NAVORD OP 2217

FIRST REVISION

MISCELLANEOUS CHEMICAL MUNITIONS

DESCRIPTION AND OPERATION

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LIST OF EFFECTIVE PAGES

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CHANGE RECORD

Change Number	Date	Title and/or Brief Description	Signature of Validating Officer

FOREWORD

1. This first revision of Ordnance Pamphlet 2217 has been prepared for Fleet use. Purpose and scope of this publication are contained in Chapter 1.

2. This publication supersedes OP 2217 dated 21 January, 1958.

3. Comments concerning suggested corrections or revisions to this publication are invited and should be sent to:

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SAFETY SUMMARY

LISTED BELOW IS EVERY "WARNING" CONTAINED IN THIS VOLUME AND THE PAGE ON WHICH THE "WARNING" IS LOCATED. ALL PERSONNEL INVOLVED IN THE OPERATION AND USE OF THE MUNITIONS OR EQUIPMENTS MUST FULLY UNDERSTAND THE "WARNINGS" AND THE PROCEDURES BY WHICH THE HAZARD IS TO BE REDUCED OR ELIMINATED.

WARNINGS

Always take the following safety precautions when handling or firing chemical hand grenades:

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.
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. When using chemical grenades for training, keep equipment for fighting brush fires handy since grenades may start such fires. Page 3-1

Do not stand directly downwind from the burning grenade even if equipped with a protective mask. Burning time for this grenade is about 1-1/2 minutes. Page 3-2

Field tests for the shipboard handling and storage of chemical filled bombs have not been completed. Refer to the following publications with their latest changes, TM 3-220, TM 3-290, TM 3-400, FM 3-8 and Chemical Corps Safety Directive Nos. 385-8, TM 3-304 and TM 8-285. Page 4-2

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. Page 4-5

Aircraft should never land with full (Mk 12 Mod O) 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 can not escape properly, and the tank must be jettisoned. Page 7-10

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 8-5 and 8-8

SAFETY SUMMARY (Cont'd)

FS reacts violently with water. The reaction releases heat and causes sulfuric acid to be formed. When loading FS into a receptacle, be sure the receptacle is dry, and 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 8-6

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 presence of agent in the burster well when removing the nose plug. Page A-14

Do not attempt to disarm an armed fuze. Only EOD personnel should undertake disarming and disposal of fuzes. Pages A-14, A-18, and A-22.

When handling the AN-M78 gas bomb, personnel should wear protective masks to guard against possible leaking CG or CK. Page A-17

When handling the AN-M79 nonpersistent gas bomb, personnel must wear protective masks to guard against possible leaking CG, AC, or CK. Page A-21

Chapter 1

INTRODUCTION

GENERAL

This publication describes certain lethal, incapacitating and harassing munitions and associated delivery systems, storage units, and training devices in current use by the Navy, including chemical agents used in chemical grenades, bombs, spray tanks, projectiles, cartridges, and dispersers, and related training materials.

Many of the munitions described in this publication are toxic in nature. 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. For this reason, the nature of the various agents found in chemical munitions must be understood by personnel concerned with their use, and necessary cautions must be observed in the handling, storage, or disposal of the munitions.

CHEMICAL MUNITIONS IN THE U.S. NAVY

Chemical munitions have an important place in Navy operations not only on the sea, but also in amphibious landings, carrier based air operations, and in land or airborne operations involving the 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 casualities. 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 under consideration in this publication can be by bombs, spray tanks, and dispersers mounted on carrier based aircraft or helicopters, by projectiles fired from Navy and Marine Corps guns and howitzers, or in the case of chemical grenades, by agent filled munitions hand launched by Navy or Marine Corps land forces. 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.

The superseded edition of OP 2217 contained information on burning type smokes and incendiary materials which, while current and appropriate, is no longer considered pertinent to the coverage of this revision. These items will be found in forthcoming revisions of OP 2213.

Chapter 2

CHEMICAL AGENTS

GENERAL

This chapter presents the chief characteristics and properties of chemical agents used in the munitions, dispersers, and spray tanks described in the succeeding chapters. The capabilities, limitations, toxicity, area coverage, and expenditure rates are presented where applicable. For more detailed data on weights, dimensions, and other tabular statistics, consult individual instruction manuals as referenced.

A chemical agent is a solid, liquid, or gas which, through its chemical properties, produces a lethal or damaging effect on man, animals, plants, or materiel, or produces a screening or signaling smoke.

Toxic ammunition should be considered as a combination toxic-HE munition, since it is difficult to distinguish the fragmentation and blast effects of a toxic munition from those of a conventional HE (high explosive) round. These HE effects are considered an important bonus. Although toxic agents do not destroy materiel, they can interfere with use of terrain, equipment, or food as a result of contamination. Target sizes for toxic chemical attack vary from individual vehicles to areas of several hundred square miles.

STANDARD TOXIC CHEMICAL AGENTS

The standard toxic chemical agents used in the greatest variety of ground and air chemical munitions are the nerve agents, GB and VX; the blood gases AC and CK; and the blister agent, mustard gas, HD. Types GB, VX, and HD are suitable for employment in liquid or vapor form, and can produce casualties by inhalation, eye effects, and by percutaneous (through the skin) routes. Other agents such as CS, CN, DM, CNB, and CS1 are used for riot control and similar emergencies and are classified as incapacitating chemical agents.

The principal methods for producing casualties with toxic chemical agents are:

(1) Inhalation of agent in vapor or aerosol form

(2) Skin absorption of agent in vapor or aerosol form

(3) Skin absorption of agent in liquid form

(4) Direct injection of agent into tissues by fragments impregnated with agent

Major dissemination systems for chemical agents are considered to be spray tanks, controlled drones, missile warheads, rocket warheads, bombs, generators, mines, and shells. Bombs for current application would be either the massive or cluster type with bomblets loaded with agents. These systems can be used by either land- or carrier-based aircraft.

STANDARD INCAPACITATING CHEMICAL AGENTS

An incapacitating chemical agent is one that renders individuals temporarily incapable of concerted effort in the performance of their assigned duties. A riot control agent is a chemical agent that produces only a temporary irritating or incapacitating effect when used in

field concentrations. The incapacitating chemical agents produce their effects by inhalation.

The incapacitating agents described in this publication are generally disseminated by grenades, either hand or rifle launched, or by helicopter or fixed wing aircraft spray tanks and dispersers.

SMOKE SCREENING CHEMICAL AGENT

A screening smoke is a chemical agent which when burned, hydrolyzed, or atomized, produces an obscuring smoke and is used to mask observation and reduce effectiveness of aimed fire.

The smoke agents included in this publication are FM and FS. FS is a mixture of sulphur trioxide and chlorosulfonic acid, generally distributed from smoke generators and spray tanks. FM, titanium tetrachloride, which was once used and in some cases is still available, is included in Appendix A.

CHEMICAL SYMBOLS

Many chemical symbols are used throughout this publication for brevity. These symbols must not be confused with the chemical formulas. The principal ones used are given, with their complete names, in the following list. The succeeding pages of this chapter describe each agent and its decontamination in a separate entry.

Screening Smoke

FM	Titanium tetrachloride
FS	Sulfur trioxide-chlorosulfonic acid mixture

Incapacitating Agents

CN	Chloroacetophenone (a tear riot agent or lacrimator)
CNB	CN in benzine or carbon tetrachloride
CS	Ortho-chlorobenzalmalononitrile (a tear riot agent or lacrimator)
DM	Adamsite (a vomiting or sneezing riot agent)

Toxic Chemical Agents

AC	Hydrogen cyanide (a blood agent)
CK	Cyanogen chloride (a blood agent)
CG	Phosgene (a choking agent of low persistency)
GB	Sarin (a nonpersistent nerve agent)
HD	Distilled mustard (an irritating, blistering agent)
VX	VX (a persistent nerve agent)

STORAGE. For storage purposes chemical munitions are classified in groups according to the nature of the chemical with which they are filled. Those groups are as follows:

Group	Filler
A	Agents requiring mask plus protective clothing. Blister and nerve agents
B	Agents requiring mask alone. Nonburning irritants and smokes, choking and blood agents
C	Spontaneously flammable agents. WP, PWP
D	Readily flammable mixtures. Incendiaries, burning type irritants

Chemical munitions of groups A and B are employed only under the supervision of specially qualified chemical personnel. The group classification of each chemical described in this chapter is included in the description of that chemical. It should be noted that when certain chemicals of group B are mixed with a solid propellant in a chemical munition such as a hand grenade,

that munition is then classified in group D. Chapter 11 of this publication contains general storage data and disposal methods for all munitions except riot agents.

Preferably, chemical munitions of one group should be stowed only with other munitions of that group. When such stowage is not practicable, stowage with chemical munitions of other groups is acceptable if in accordance with the instructions in OP 5, Volume 1, Appendix A, Chart of Permissible Stowages of Ammunition and Explosives.

COLOR CODE. The base color of all chemical munitions is ocean gray. To identify the type of filler in chemical munitions, colored bands or colored markings are stenciled on the body of the munition and on its container according to the method shown in table 2-1. These markings apply to munitions manufactured since the issuance of MIL-STD-709, 27 June 1960.

