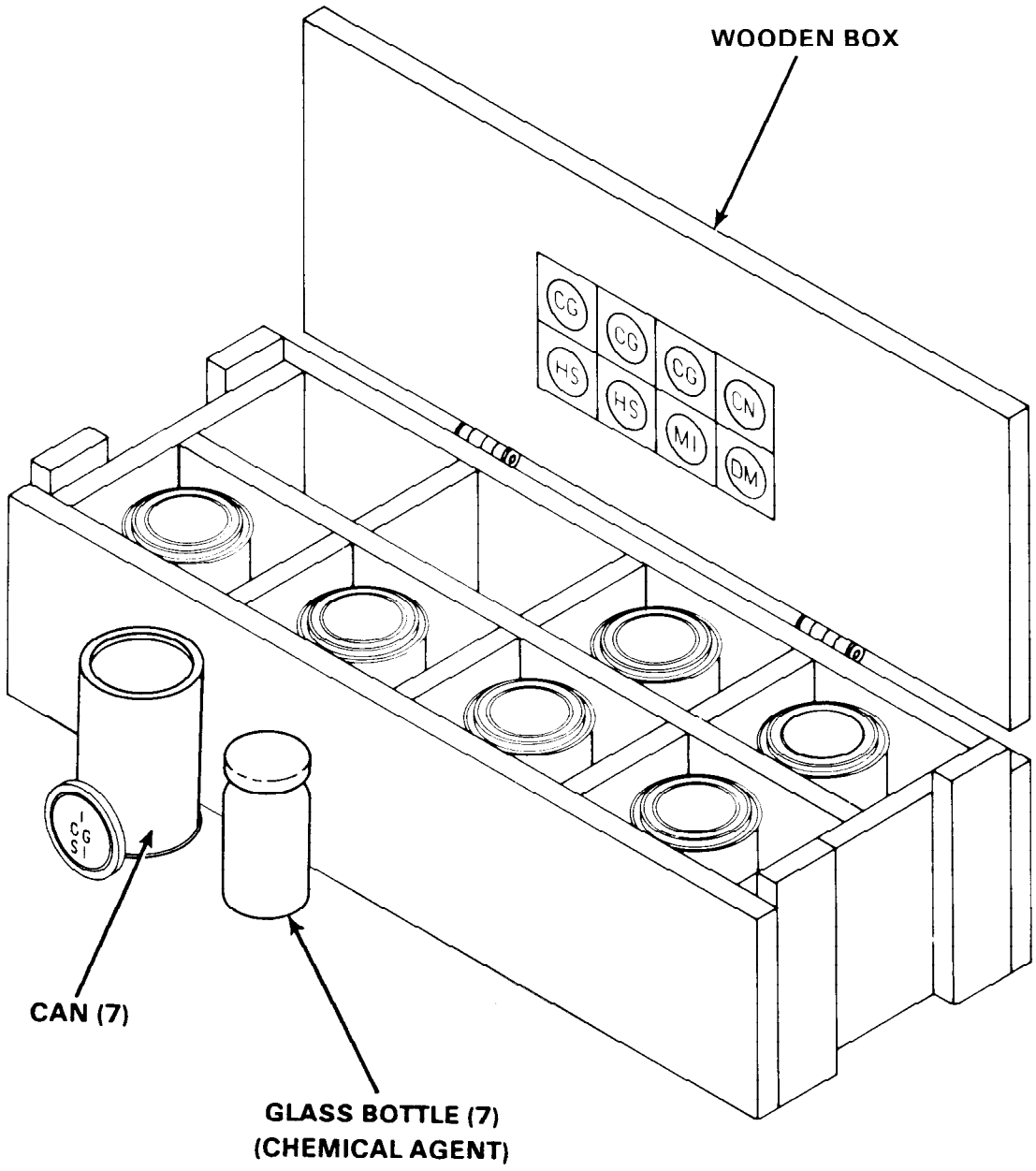


Figure 15-2.4. M1 Instrucitonal War Gas Identification Set

15-2.5. WAR GAS IDENTIFICATION SET, DETONATION, M1

15-2.5.1. Intended Use. The M1 Detonation War Gas Identification Set is a training device used to train personnel in the detection and recognition of chemical agents. The M1 set is no longer in use by the Navy.

15-2.5.2. Description. The M1 Gas Identification Detonation Set, Figure 15-2.5, consists of a cylindrical forged-steel shipping container 0.145 inch thick and approximately 38.00 inches long and 6.62 inches in diameter. The shipping container is sealed with a steel cover with lead gasket and secured by eight bolts. Four press-fit metal containers are packed in the steel cylinder. Inside each press-fit metal container are 12 cardboard screw cap containers, each containing a hermetically sealed glass tube approximately 7.50 inches long and 1.00 inch in diameter. Each of the four metal containers contain three tubes each of the following agents: Mustard (H), Lewisite (L), Phosgene (CG), and Chlorpicrin (PS). The agents in each of the four metal containers are as follows:

1. Three tubes, H, each containing 40cc of 5% solution of H (Mustard) in chloroform.

2. Three tubes, L, each containing 40cc of 5% solution of L (Lewisite) in chloroform.

3. Three tubes, PS, each containing 40cc of 50% solution of PS, (Chlorpicrin) in chloroform.

4. Three tubes, CG, each containing 40cc of 100% CG (Phosgene).

15-2.5.3. Operation. This gas identification detonation set is only used out-of-doors ashore. It is never used on board ships. The protective mask must invariably be worn when handling or preparing to fire any of the detonation tubes. The M1 Detonation Accessories Set is issued for use with the M1 identification set and should be requested as needed. Detonator, Electric, No. 8, is the only detonator (blasting cap) authorized for use with this set and should be requested in multiples of 70 as needed. A weaker detonator may fail to give proper dispersion and a stronger detonator may scatter the contents including the glass fragments too widely.