Table 2-1

CHEMICAL MUNITIONS MARKINGS

FIVE-ELEMENT MARKING (OLD SYSTEM)				
NO. OF BANDS ON GRAY (DURATION OF EFFECTIVENESS)	COLOR OF BANDS (USE)	SYMBOL (EXACT FILLING)	DESCRIPTIVE WORD (GENERAL NATURE OF AGENT ON RELEASE)	USE INDICATED BY COLOR
1	GREEN	GB, CG, CK	GAS	TOXIC CHEMICAL AGENTS (CASUALTY AGENTS)
2	GREEN GREEN	VX, HD, H, HT	GAS	TOXIC CHEMICAL AGENTS (CASUALTY AGENTS)
1	RED	CN, DM, CS, CNI, DMI, CSI	GAS	IRRITANT AGENTS (RIOT CONTROL AGENTS)
1	PURPLE	TH, NP, PTI, PTV	INCENDIARY	INCENDIARIES
1	YELLOW	HC, WP, PWP	SMOKE	SMOKES (SCREENING AND SIGNALING)

STANDARD COLOR CODING (NEW SYSTEM)[1]		
TOXIC CHEMICAL AGENTS (CASUALTY)	GREEN — NONPERSISTENT EFFECT AGENTS GREEN / GREEN — PERSISTENT EFFECT AGENTS GREEN / GREEN / GREEN — ALL NERVE AGENTS	ALL MARKINGS IN GREEN ON GRAY BACKGROUND
IRRITANT AGENTS (RIOT CONTROL)	RED — NONPERSISTENT EFFECT AGENTS RED / RED — PERSISTENT EFFECT AGENTS[2]	ALL MARKINGS IN RED ON GRAY BACKGROUND
INCENDIARIES	ALL MARKINGS IN BLACK ON LIGHT RED BACKGROUND	
SMOKES	ALL MARKINGS IN BLACK ON LIGHT GREEN BACKGROUND EXCEPT WP AND PWP WHICH ARE IN LIGHT RED	
PRACTICE	ALL MARKINGS IN BLACK ON BLUE BACKGROUND	
EXPLOSIVE COMPONENTS	YELLOW — HIGH EXPLOSIVE BROWN — LOW EXPLOSIVE	

[1] All chemical munitions are still marked with the same symbol and descriptive word as under the old system except that munitions filled with irritant agents are now marked with the word "RIOT" instead of the word "GAS."

[2] Munitions filled with incapacitating agent BZ are marked as a persistent effect agents.

FS--SULFUR TRIOXIDE--CHLOROSULFONIC ACID SOLUTION--SMOKE

Action on metals	Corrosive in presence of moisture; will destroy any material decomposed by acids
Action on water	Violent
Boiling point	About 176°F.
Chemical storage group	B
Decomposition temperature	About 176°F.
Decontaminants	Any alkali in solid or solution form
Formula	55 parts SO_3, 45 parts $ClSO_3H$ by weight
Freezing point	-22°F.
Hydrolysis products	Sulfuric acid is produced by hydration, rather than by hydrolysis, of sulfur trioxide. Chlorosulfonic acid is hydrolized to form hydrogen chloride and sulfuric acid.
Munitions markings	FS Smoke in black on light green background
Odor	Acrid
Rate of hydrolysis	Instantaneous
Specific gravity	1.9 at 68°F.
Stability in storage	Adequate if dry

DESCRIPTION

FS generates a dense, white, corrosive smoke. It consists of a solution of sulfur trioxide in liquid chlorosulfonic acid. It is a very corrosive, heavy, fuming liquid weighing about 16 pounds per gallon. In contact with air, FS reacts with the moisture present to form a mixture of sulfuric and hydrochloric acid mist. Both the smoke and the smoke mixture are extremely corrosive.

FS should not be used where possible damage to nylon or to automobile finishes may occur. It decomposes nylon plastic and is injurious to many types of paint.

The vapor pressure and volatility of FS smoke depend upon the air temperature and the humidity. When FS is atomized in the air, the SO_3 quickly evaporates from the small drops and reacts with atmospheric moisture to form sulfuric acid (H_2SO_4) vapor, which, in turn, condenses to form small drops of liquid or smoke particles. The higher the humidity, the denser the smoke becomes.

Liquid FS is very damaging to the skin; acid particles in the smoke cause a prickling sensation. Splashes of liquid FS in the eyes produce extremely painful acid burns. Exposure to heavy concentrations or prolonged

exposure to ordinary concentrations may cause severe irritation of the eyes, skin, and respiratory tract.

DECONTAMINATION

1. Personnel handling FS drums or munitions must wear protective gloves and boots.

2. Personnel handling FS during filling operations, or at other times when this agent could splash on them should wear goggles, protective aprons or clothing, gloves, and boots.

3. It is preferable for personnel operating in an FS smoke cloud to wear protective masks if possible. Protective masks should always be worn when the cloud is in a confined space where high concentrations of FS smoke exist.

4. When FS is spilled, it must be destroyed by repeated dousing with water, taking care to avoid injury caused by droplets that are likely to be scattered by the violent reaction with water. For this reason, a small amount of water should never be allowed to contact a large amount of FS mixture. If liquid FS should come into contact with any part of the body, it should be wiped off immediately and the body washed with an abundance of water, then rewashed with a weak solution of bicarbonate of soda or ammonia in water. Contaminated clothing should be removed before washing the body with water, or serious burns are likely to result.

5. Because of the strongly corrosive properties of FS and its smoke, care should be taken to prevent FS fumes or smoke from contacting any machinery, aircraft, or other delicate equipment that may be near.

CN - CHLOROACETOPHENONE MIXTURE

Action on metals or other materials	Slight
Boiling point	476° F.
Chemical name	Chloroacetophenone
Chemical storage group	B* D**
Decomposition	Stable to boiling point
Decontaminants	Aeration sufficient in field
Formula	$C_6H_5COCH_2Cl$
Freezing point	138.2° F.
Munitions markings	CN RIOT and one band, all in red on gray background
Odor	Like apple blossoms
Persistency	Nonpersistent
Rate of action	Rapid
Rate that body throws off effects (detoxification)	Rapid
Stability in storage	Stable

* When in bulk or as a chemical filler in munitions.
** When mixed with a solid propellant.

DESCRIPTION OF CN

CN, or "tear gas," is used primarily for training personnel in chemical warfare procedures and for riot and mob control. It forces personnel to don masks or take gas-preventive measures. Tear gases have little more than nuisance value in war in view of the effectiveness of the modern protective mask.

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 it 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.

HANDLING OF CN

Chemical munitions containing CN are issued filled and sealed. They must be handled with care in order to prevent deformation of containers and possible leakage due to loosening of plugs and other closures.

STOWAGE OF CN

Chemical munitions containing CN should preferably be stowed separately. If separate stowage is not available, they may be stowed with other munitions filled with different types of chemical agent. Refer to the Ammunition Hazard Classification and Weights (NAVWEPS OP 1631 2nd Rev).

CS, CS1--ORTHO-CHLOROBENZALMALONONITRILE

	CS	CS1
Action on metals	Very slight	Very slight
Boiling point	590° to 599° F.	--
Chemical name	Ortho-Chlorobenzal-malononitrile	CS plus silica aerogel
Chemical storage group	B	D
Decomposition temperature	Not available	Not available
Decontaminants	DS2 or 5% sodium hydroxide in equal parts of ethanol and water	Same as CS
Melting point	199° to 203° F.	--
Munitions marking	CS RIOT and one band, all in red on gray background	CS1 RIOT and one band, all in red on gray background
Odor	Pepper	Pungent
Persistency	Nonpersistent	Nonpersistent
Physical state	Powder, disseminated by burning	Nonburning, micro-pulverized powder, disseminated by explosion or disperser
Rate of action	Rapid	Rapid
Rate of detoxification	Rapid	Rapid
Stability in storage	Stable stored in paper bags inside 55-gallon steel drums	Stable stored in paper bags inside 55-gallon steel drums. Dust is readily ignited by weak sparks and constitutes severe explosion hazard. Minimum dust concentration 0.025 oz./cu. ft.

DESCRIPTION OF CS

CS is a riot control agent ten times more powerful than CN. CS is a powder that causes the eyes to burn and tear and produces irritation of the throat and constrictions of the chest; moist areas of the skin have a stinging sensation, and there are spasms of the eyelids and distressing coughing and sneezing. 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 of the casualty. Experiments have shown that troops simulating rioters disperse even faster after a second exposure to CS than they did on first encounter. This non-toxic agent has been employed successfully in one Korean combat situation, in which night infiltrators were rendered completely incapable of carrying on their mission after tripping over wires that detonated CS grenades.

CS, while more potent than CN, is at the same time less toxic and far safer to use in training to simulate life in a toxic chemical agent attack target area. CS also attacks its victims more quickly than CN, and even experienced troops may be incapacitated before they can don their protective masks. Some test participants have found after their masks were on that the riot control agent was trapped inside, which drove them to remove the masks and fall victim to the full strength attack.

The method of producing the physical symptoms is not yet known, but observation shows that the minute particles cause the feelings of discomfort when they come in contact with the eyes and mucous membranes of the respiratory tract without danger of permanent damage to the body.