The detonators are to be fastened to the glass tubes containing H, L, and PS, and to the cardboard container of the CG filled glass tubes. (Never remove the glass tube of CG from the cardboard container as internal pressures may, as a result of heat from the hand, build up and burst the tube). The tubes with detonators attached are to be placed in small pits about 9 inches deep. Care should be exercised to keep the detonators on the underside of the glass or cardboard tube to insure the discharge of the agent into the air.

When two or more tubes are fired at once, the firing line should be at right angles to the wind direction. When firing two or more tubes simultaneously, they should be attached in series, care being taken that the capacity of the blasting machine is not exceeded. When firing in series, detonators of the same manufacturer should be used in order that the resistance of each detonator is equal.

The blasting machine should be placed about 25 yards upwind from the firing line. The class or observers should be placed from 30 to 40 yards downwind. A small portable windvane will greatly aid in placing the students. The stronger the wind, the farther away the students should be placed. The wiring should not be completed until all personnel are clear. All circuits should be tested with a circuit tester or blasting galvanometer. The last wire is attached to the blasting machine by the operator just prior to pushing the plunger or turning the handle. The blasting machine should be activated as strongly as possible to insure an adequate current.

15-2.5.4. Demonstration of Agents. Use one detonator only on the cardboard tube containing the glass tube of phosgene (CG), on the glass tube of chlorpicrin (PS), and on the Lewisite (L) glass tube; two detonators are needed for mustard (H). Never attach the detonators to the cardboard tube containing the glass tube of mustard of Lewisite. The fragments of cardboard will be contaminated and may cause injury on contact.

When the gas tubes are detonated, small puffs of smoke are produced by the detonators. The gas cloud is usually colorless, but moves along with the smoke. Have the observers pass at right angles through the cloud, stop and bend down so as to get a good concentration and sniff for gas. Do not inhale deeply.

Have a metal spade or shovel handy and take a sample of earth from the detonation hole. Then have each student who did not get a good impression of the odor pass by and sniff the odor of the agent given off the earth. This earth is contaminated and should be handled with caution. Do not allow the students to approach within 15 yards downwind of the holes as the area may be contaminated.

After a demonstration, decontaminate the area of the holes with bleach and fill in the detonation holes after raking into them the detonator leads and any particles of glass. In handling the lead wires, care must be taken as they may have become contaminated. Rubber gloves should be worn. The location of the holes should be marked so that the same hole is not redug for a later demonstration.

A first aid kit should be kept on hand for every demonstration. Should any personnel become contaminated, M5 protective ointment should be applied immediately.

15-2.5.5. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this term. The M1 set is designated as a Group A Chemical Ammunition for handling and storage purposes.

All unused tubes must be returned to their multiple containers, the containers to the metal shipping cylinder and the flange bolted wrench tight. Individual tubes or cans of tube must not be stowed outside of the metal cylinder. In no case is the metal cylinder to be returned until all tubes are expended. The Set, Gas Identification, Detonation, M1 should be kept as cool as possible. If exposed to high temperatures (over 100°F), the CG tubes may burst and a dangerous concentration of CG may be encountered on opening the cylinder. Always have a protective mask available when opening the metal cylinder.

15-2.5.6. Safety Precautions. Observe the following precautions when using the M1 identification detonation set:

1. Do not choose as the site for the exercise a place where children are liable to play later.

2. Do not remove the CG tube from its cardboard tube. It may explode.

3. Do not leave tubes in direct sunshine too long.

4. Detonators are dangerous. Do not carry them in pockets. Handle gently, keep them cool and out of direct rays of sun.

5. Do not use detonators that are corroded, or show signs of having been wet.

6. In case of misfire, wait at least 5 minutes before approaching. It is not necessary to remove detonator, but merely tape on another. Any dud detonators remaining should be exploded after the exercise by taping to a good detonator.

7. Do not smoke while handling detonators.

8. In firing tubes in series, do not use detonators of different manufacture.

9. Do not stow detonator in same compartment with or near radio apparatus or antenna leads.

15-2.5.7. Shipping Containers. The metal container includes strips of adhesive tape and instructions for use. Four of these multiple containers are packed in a drawn steel container. Double faced corrugated cardboard fillers are placed on top of the containers, and a double face corrugated strawboard filler is placed on the bottom so that well-cushioned packing is supplied when the blind flange with its gasket is bolted down tight on the shipping container flange. This packing is air-tight and will stand 250 psi internal pressure when bolted tight. The nuts are hexagonal and can be removed with a standard 1 1/4-inch wrench.

The Detonator, Electric, No. 8, (Blasting Cap) is the only detonator authorized for use with this set. These are primarily packed in a large wooden box which contains smaller metal boxes each containing 70 detonators. The detonators are packed in sawdust and the metal boxes are also surrounded by sawdust. Seventy detonators should be requested with each Set, Gas Identification, Detonation, M1, unless sufficient quantity is on hand. Detonators with 6 foot leads or longer are preferable.

15-2.5.8. Identification Data. The M1 gas identification set is listed under Specification MIL-S-11149, NSN 1365-00-025-3283, and DODIC/ NALC K952.

15-2.5.9. General Data. The following table provides general data on the M1 identification set:

Cylinder diameter	6.75 inches
Flange diameter	9.25 inches
Length	40.25 inches
Package data	1 steel cylinder
Weight	110 pounds
Cubage (cu. ft.)	2.1 cubic feet
Contents	48 tubes
Chemical agents included	H, L, PS, and CG
Detonation Accessories Set, M1	
Specification	MIL-S-12398

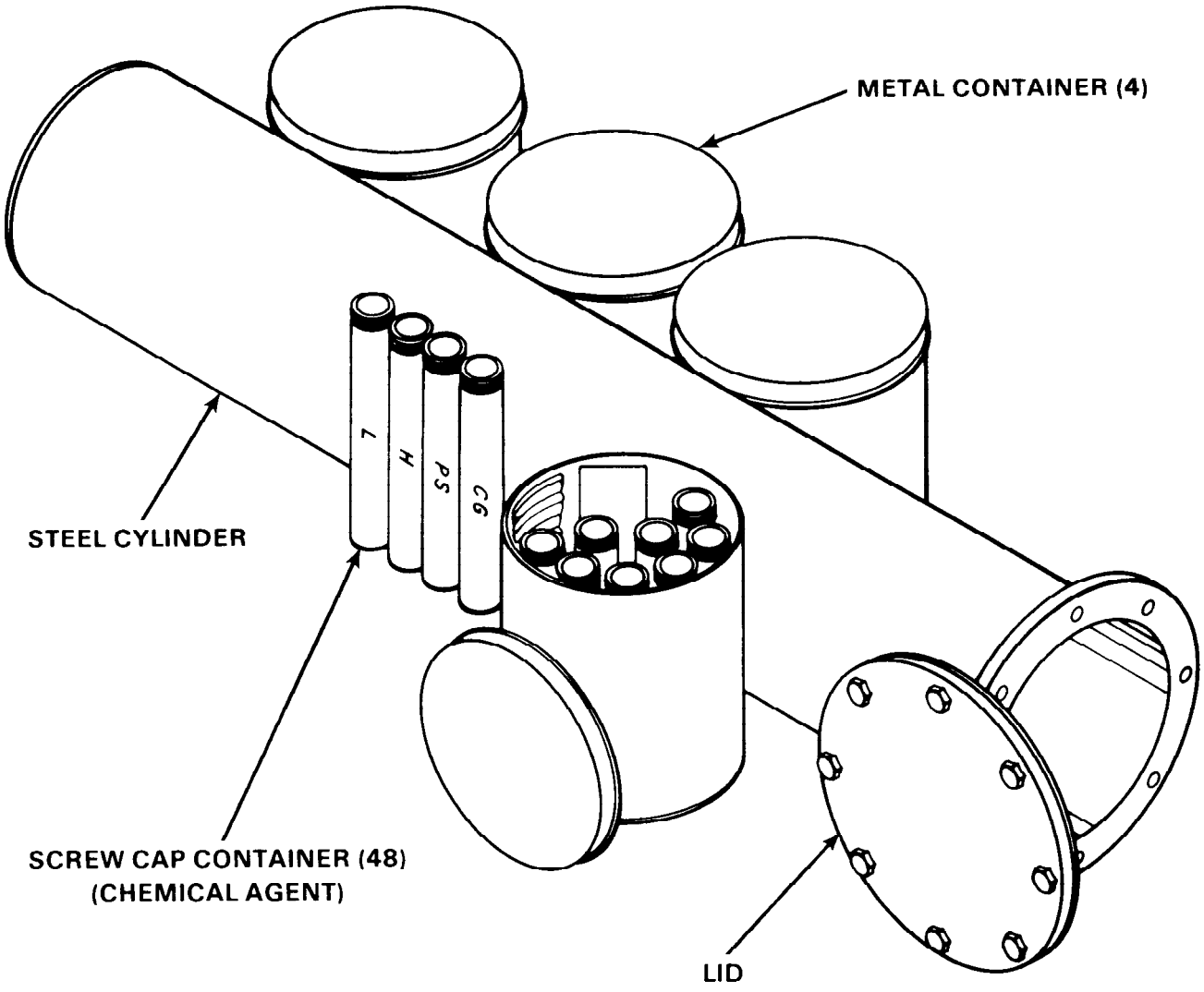


Figure 15-2.5. M1 Detonation War Gas Idnetification Set

15-2.6. WAR GAS IDENTIFICATION SET, DETONATION, AN-M1A1

15-2.6.1. Intended Use. The AN-M1A1 Detonation War Gas Identification Set is a training device used to train personnel in the detection and recognition of chemical agents. The AN-M1A1 set is no longer used by the Navy.

15-2.6.2. Description. The AN-M1A1 Gas Identification Detonation Set, Figure 15-2.6, consists of a cylindrical forged-steel shipping container 0.145 inch thick and approximately 38.00 inches long and 6.62 inches in diameter. The shipping container is sealed with a steel cover with a lead gasket and secured by eight bolts. Four press-fit metal containers are packed in the steel cylinder. Inside each press-fit metal container are 12 cardboard screw cap containers, each containing a hermetically sealed glass tube approximately 7.50 inches long and 1.00 inch in diameter. Each of the four metal containers contain two tubes each of the following agents: Distilled Mustard (HD), Lewisite (L), Phosgene (CG), Cyanogen Chloride (CK), Nitrogen Mustard (HN1), and GA simulant. The GA simulant is not considered a lethal agent. The agents in each of the four metal containers are as follows:

1. Two tubes, HD, each containing 40cc of 5% solution of HD (Distilled Mustard) in chloroform.

2. Two tubes, L, each containing 40cc of 5% solution of L (Lewisite) in chloroform.

3. Two tubes, HN1, each containing 40cc of 10% solution of HN1 (Nitrogen Mustard) in chloroform.

4. Two tubes, CG, each containing 40cc of 100% CG (Phosgene).

5. Two tubes, CK, each containing 40cc of 100% CK (Cyanogen Chloride).

6. Two tubes, GA simulant, each containing 40cc of 100% GA simulant.

15-2.6.3. Operation. This gas identification detonation set is only used out-of-doors ashore. It is never used on board ships. The protective mask must invariably be worn when handling or preparing to fire any of the detonation tubes. The M1 Detonation Accessories Set is issued for use with the AN-M1A1 identification set and should be requested as needed. Detonator, Electric, No. 8, is the only detonator (blasting cap) authorized for use with this set and should be requested in multiples of 70 as needed. A weaker detonator may fail to give proper dispersion and a stronger detonator may scatter the contents including the glass fragments too widely.