CS is disseminated by burning which carries the powder into the air in particles that average larger than 4 to 5 microns in diameter.

DESCRIPTION OF CS1

CS1 is a non-burning, micropulverized mixture of 95 percent CS and 5 percent silica aerogel. It is more subject to moisture than CS. Its particles average 4 to 5 microns in size and are distributed by dry spray devices or exploding grenades.

HANDLING

Chemical munitions containing CS or CS1 are issued filled and sealed. They must be handled with care in order to prevent deformation of containers and possible leakage due to loosening of plugs and other closures.

STOWAGE OF CS AND CS1

Chemical munitions containing CS and CS1 should be stowed separately, under group B procedures for CS, and group D procedures for CS1 munitions. CS1 grenades are adversely affected by moisture. Do not remove grenades from the containers in which they are packaged until shortly before they are to be used. Refer to the Ammunition Hazard Classification and Weights (NAVWEPS OP 1631, 2nd Rev.).

DECONTAMINATION OF CS, CS1

If the eyes come in contact with the agent, they must be thoroughly irrigated with water or a 1 percent sodium bicarbonate solution and the victim sent to the dispensary without delay for further treatment. The eyes must not be rubbed. If a person has been exposed to CS, he should be moved into the fresh air. If further treatment is needed, he should report to the dispensary. Personnel leaving the toxic area will shower to remove the CS or CS1

particles on the protective clothing, taking care to keep water out of the protective mask canister. The person should remove his protective garments and shower thoroughly, being sure to remove all traces of CS from ears, hair, and body crevices. CS particles on the skin are very irritating when they contact perspiration.

Equipment can be decontaminated with DS-2 or a 5 percent solution of sodium hydroxide in equal parts of ethanol and water.

DM, ADAMSITE

Action on metals	None, or very slight when pure
Boiling Point	770° F. with decomposition
Chemical name	Diphenylaminechloroarsine
Chemical storage group	D
Decomposition point	Above boiling point
Decontaminants	None needed in field; bleaching powder used for gross contamination in closed places
Flash point	None under usual conditions
Formula	$(C_6H_4)_2NHAs\ Cl$
Freezing point	383° F.
Hydrolysis products	Hydrogen chloride and diphenylaminoarsinous oxide. The oxide is very poisonous if taken internally
Munitions markings	DM RIOT and one band, all in red on gray background
Odor	None
Persistency	Nonpersistent
Physical state	Yellow or green crystal; solid in pure state, vaporizing when heated to form a yellow smoke
Rate of action	Very high; only about 1 minute required for incapacitation
Rate of detoxification	Quite rapid in small amounts. Incapacitating amounts lose their effect after about 30 minutes
Specific gravity	1.65 at 68° F.
Stability in storage	Quite stable in steel or glass

DESCRIPTION OF DM

DM is a vomiting gas and is classed as a nonpersistent chemical agent since it is dispersed as an aerosol having a persistency of less than 10 minutes.

Composed of yellow or green crystals in its solid, pure state, DM is converted by heat into a vapor which forms a yellow smoke. It has no identifying odor.

DM is usually found combined with CN in a burning type grenade such as M6, in Navy Stocks. When initiated, the burning mixture forms a gas with the surrounding air. The nonpersistent gas comprises less than 2 percent of the resulting gas-air mixture.

Minute concentrations of DM cause irritation of the nose and throat. Longer exposure causes

tightness of the chest, headaches, sneezing, coughing, intense nausea, and weakness. These effects increase in severity for some time after exposure, and temptation to remove the mask must be resisted. Irritation produced by this gas is so intense that an intolerable concentration is reached long before it becomes dangerous to life. The effects may last up to 3 hours but no permanent injury is caused. Constant wearing of the protective mask is the only protection necessary against DM.

HANDLING

Handle DM munitions very carefully. They should not be dropped or jarred.

STOWAGE

Stow DM under cover protected from the direct rays of the sun. DM munitions should be stowed in magazines that have concrete floors treated with sodium silicate.

Aboard ship, chemical munitions containing DM should preferably be stowed separately. If separate stowage is not available, they may be stowed with other munitions filled with other types of chemical agents. Refer to the Chart of Permissible Stowages of Ammunition and Explosives (OP5, Volume 1, Appendix A).

DECONTAMINATION

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

HD - DISTILLED MUSTARD - BLISTER AGENT

Action on metals	No action
Boiling point	419° F.
Chemical name	Dichloroethyl sulfide
Chemical storage group	A
Decomposition point	300° F. to 350° F.
Decontaminants	DS2, DANC, bleach slurry, dry mix
Formula	$(Cl\ CH_2CH_2)_2S$
Freezing point	57° F.
Munition marking	Two green bands on gray background
Odor	Garlic
Percent expected fatalities	2%
Persistency	7 days or more in cold weather, 1 to 2 days in warm weather
Physical state	Oily liquid
Rate of action	4 to 6 hours
Rate of detoxification	3 days, to 3 to 6 months, depending on severity
Specific gravity	1.999
Stability in storage	Stable in metal containers below 250° F.

DESCRIPTION

HD agent, distilled mustard gas, is an oily, irritating, blistering gas which is better for its incapacitating effects than for its lethal effects. It is most effective in hot humid weather of about 80°F, by skin absorption of vapor among masked personnel in situations where the considerable delay in the onset of its incapacitation is acceptable. As a liquid it is effective for a longer period than as a vapor; and, thus, can force the enemy to mask for extended periods of time. It has a slow rate of evaporation and is heavier than water. HD is H which has been purified by washing and vacuum distillation. It has less odor and greater blistering power than H and is more stable in storage. Its odor is like garlic. HD produces predominantly temporary incapacitation and a low percentage of deaths. One of its limitations is its rate of action, which is delayed usually from 4 to 6 hours. The physiological effects produced are inflammation of the eyes, redness of skin and blistering and inflammatory reaction of nose, throat, and lungs. HD is persistent and may remain 1 or 2 days under average conditions, and a week or more under cold conditions.

The liquid may be used to contaminate terrain and material and to cause casualties among troops encountering these contaminated surfaces. The principal dissemination systems are bombs, artillery projectiles, land mines, and airplane spray tanks.

Symptoms of HD-agent toxification are inflammation of the eyes; redness, blistering and ulceration of the skin; and inflammation of the nose, throat, trachea, bronchi and lung tissue. The symptoms do not appear for 4 to 6 hours. Skin and lung effects can persist for 3 months; eye effects can persist from 2 weeks to 6 months. However, the fatality rate is low, 2 percent, based on World War I experience. Blister gases were the agents used in the only two recorded instances of toxic chemical warfare since the end of World War I.

The protective mask and permeable (impregnated) clothing provide protection against HD vapor and impermeable clothing against the liquid. The body can be coated with M5 protective ointment, and personal gear can be coated with vesicant gas-resistant leather dressing.

DECONTAMINATION

Material contaminated with HD-agent should be washed with DS2 or DANC solution, or bleach slurry consisting of half supertropical bleach and half water. A dry mix may be made with two shovelfuls of bleach to three shovelfuls of dry earth. M5 protective ointment may be applied to decontaminate personal equipment.

Personnel can be decontaminated with M5 ointment which is packaged in 3/4-ounce tubes. The skin area must first be washed with water. M5 ointment can not be used in the eyes.

For first aid, pinch the blot on the skin, flush with water, apply M5 protective ointment, wipe dry. Apply more ointment to the affected area and leave it there. For liquid HD agent in the eyes, flush with water from a canteen while holding lids open and apply M5 protective ointment 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.

GB - SARIN - NERVE AGENT

Action on metals	Slight corrosion of steel
Boiling point	303° F.
Chemical name	Fluoroisopropoxymethylphosphine oxide
Chemical storage group	A
Decomposition point	Not available. Will decompose at high temperature
Decontaminants	DS2, bleach slurry, lye solutions
Formula	$CH_3P(O)(OC_3H_7)(F)$
Freezing point	-68.8° F.
Munition marking	Three green bands on gray background
Odor	Not detectable
Percent expected fatalities	25%, average
Persistency	Low, except at temperatures below 0° C.
Physical state	Liquid. Disseminated as vapor
Rate of action	Rapid, 2 to 5 minutes
Rate of detoxification	1 to 5 days
Specific gravity	1.07
Stability in storage	Stable in one-ton containers

DESCRIPTION

GB agent is an odorless, colorless liquid when pure. It is a quick-acting, casualty-producing nerve agent with very high eye toxicity. It produces casualties primarily by inhalation effects, although skin absorption is a significant factor in some cases. The fragmentation effect of a GB burst is about one-half that of an HE round, and the casualty effect in that area is nearly as rapid. Its skin toxicity is low except where the skin is broken. It is non-persistent as a vapor; as a liquid its persistence varies with the temperature. It evaporates at about the same rate as water (depending upon the weather). The rate of action is very rapid, usually causing death within 2 to 30 minutes after a lethal dosage is inhaled. A drop of GB the size of a pinhead, volatized and inhaled would be lethal. The action is so fast that there is little time for protection, detection, or treatment.

For dissemination, GB is used as a filling in bombs, rockets, and artillery projectiles.