The detonators are to be fastened to the glass tubes containing HD, L, HN1, CK and GA, and to the cardboard container of the CG filled glass tubes. (Never remove the glass tube of CG from the cardboard container as internal pressures may, as a result of heat from the hand, build up and burst the tube). The tubes with detonators attached are to be placed in small pits about 9 inches deep. Care should be exercised to keep the detonators on the underside of the glass or cardboard tube to insure the discharge of the agent into the air.

When two or more tubes are fired at once, the firing line should be at right angles to the wind direction. When firing two or more tubes simultaneously, they should be attached in series, care being taken at the capacity of the blasting machine is not exceeded. When firing in series, detonators of the same manufacturer should be used in order that the resistance of each detonator is equal.

The blasting machine should be placed about 25 yards upwind from the firing line. The class or observers should be placed from 30 to 40 yards downwind. A small portable wind-vane

will greatly aid in placing the students. The stronger the wind, the farther away the students should be placed. The wiring should not be completed until all personnel are clear. All circuits should be tested with a circuit tester or blasting galvanometer. The last wire is attached to the blasting machine by the operator just prior to pushing the plunger or turning the handle. The blasting machine should be activated as strongly as possible to insure an adequate current.

15-2.6.4. Demonstration of Agents. Use one detonator only on the cardboard tube containing the glass tube of phosgene (CG), on the glass tube of cyanogen chloride (CK), on the glass tube of nitrogen mustard (HN1), on the glass tube of GA simulant, and on the Lewisite (L) glass tube; two detonators are needed for distilled mustard (HD). Never attach the detonators to the cardboard tube containing the glass tube of mustard or Lewisite (L). The fragments of cardboard will be contaminated and may cause injury on contact.

When the gas tubes are detonated, small puffs of smoke are produced by the detonators. The gas cloud is usually colorless, but moves along with the smoke. Have the observers pass at right angles through the cloud, stop and bend down so as to get a good concentration and sniff for gas. Do not inhale deeply.

Have a metal spade or shovel handy and take a sample of earth from the detonation hole. Then have each student who did not get a good impression of the odor pass by and sniff the odor of the agent given off the earth. This earth is contaminated and should be handled with caution. Do not allow the students to approach within 15 yards downwind of the holes as the area may be contaminated.

After a demonstration, decontaminate the area of the holes with bleach and fill in the detonation holes after raking into them the detonator leads and any particles of glass. In handling the lead wires, care must be taken as they may have become contaminated. Rubber gloves should be worn. The location of the holes should be marked so that the same hole is not redug for a later detonation.

A first aid kit should be kept on hand for every demonstration. Should any personnel become contaminated, M5 protective ointment should be applied immediately.

15-2.6.5. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this term. The AN-M1A1 set is designated as a Group A Chemical Ammunition for handling and storage purposes.

All unused tubes must be returned to their multiple containers, the containers to the metal shipping cylinder and the flange bolted wrench tight. Individual tubes or cans of tube must not be stowed outside the metal cylinder. In no case is the metal cylinder to be returned until all tubes are expended. The Set, Gas Identification, Detonation, AN-M1A1 should be kept as cool as possible. If exposed to high temperatures (over 100°F), the CG tubes may burst and a dangerous concentration of CG may be encountered on opening the cylinder. Always have a protective mask available when opening the metal cylinder.

15-2.6.6. Safety Precautions. Observe the following precautions when using the AN-M1A1 identification detonation set:

1. Do not choose as the site for the exercise a place where children are liable to play later.

2. Do not remove the CG tube from its cardboard tube. It may explode.

3. Do not leave tubes in direct sunshine too long.

4. Detonators are dangerous. Do not carry them in pockets. Handle gently, keep them cool and out of direct rays of sun.

5. Do not use detonators that are corroded, or show signs of having been wet.

6. In case of misfire, wait at least 5 minutes before approaching. It is not necessary to remove detonator, but merely tape on another. Any dud detonators remaining should be exploded after the exercise by taping to a good detonator.

7. Do not smoke while handling detonators.

8. In firing tubes in series, do not use detonators of different manufacture.

9. Do not stow detonator in same compartment with or near radio apparatus or antenna leads.

15-2.6.7. Shipping Containers. The metal container includes strips of adhesive tape and instructions for use. Four of these multiple containers are packed in a drawn steel container. Double faced corrugated cardboard fillers are placed on top of the containers, and a double face corrugated strawboard filler is placed on the bottom so that well-cushioned packing is supplied when the blind flange with its gasket is bolted down tight on the shipping container flange. This packing is air-tight and will stand 250 psi internal pressure when bolted tight. The nuts are hexagonal and can be removed with a standard 1 1/4-inch wrench.

The Detonator, Electric, No. 8, (Blasting Cap) is the only detonator authorized for use with this set. These are primarily packed in a large wooden box which contains smaller metal boxes each containing 70 detonators. The detonators are packed in sawdust and the metal boxes are also surrounded by sawdust. Seventy detonators should be requested with each Set, Gas Identification, Detonation, AN-M1A1, unless sufficient quantity is on hand. Detonators with 6 foot leads or longer are preferable.

15-2.6.8. Identification Data. The AN-M1A1 gas identification set is listed under Specification MIL-S-11149, NSN 1365-00-338-0735, and DODIC/NALC K954.

15-2.6.9. General Data. The following table provides general data on the AN-M1A1 identification set:

Cylinder diameter	6.75 inches
Flange diameter	9.25 inches
Length	40.25 inches
Package data	1 steel cylinder
Weight	110 pounds
Cubage (cu. ft.)	2.1 cubic feet
Contents	48 tubes
Chemical agents included	HD, L, CG, HN-1, CK, and GA
Detonation Accessories Set, M1	
Specification	MIL-S-12398

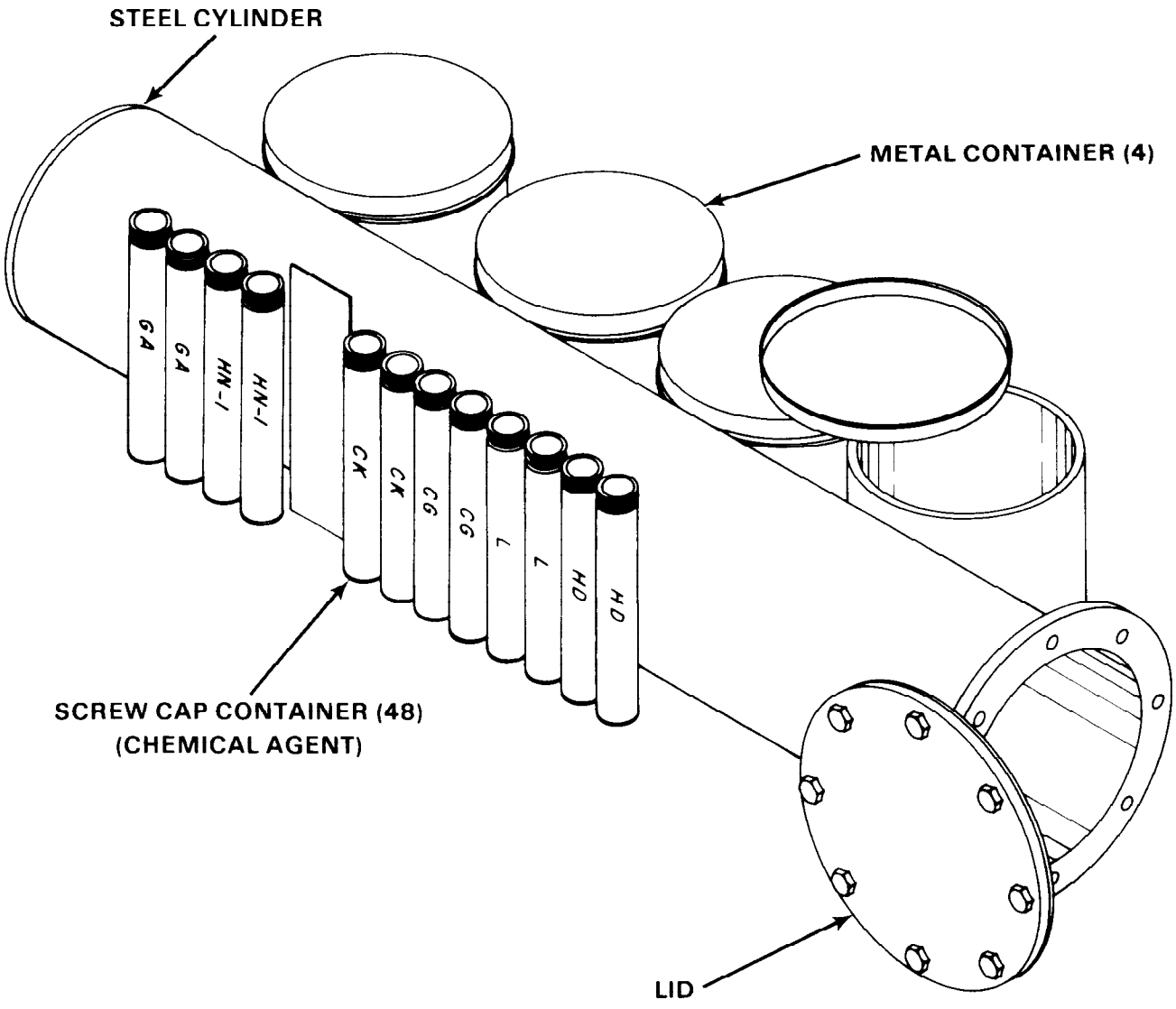


Figure 15-2.6. AN-M1A1 Detonation War Gas Identification Set

15-2.7. TOXIC GAS SET, M1

15-2.7.1. Intended Use. The M1 Toxic Gas Set is a training device used to train personnel in the detection and recognition of chemical agent H or HD. The M1 toxic gas set is no longer used by the Navy.

15-2.7.2. Description. The M1 Gas Set, Figure 15-2.7, consists of a cylindrical forged-steel shipping container 0.145 inch thick and approximately 38.00 inches long and 6.62 inches in diameter. The shipping container is sealed with a steel cover with lead gasket and secured by eight bolts. Six sealed metal containers are packed in the steel cylinder. Each of the six containers has four 4.0 ounce bottles filled with 3.5 ounces of either Mustard (H) or Distilled Mustard (HD) (100%). Each bottle is placed in a layer of sawdust to prevent breakage.

15-2.7.3. Operation. The M1 Gas Set is used to familiarize trainees with the chemical agents, H and HD. Small quantities of H or HD are used to contaminate designated training areas. Personnel are trained in recognizing the effects of H or HD and the proper decontamination procedures. Due to the toxic and vesicant nature of H and HD every precaution shall be taken in handling this toxic gas set. Personnel shall wear protective masks and clothing at all times.

15-2.7.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. The M1 toxic gas set is designated as a Group A Chemical Ammunition for handling and storage purposes.

15-2.7.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this item.

15-2.7.6. Shipping Container. The steel shipping container is air-tight and will stand 250 psi internal pressure when bolted tight. The nuts are hexagonal and can be removed with a standard 1 1/4-inch wrench.

15-2.7.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this set is approximately 5.25 pounds.

15-2.7.8. Identification Data. The M1 toxic gas set is listed under Specification MIL-S-10333, NSN 1365-00-219-8574, and DODIC/NALC K941.