The symptoms of an individual affected by GB agent are running nose; tightness of chest; dimness of vision with a pin-pointing of the eye pupils; difficulty in breathing; excessive salivation and perspiration; nausea, vomiting, cramps, and

involuntary defecation and urination; twitching, jerking, staggering; headache; confusion; drowsiness; coma and convulsion; cessation of breathing and death.

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

Liquid GB evaporates at approximately the same rate as water. Although the persistency of GB is low under normal meteorological conditions, the agent is quite persistent at temperatures below 0° F. and can be carried into shelters on clothing or tracked in with mud by troops who have passed through contaminated areas. 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 weather, temperature, and scale of the attack. In general, an area attacked by GB can be traversed by troops with only negligible risk shortly after the attack if protective masks are worn.

DECONTAMINATION

Decontamination is generally not required due to the low persistency of GB. For first aid, personnel should flush the affected area with a stream of water and wash with hot, soapy water. Contaminated clothing should be removed with care to prevent self-contamination. For liquid GB in the eyes, flush with clear water or a solution of bicarbonate of soda and immediately inject atropine into a muscle.

Material can be decontaminated with DS2, bleach slurry, 10-percent caustic solution, dilute water solutions of alkalies (5-percent washing soda or lye solutions), or hot soapy water. In confined areas, steam, ammonia, or hot soapy water is effective.

VX - PERSISTENT NERVE AGENT

Chemical storage group	A
Decontaminants	DS2, DANC, bleach slurry, 5% sodium hypochlorite, M5 vesicant agent ointment
Munition marking	Three green bands on gray background
Odor	Not detectable
Percent expected fatalities	25% average
Persistency	Considerably longer than GB
Physical state	Liquid, disseminated as a vapor
Rate of action	3 to 10 minutes
Rate of detoxification	1 to 5 days
Stability in storage	Stable in one-ton containers

DESCRIPTION

VX agent is a nerve agent similar to GB but of lower volatility. VX is casualty-producing either in aerosol or liquid form. It is liquid under all climatic conditions, but has a much lower volatility than GB. The physiological effects produced are convulsions, paralysis, and respiratory failure. Its outstanding characteristic is a very high eye and skin toxicity. The fragmentation effect of a VX burst is about one-half that of an HE round, but the casualty effect in that area is nearly as rapid as that from HE. VX is about as heavy as water, has the consistency of machine oil, and is odorless and colorless when pure. It is persistent, and can contaminate areas for several days. Its rate of action by inhalation is 3 to 10 minutes and by skin absorption is 30 minutes to 24 hours.

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.

DECONTAMINATION

Surfaces contaminated with VX can be decontaminated with DS2, DANC, STB (supertropical bleach), bleach slurry, 5-percent solution of sodium hypochlorite, or alcoholic caustic solution.

VX may be effectively removed from the skin by use of M5 protective ointment or a 5-percent aqueous

solution of sodium hypochlorite (household bleach). Prompt decontamination of the skin is imperative. For decontamination by showering, the body should be first flushed with cold water and then washed with soapy warm water.

Chapter 3

CHEMICAL GRENADES

INTRODUCTION

The chemical hand grenades considered in this chapter may be used for casualty, harassing, or riot control purposes. They are employed in training to teach troops the tactics of chemical warfare and in the use and importance of protective masks.

The effects of weather on the functioning of chemical 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 chemical 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- or carbine-projected. See TM 3-300 and FM 23-30 for more information on this subject.

HANDLING AND STOWAGE. Fire hazard is the first consideration in stowing chemical grenades. See OP 5 and chapter 1 of this publication for detailed instructions on handling and stowage.

SAFETY PRECAUTIONS

Always take the following safety precautions when handling or firing chemical hand grenades:

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

CN-DM RIOT HAND GRENADE, M6

Specification	MIL-G-10124
Assembly drawing	B13-22-2
Chemical storage group	D
Length of body (in.)	4.5
Diameter (in.)	2.5
Weight (oz.)	16
Burning time (min.)	0.5-1
Color marking	RIOT, CN-DM, and one band, all in red
Filling	
Material	CN, DM, EC smokeless powder
Weight (oz.)	10
Fuze	
Type	Igniting, M201A1
Delay (sec.)	2
Packing	
Units per case	16
Shipping weight (lb.)	33

GENERAL

CN-DM Riot Hand Grenade, M6, figure 3-1, is used for the control of riots, mobs, and other disturbances, and for training purposes.

The body of the grenade has three rows of six emission holes each in its body walls. The filling consists of CN, DM, and EC smokeless powder. A starter mixture, with binder, is contained in a zinc or plastic cup attached inside the top of the container. The fuze lever is held in an unarmed position by a ringed safety pin.

OPERATION

To fire the grenade, hold the fuze lever firmly against the grenade body with the throwing hand. Remove the safety pin and throw or toss the grenade. The fuze begins to function as soon as pressure on the fuze lever is released. After a delay time of about 2 seconds, the fuze sets off the starter mixture which, in turn, ignites the main filling. The CN-DM vapors are emitted in the form of a smoke.

This grenade can be rifle projected with the M2 grenade-projection adapter.

WARNING

Do not stand directly downwind from the burning grenade even if equipped with a protective mask. Burning time for this grenade is about 1-1/2 minutes.

See chapter 11 for information regarding handling, stowage, and safety precautions for chemical agents.

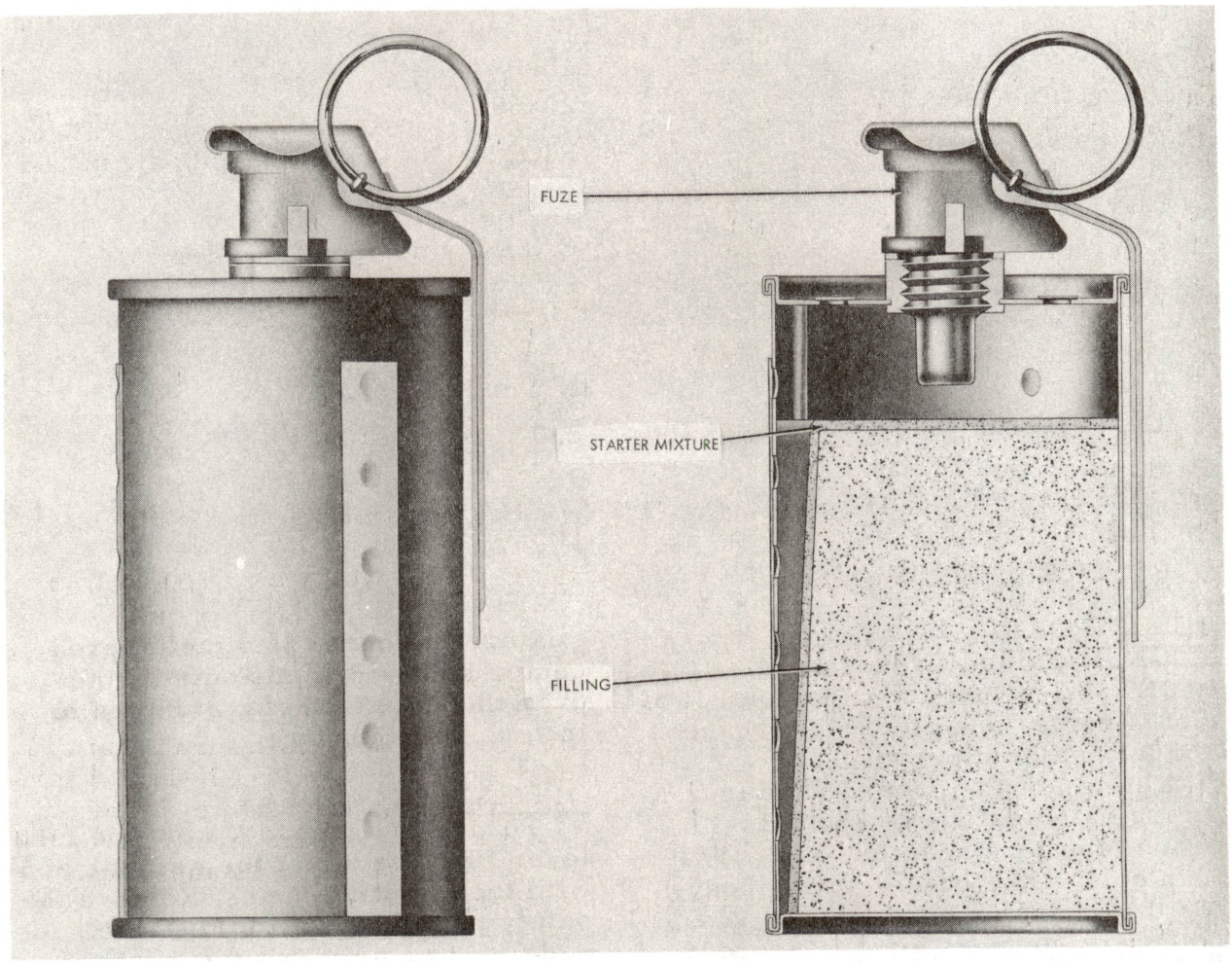

Figure 3-1 CN-DM Riot Hand Grenade, M6

CN RIOT HAND GRENADE, M7A1

Specification	MIL-G-11968A
Assembly drawing	B13-21-3
Chemical storage group	D
Length of body (in.)	4.5
Diameter (in.)	2.5
Weight (oz.)	16
Burning time (sec.)	20-60
Color marking	RIOT, CN, and one band, all in red
Filling	
Material	CN, EC smokeless powder
Weight (oz.)	12
Fuze	
Type	Igniting M201A1
Delay (sec.)	2.0
Packing	
Units per case	16
Shipping weight (lb.)	35

DESCRIPTION

CN Riot Hand Grenade, M7A1, figure 3-2, is used for the control of riots, mobs, and other disturbances, and for training purposes.