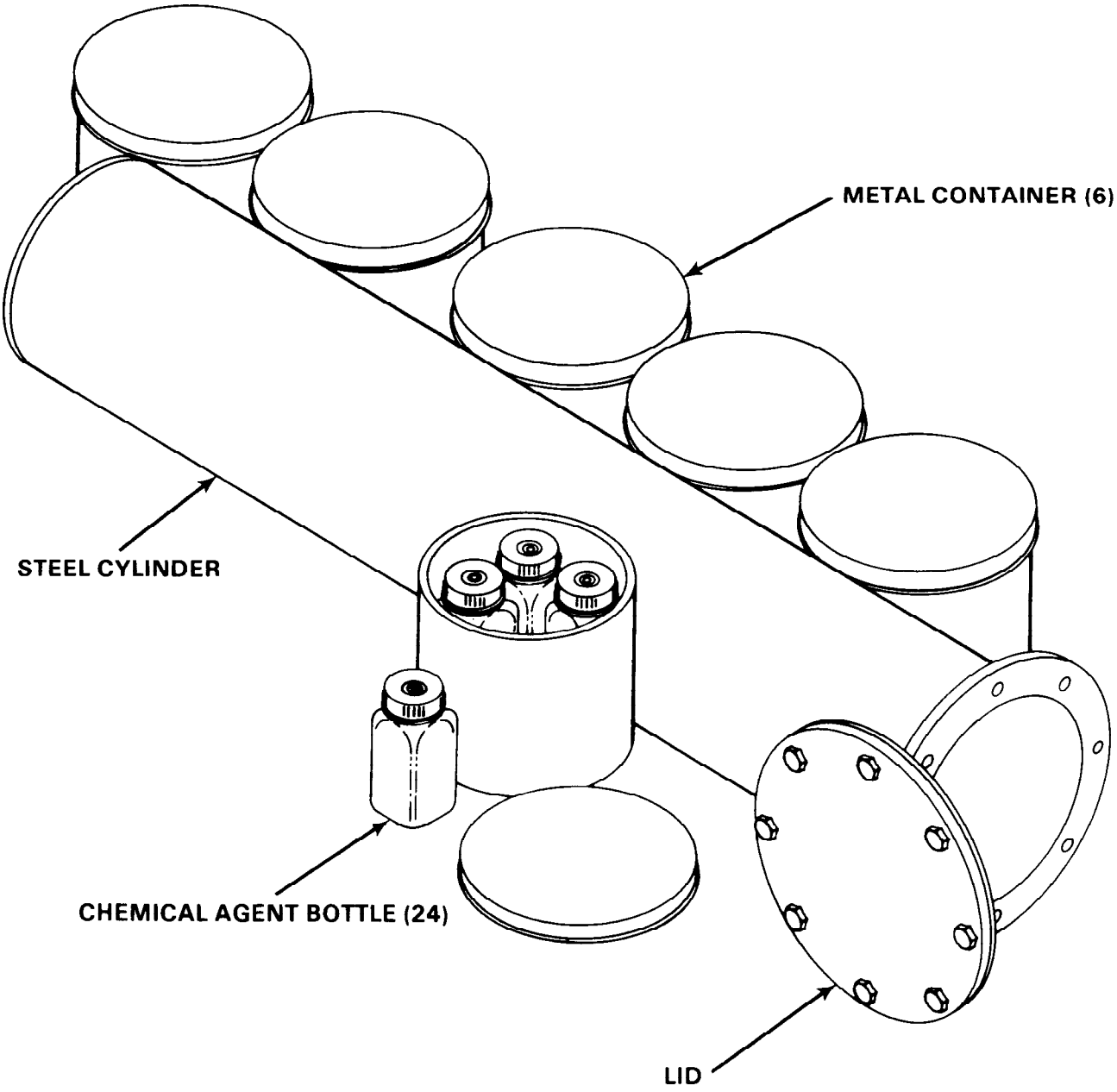


Figure 15-2.7. M1 Training Toxic Gas Set

15-2.8. TOXIC GAS SET, M2

15-2.8.1. Intended Use. The M2 Toxic Gas Set is a training device used to train personnel in the detection and recognition of chemical HD. The M2 toxic gas set is no longer used by the Navy.

15-2.8.2. Description. The M2 gas set, Figure 15-2.8, consists of a 20-gauge steel drum approximately 14.0 inches high and 14.0 inches in diameter. The drum is painted gray with two green bands. Two hexagonal fiberboard containers are packed inside the steel drum, each containing 14 tearstrip containers. Each tearstrip container contains one ampule approximately 4.62 inches long and 1.87 inches in diameter. The ampules (28) each contain 100% Distilled Mustard (HD), 3.81 ounces per ampule.

15-2.8.3. Operation. The M2 gas set is used to familiarize trainees with the chemical agent HD. Small quantities of HD are used to contaminate designated training areas. Personnel are trained in recognizing the effects of HD and the proper decontamination procedures. Due to the toxic and vesicant nature of HD, every precaution shall be taken in handling this toxic gas set. Personnel shall wear protective masks and clothing at all times.

15-2.8.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. The M2 toxic gas set is designated as a Group A Chemical Ammunition for handling and storage purposes.

15-2.8.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this item.

15-2.8.6. Shipping Container. This set is contained within the sealed steel drum.

15-2.8.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this set is approximately 6.67 pounds.

15-2.8.8. Identification Data. The M2 toxic gas set is listed under Specification MIL-S-51058, NSN 1365-00-563-4146, and DODIC/NALC K942.