The top of the grenade has four emission holes evenly spaced around the fuze adapter, and a 1/2-inch hole in the bottom of the body for the emission of tear gas. All holes are covered with waterproof pressure sensitive tape which is blown or burned off after the grenade begins to function. Asbestos discs, with holes corresponding to the holes in the body, are placed inside the top and bottom of the grenade.

A center hole, tapered from 1/2-inch at the bottom to 3/8-inch at the top, is surrounded by the tear mixture which consists of CN and EC smokeless powder. A starter mixture is poured into the tapered center hole and is also distributed over the top of the tear mixture to insure even burning.

OPERATION

To fire the grenade, hold the fuze lever firmly against the grenade body with the throwing hand. Remove the safety pin and throw or toss the grenade. After a delay time of about 2 seconds, the grenade disperses a smoke containing CN vapor for 20 to 60 seconds. The grenade can be launched from an M1 rifle by using the M2A1 grenade projection adapter (FM 23-30).

See chapter 11 for information regarding handling, stowage, and safety precautions for group D chemical agents.

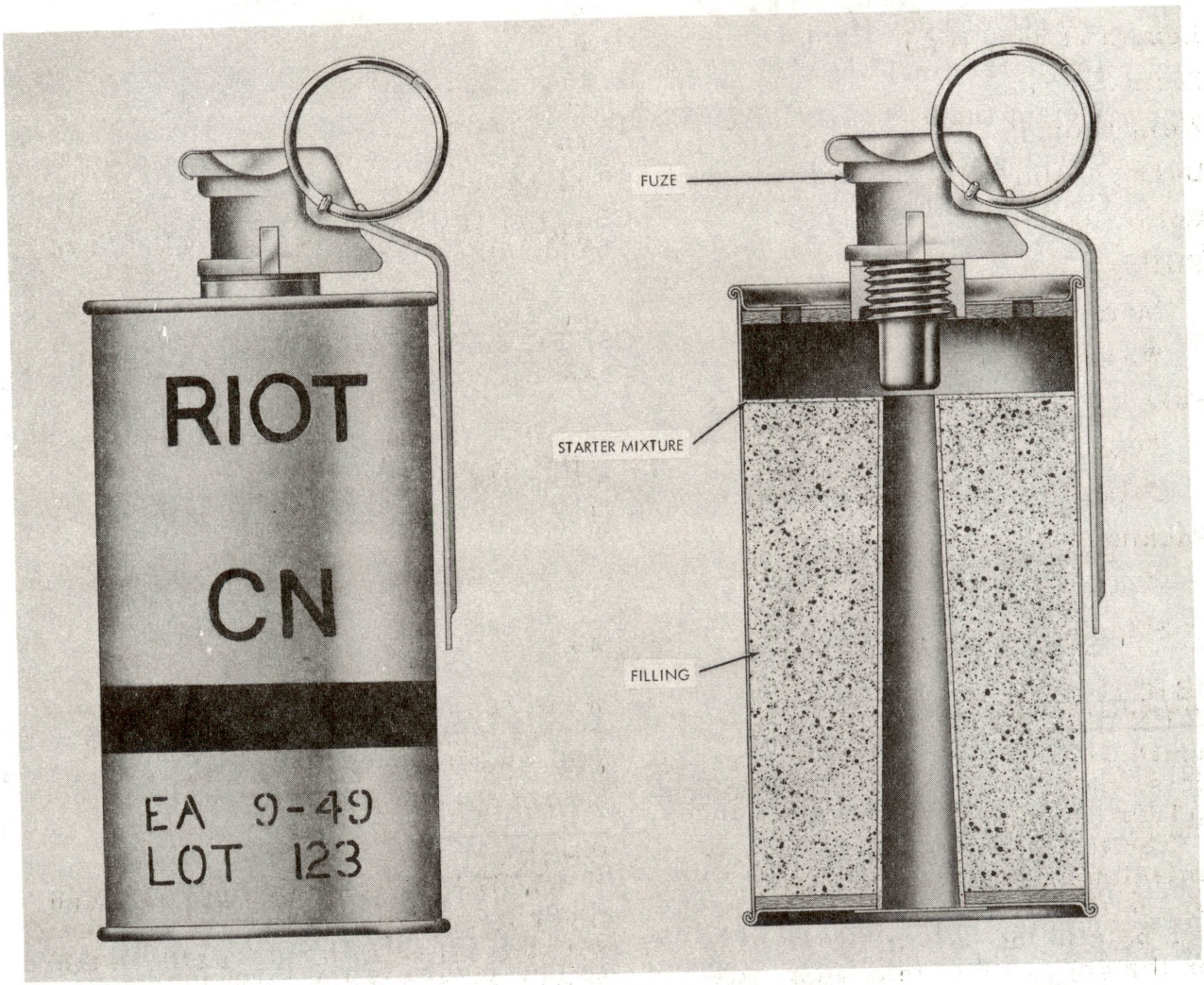

Figure 3-2 CN Riot Hand Grenade, M7A1

CS RIOT HAND GRENADE, M7A1

Specification	MIL-G-11968
Assembly drawing	D13-21-6
Chemical storage group	D
Length of body (in.)	4.5
Diameter (in.)	2.25
Weight (oz.)	16
Burning time (sec.)	15 to 35
Color marking	CS M7A1 (BURNING TYPE) and one band, all in red
Filling	
Material	CS, EC smokeless powder
Weight	9.5
Fuze	
Type	Igniting, M201A1
Delay (sec.)	0.7 to 2.0
Packing	
Units per case	16
Shipping weight (lb.)	34

DESCRIPTION

CS Riot Hand Grenade, M7A1, figure 3-3, is used for the control of riots, mobs, and other disturbances, and for training purposes.

The body of the grenade is a thin sheet-metal cylinder with four agent emission holes in the top and one in the bottom. These holes are covered with waterproof pressure sensitive tape to protect the filling from moisture. The M201A1 fuze is screwed into an adapter in the top of the grenade. The pressure sensitive tape is burned or blown off after the grenade is fired.

A tapered hole in the filling is lined with starter mixture, and the top of the filling is also covered with starter mixture to insure even burning. The starter mixture fires the tear mixture which consists of CS and EC smokeless powder.

OPERATION

The M7A1 CS grenade may be launched from a rifle or thrown by hand.

To throw the grenade, cradle it in the fingers of the throwing hand with the ball of the thumb pressed tightly against the safety lever. Withdraw the safety pin by pulling the pull ring with the free hand, and throw the grenade. When the grenade is thrown, the safety lever of the grenade is released, allowing the striker to hit the primer which in turn ignites a 0.7 to 2.0-second delay element. The delay element then ignites the grenade starter

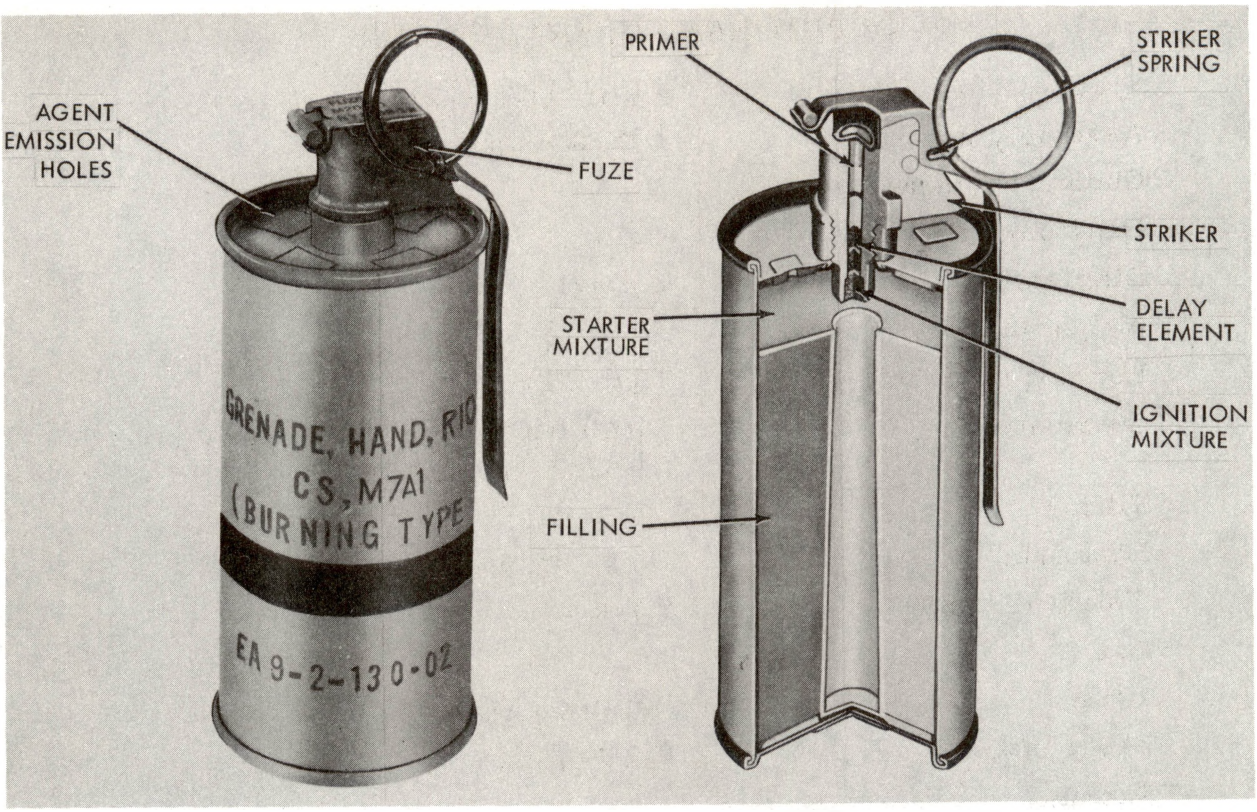

Figure 3-3 CS Riot Hand Grenade, M7A1

mixture and fires the agent filling, blowing off the tape seals.

The grenade can be launched from an M1 rifle by using the M2A1 grenade projection adapter. Do not attempt to launch the grenade with service ammunition or with blank ammunition. Use only the special grenade cartridges designed for this purpose. See chapter 11 for information regarding handling, stowage and safety precautions for group D chemical agents.

CS RIOT HAND GRENADE, ABC-M7A2

Specification	196-131-759
Assembly drawing	D13-22-29
Chemical storage group	D
Length of body (in.)	4.5
Diameter (in.)	2.25
Weight (lb.)	16
Burning time (sec.)	15 to 35
Color marking	M7A2 RIOT CS and one band, all in red
Filling	
Material	CS capsules, burning mixture
Weight (grams)	97 of CS, 150 of burning mixture
Fuze	
Type	Igniting, M201A1
Delay (sec.)	0.7 to 2.0
Packing	
Units per case	16
Shipping weight (lb.)	34

DESCRIPTION

CS Riot Hand Grenade, ABC-M7A2, figure 3-4, is used for the control of riots, mobs and other disturbances, and for training purposes.

The body of the grenade is a thin sheet-metal cylinder. A fuze is screwed into an adapter in the top of the grenade. There are three agent emission holes in the top of the grenade and one in the bottom. These holes are covered with pressure sensitive tape to protect the filling from moisture. The grenade filling consists of 150 grams of burning mixture (fuel) and approximately 115 grams of encapsulated agent, which comprises 97 grams of powdered CS agent in gelatin capsules. The filling is compressed into the grenade body to leave a tapered channel through the filling. The bottom of this channel coincides with the emission hole in the bottom of the grenade body. The top surface of the filling and the tapered walls of the hole are coated with starter mixture to ensure ignition of the fuel by the fuze.

An M201A1 grenade igniting fuze is screwed into the adapter in the top of the grenade body. In this position, the ignition mixture of the fuze is centered over the hole through the middle of the grenade and just slightly above the starter mixture coating of the top surface of the filling.

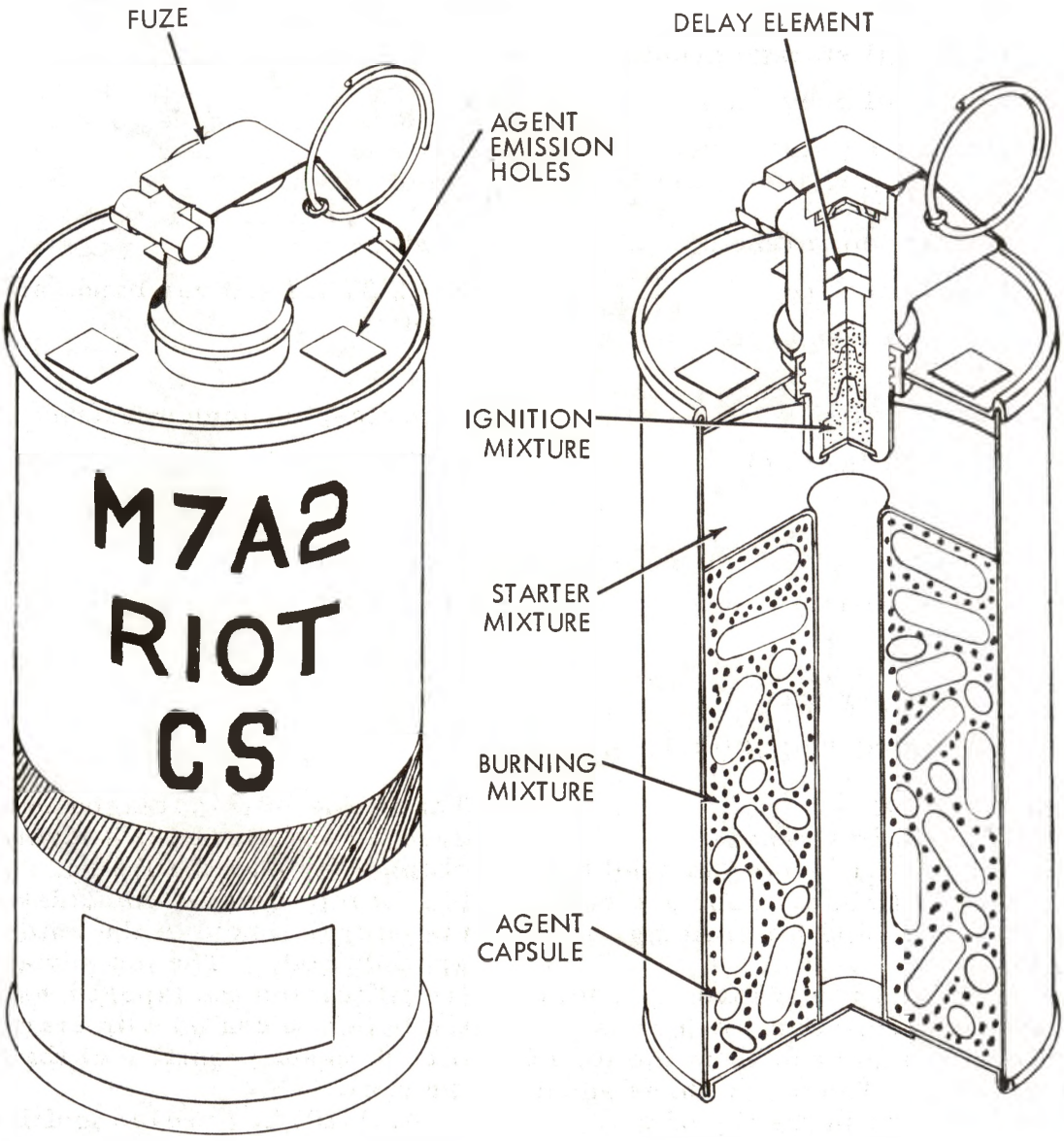

Figure 3-4 CS Riot Hand Grenade, ABC-M7A2

OPERATION

The ABC-M7A2 CS riot grenade may be launched from a rifle or thrown by hand.

To throw the grenade, cradle it in the fingers of the throwing hand with the ball of the thumb pressed tightly against the safety lever. Withdraw the safety pin by withdrawing the pull ring with the free hand, and throw the grenade. The safety lever of the fuze is released, allowing the striker to hit the primer, which in turn ignites the 0.7 to 2.0 second delay element. Upon expiration of this time, the delay element ignites the starter mixture and the filling. Pressure developed by burning fuel blows the top off and forces out the CS agent.

The grenade can be launched from an M1 rifle by using the M2A1 grenade projection adapter and an M3 caliber .30 grenade cartridge. Do not attempt to use service or blank ammunition.

See chapter 11 for information regarding handling, stowage and safety precautions for group D chemical agents.

CN RIOT HAND GRENADE, M25A1

Specification	MIL-G-10280
Assembly drawing	B13-25-2
Chemical storage group	B
Body	Plastic spherical
Diameter (in.)	3
Weight (oz.)	8
Radius of burst (yd.)	5
Color marking	RIOT, CN, and one band, all in red--on metal container, not on the grenade
Filling	
Material	CN
Weight (oz.)	3.33
Fuze	
Type	Bursting
Delay (sec.)	1.4 to 3
Packing	
Units per case	50
Shipping weight (lb.)	60

DESCRIPTION

CN Riot Hand Grenade, M25A1, figure 3-5, is designed primarily for use in the control of riots, mobs, and other disturbances. Its weight, size, and shape allow easy handling and projection.

The grenade is spherical and has a diameter of slightly less than 3 inches--approximately the size and shape of a baseball. Upper and lower phenolic plastic halves are cemented together to form the grenade body. Inside sleeves, integral with the halves, telescope (the lower is cemented into the upper) and form a tubular opening through the center of the grenade. The opening thus formed becomes the casing for the firing components of the grenade. A plastic closure plug in the base of the lower half-sleeve has an integral firing pin on its inner side. The CN filling is loaded through an opening 1/2-inch from the firing-pin closure plug.