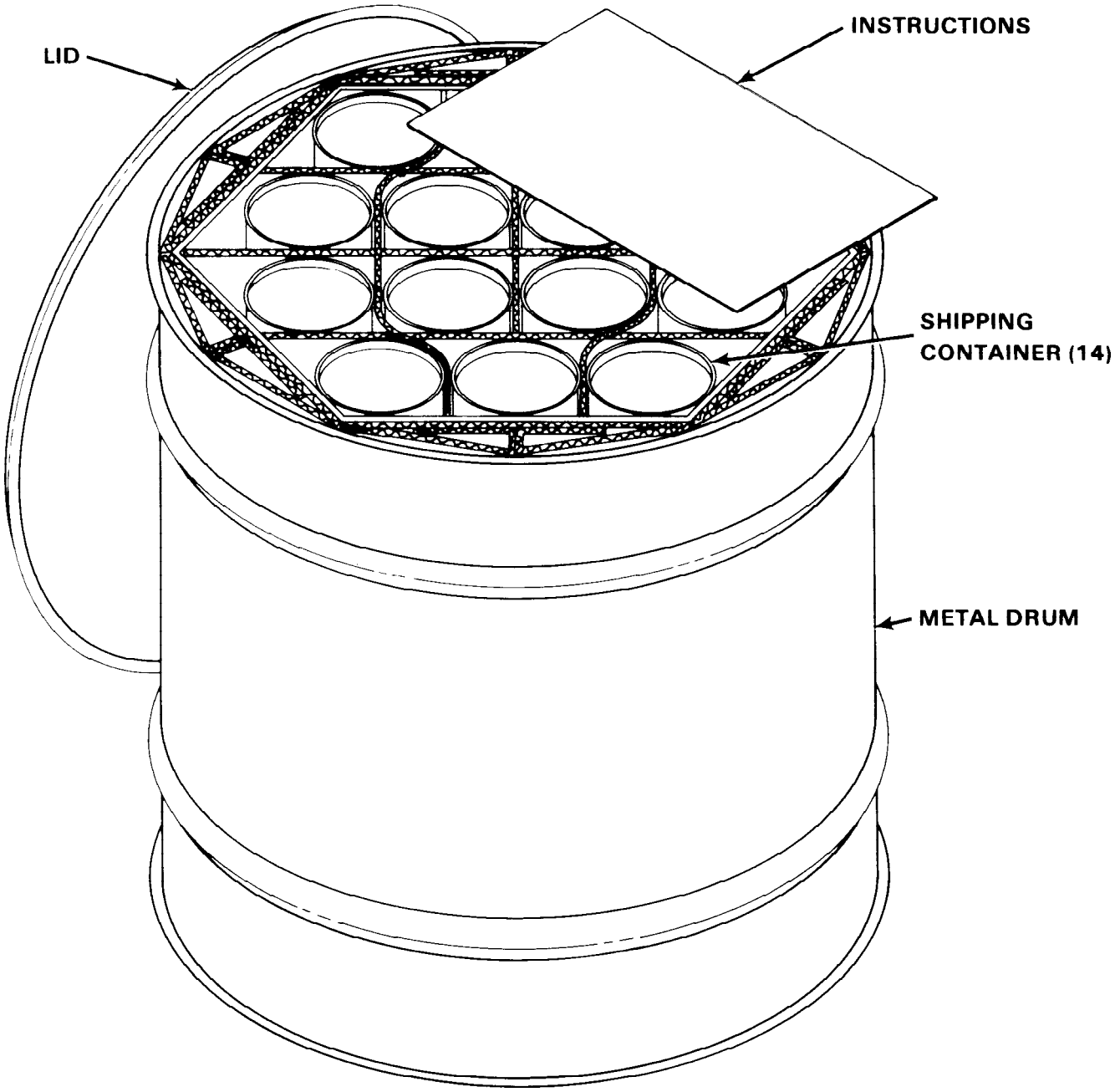


Figure 15-2.8. M2 Training Toxic Gas Set

15-2.9. TRAINING SET, CHEMICAL AGENT IDENTIFICATION, M72

15-2.9.1. Intended Use. The M72 Chemical Agent Identification Training Set is a training device intended for use by qualified instructors to demonstrate color changes associated with chemical detectors, such as detector tubes, tickets, and paper. The M72 training set is no longer in use by the Navy.

15-2.9.2. Description. The M72 set, Figure 15-2.9, consists of a gray plastic carrying case containing eight plastic-coated square bottles of chemical agents and three vials of simulants. The carrying case is approximately 12.0 inches long, 5.5 inches wide, 4.0 inches high, and weighs 3.0 pounds. Alternate corners of the carrying case are marked with three green bands. The date of the initial filling of the bottles and vials is marked on the cover of the carrying case. The bottles contain chemical agents as follows:

1. Four bottles of nerve agent (GB).
2. One bottle of Lewisite (L).
3. One bottle of Mustard (H).
4. One bottle of Phosgene (CG).
5. One bottle of Potassium Cyanide (AC).

15-2.9.3. Operation. When using the M72 identification set, small quantities of the chemical agents are used with detectors to demonstrate color changes associated with surface contamination. The color changes produced by the detectors by using this training set are the same as those obtained with chemical agents under field conditions.

15-2.9.4. Handling and Storage. The general rules and regulations governing the handling and storage of chemical munitions as set forth in Section 1-5 of this manual apply to this item. This training set is designated as a Group A Chemical Ammunition for handling and storage purposes.

15-2.9.5. Safety Precautions. The general safety precautions contained in Chapter 2 apply to this training set.

15-2.9.6. Shipping Containers. This training set is packaged one per metal drum. The filled drum weighs approximately 15 pounds.

15-2.9.7. Explosive/Chemical Weight. The aggregate weight of the principal explosive and/or chemical components in this set is approximately 5.42 ounces.

15-2.9.8. Identification Data. The M72 identification set is listed under Specification MIL-T-51321, NSN 1365-00-051-1807, and DODIC/NALC K945.