The firing mechanism consists of:

1. Fuze assembly, containing primer, delay element, and detonator
2. Slider, holding the fuze assembly cemented inside its lower end (a hole in the upper end receives the safety pin)
3. Safety balls (two), fitting into a groove around the slider and holding it in an unarmed position until forced into recesses by action of the firing spring after the arming sleeve is expelled
4. Firing pin, on inner side of closure plug in the base of the lower half-sleeve

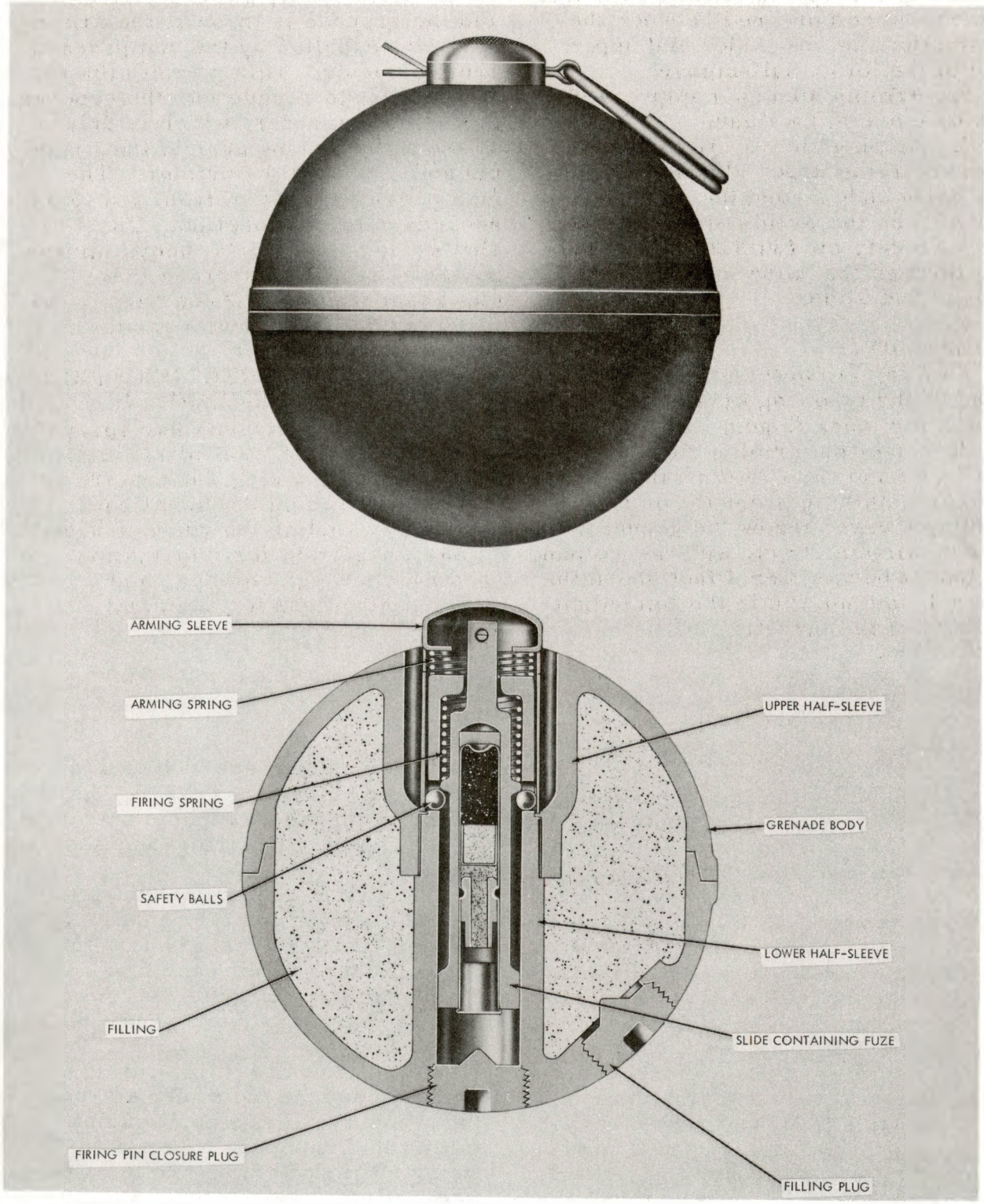

Figure 3-5 CN Riot Hand Grenade, M25A1

5. Firing spring, fitting over the slider and compressed between the projections on the slider and upper end of the lower half-sleeve

6. Arming spring, compressed inside the arming sleeve

7. Arming sleeve, resting in the channel of the upper sleeve, extending 5/16-inch beyond the grenade body. The top of this sleeve is open.

8. Safety pin (with ring), extending through the holes in the arming sleeve and slider

OPERATION

To fire, grasp the grenade in the hand of the throwing arm with the thumb (or index finger) held firmly on the top of the arming sleeve. With the free hand remove the safety pin and, maintaining pressure on the arming sleeve, throw the grenade. For maximum effect, aim the grenade so that it 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 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 activates the primer. The fuze provides delay of from 1.4 to 3 seconds before detonation. Upon the shattering of the plastic body, micropulverized CN is dispersed in a cloud that travels with the wind. The radius of burst is about 5 yards.

PACKAGING AND IDENTIFICATION

The grenade is hermetically sealed in an individual tin container sprayed with gray lacquer. All identification data, including a single band, are stenciled in red on the metal container only, not on the grenade body.

See Chapter 11 for information regarding handling, stowage, and safety precautions for chemical agents.

CS1 RIOT HAND GRENADE, M25A2

Specification	MIL-G-46459E
Assembly drawing	C13-25-54
Chemical storage group	D
Body	Plastic spherical
Diameter (in.)	3
Weight (oz.)	8
Radius of burst (yd.)	5
Color marking	M25A2 CS-1 and one red band, all in red.
Filling	
Material	CS-1
Weight (oz.)	3
Fuze	
Type	Integral, C12
Delay (sec.)	1.4 to 3
Packing	
Units per case	50
Shipping weight (lbs.)	50

DESCRIPTION

CS1 Riot Hand Grenade, M25A2, figure 3-6, is designed primarily for use in the control of riots, mobs, and other disturbances. Its weight, size, and shape permit easy handling and projection. CS1 is a non-burning, micropulverized powder which causes severe skin and respiratory burning, sneezing, coughing and chest convulsions and eye irritation without doing any permanent bodily injury.

The grenade is spherical and has a diameter of slightly less than 3 inches-approximately the size and shape of a baseball. Upper and lower plastic hemispheres are cemented together to form the grenade body.

A burster well is formed by a slider housing molded as a part of the lower body. A closure plug with an integral firing pin is screwed into the bottom of the burster well. This grenade has provisions for filling with CS1 (Stocked by Navy), or CN1, and DM1 (which are not stocked). Loading is accomplished through a half-inch filling plug opening on the lower grenade hemisphere near the firing pin. Grenades in stock are all loaded at the manufacturers.

The firing mechanism consists of:

1. A detonator with a delay of approximately 2 seconds integrally contained in a slider which travels from top to bottom of the burster well to impact on the firing pin. The slider is pushed against the firing pin by action of the firing spring.

2. A ball-shaped end of a retainer pin seated in a recess in the top of the slider. The retainer pin remains perpendicular to the slider as long as the slider is held in place by the