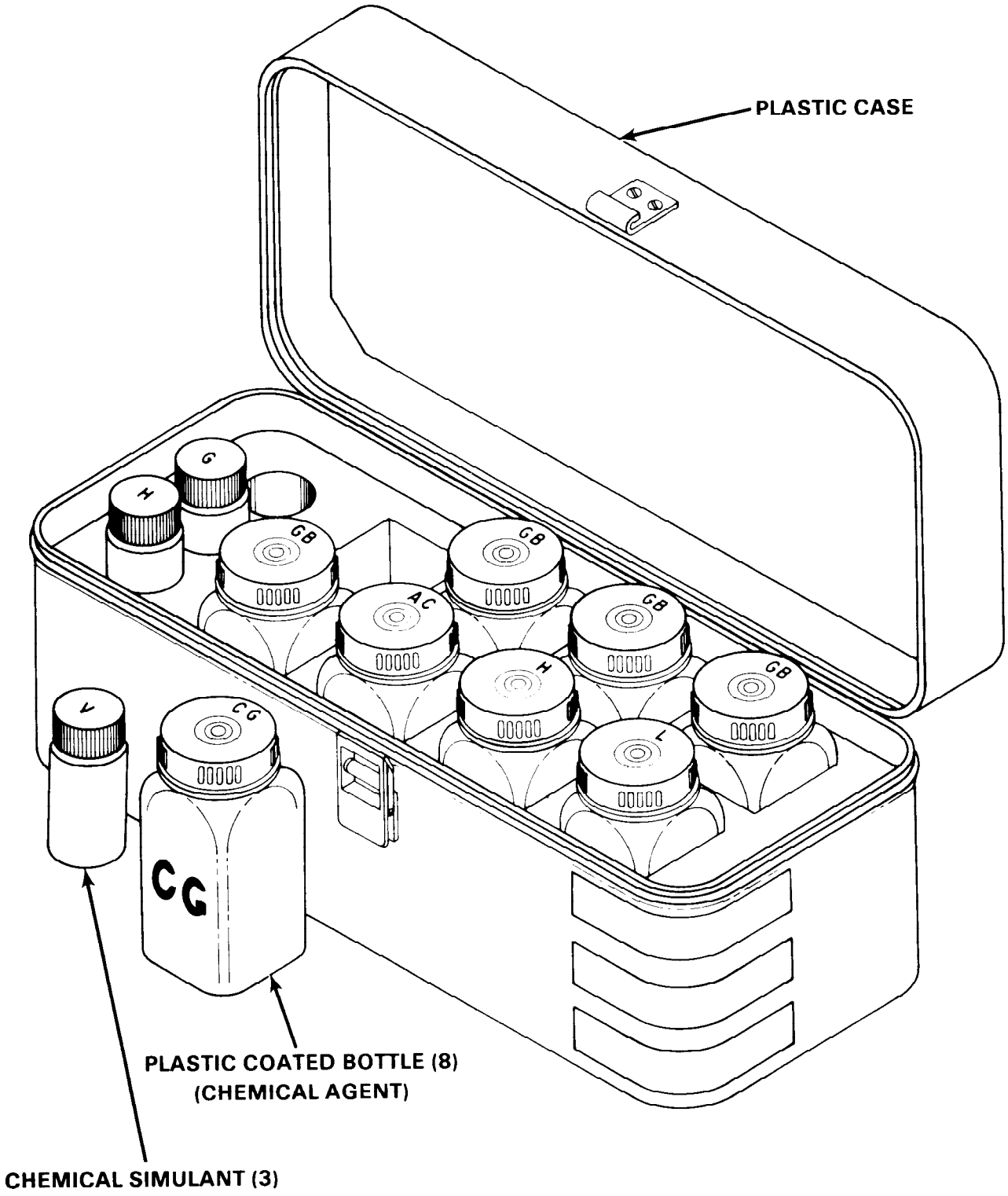


Figure 15-2.9. M72 Chemical Agent Identification Training Set

APPENDIX A

RELATED PUBLICATIONS

Navy Publications

NAVSEA OP 4, Ammunition Afloat

NAVSEA OP 5, Volume 1, Ammunition Ashore

NAVSEA OP 2165, Navy Transportation Safety Handbook

NAVSEA OP 2238, Identification of Ammunition

NAVSEA OP 3833, Hand and Rifle Grenades

NAVSEA SW010-AD-GTP-010, Small Arms and Special Warfare Ammunition

NAVSEA SW020-AC-SAF-010/020/030/040 Transportation Storage Data for Ammunition, Explosives and Related Hazardous Materials

NAVSEA SW050-AA-MMA-010, Pyrotechnic, Screening, Marking, and Countermeasure Devices

NAVSEA SW060-AA-MMA-010, Demolition Materials

NAVSEA TW060-AA-ORD-010, Index to Navy Ammunition Stock

NAVSEA TW024-AA-ORD-010, Ammunition, Unserviceable, Suspended, and Limited Use

Army Publications

TM 3-200, Capabilities and Employment of Toxic Chemicals

FM 3-220, Chemical, Biological and Radiological Decontamination

TM 3-250, Storage, Shipment, Handling, and Disposal of Chemical Ammunition

TM 3-255, Chemical Filling and Handling Equipment

TM 3-304, Protective Clothing

TM 3-4240-202-15, Protective Masks

TM 9-1940, Land Mines

TM 43-0001-26-2, Chemical Weapons and Munitions

TM 750-5-15, Chemical Weapons and Defense Equipment

*U.S. GOVERNMENT PRINTING OFFICE: 1989-748-083/00080

APPENDIX B

DEPARTMENT OF DEFENSE IDENTIFICATION CODE/ NAVY AMMUNITION LOGISTIC CODE (DODIC/NALC) INDEX

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DODIC/NALC	Item Nomenclature	Para.	Page
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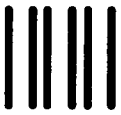

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