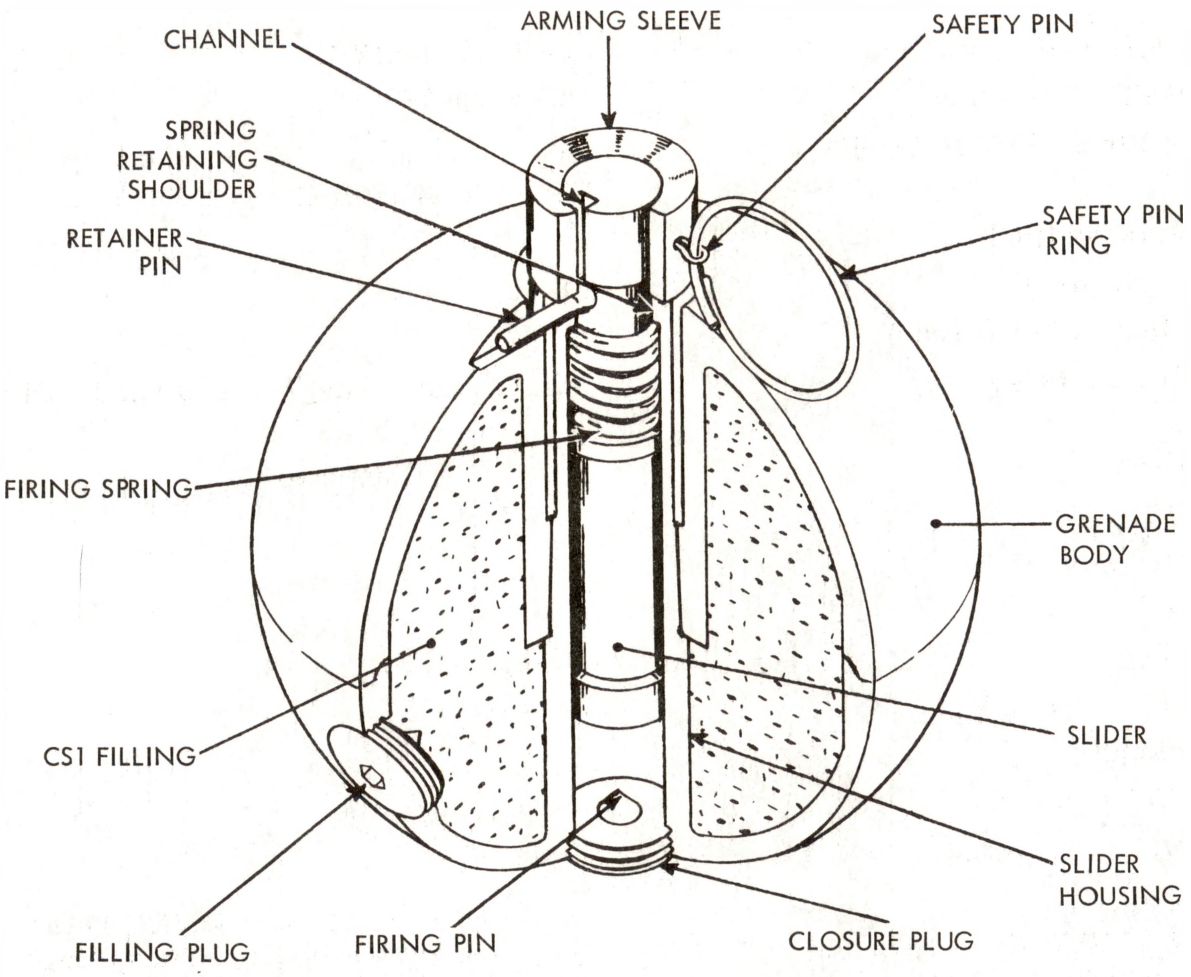

Figure 3-6 CS1, Riot Hand Grenade, M25A2

safety pin passing through the upper end of the slider and through the arming sleeve. In this position, the retainer pin prevents movement of the slider through the firing spring.

3. With the arming sleeve removed, pressure of the firing spring causes the retainer pin to pivot in its recess through a 90-degree angle, so that the pin lies against the body of the slider in a channel. In this position, the slider and retainer are free to pass through the middle of the firing spring as the spring forces the slider downward to impact against the firing pin.

OPERATION

To fire, grasp the grenade in the hand of the throwing arm with the thumb (or index finger) held firmly on the top of the arming sleeve and throw. For maximum effect, aim so that the grenade bursts on the ground about 10 feet in front of the mob with the wind blowing toward the rioters. The radius of burst is about 5 yards, but fragments of plastic may fly as far as 25 yards. Depending on wind velocity, effective quantities of CS-1 agent may be carried as far as 75 to 100 yards downwind.

After the safety pin is withdrawn and the grenade is thrown, the arming sleeve is forced from the end of the slider. Under pressure of the firing spring, the slider moves toward the bottom of the burster well, and the primer in the end of the slider strikes the firing pin. The primer ignites a delay element (2.2±0.8 seconds) in the slider which sets off a detonator also contained in the slider. The detonator explodes, shattering the grenade and dispersing the micropulverized agent.

GRENADE IGNITING FUZE, M201A1

DESCRIPTION

Grenade Igniting Fuze, M201A1, figure 3-7, is issued assembled to a grenade or other munition because, with this type of fuze, the explosion of one unit will not cause mass ignition. Munitions fitted with this type of fuze are burning-type chemical hand grenades, certain floating smoke pots, and incendiaries.

The fuze consists of a body, a striker, a safety lever, and a safety pin. The body is cylindrical and threaded for assembly to the grenade. It contains a primer, a 2-second delay element, and an igniter cup containing an ignition mixture. At the top of the body, one side extends to form a lip for attachment of the safety lever. The other side forms a hinge to carry the spring-loaded striker. The striker is restrained from movement by a safety lever. The lever hooks over the lip on the fuze body and extends across the head of the fuze and down the body of the grenade. The lever is held in position by the safety cotter pin to which a pull ring is attached.

OPERATION

When the safety pin is removed, the lever is released; the striker, driven by the spring, throws off the lever and swings about its pivot to 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 sets off the munition's starting mixture, which in turn ignites the main filling.

MAINTENANCE

Grenades equipped with these fuzes are subject to deterioration and require close surveillance to assure that fuzes are serviceable. Fuzes, however, will not be removed or replaced without direct authorization of the Bureau of Naval Weapons.

Refer to OP5, Volume 1, for handling, stowage, and safety precautions regarding fuzes.

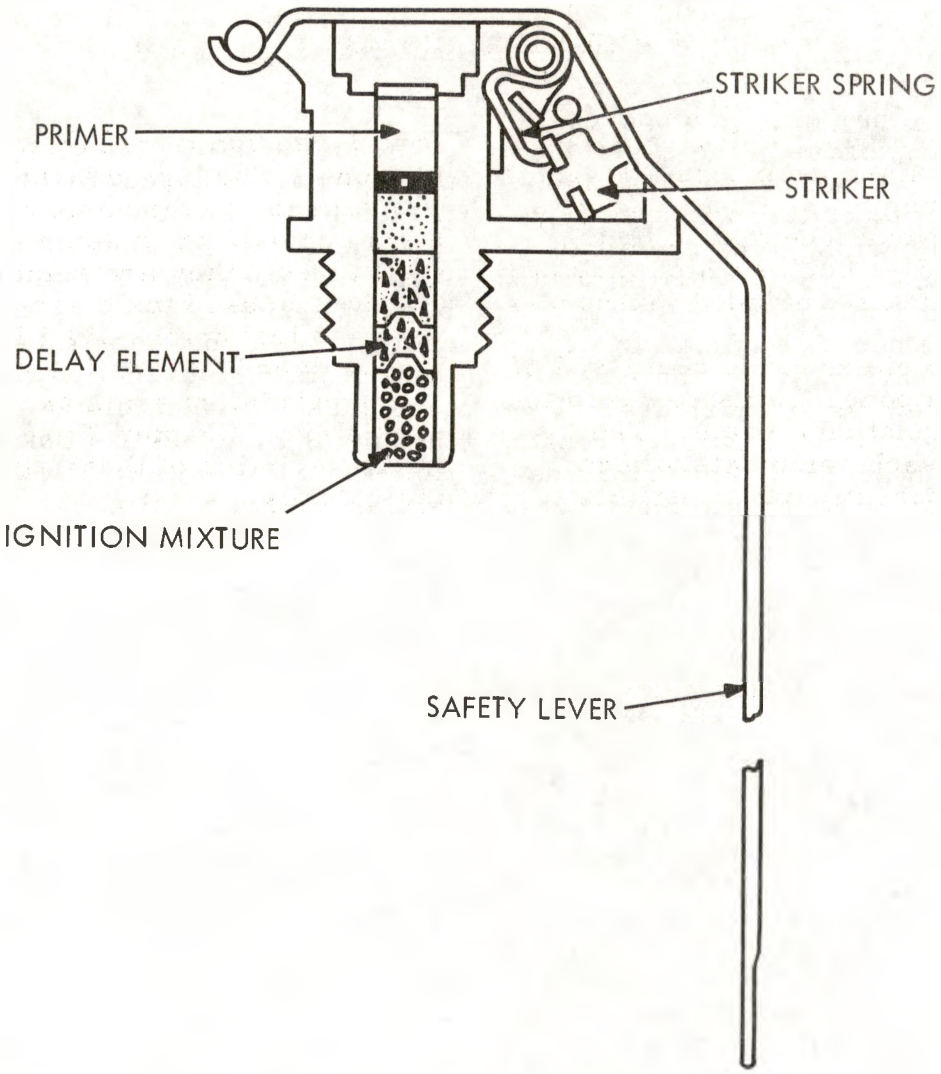

Figure 3-7 Grenade Igniting Fuze, M201A1

Chapter 4

CHEMICAL BOMBS

INTRODUCTION

This chapter describes a large chemical bomb which can deliver a variety of toxic chemical agents. Three similar bombs which may still be available are included in Appendix A.

A complete round 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.

Complete rounds are designated by 4-, 6-, 10-, 100-, 115-, 500-, 750-, and 1000-pound nominal weight classifications. For purpose of description, bombs in the 4-, 6-, 10-pound classes are regarded as small. 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.

Large bombs are not loaded into clusters but are dropped individually. For example the complete weight of a bomb classified as the M35 750-pound incendiary bomb cluster is 690 pounds.

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 non-persistent agent and HD as persistent. Chapter 2 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.

SAFETY PRECAUTIONS

WARNING

Field tests for the shipboard handling and storage of chemical-filled bombs have not been completed. Refer to the following publications with their latest changes: TM 3-220, TM 3-250, TM 3-290, TM 3-400, FM 3-8 and Chemical Corps Safety Directive Nos. 385-8, TM 3-304 and TM 8-285.

Chemical bomb fuzes contain high-explosive elements which are sensitive to heat and shock. The explosive elements deteriorate when exposed to moisture and dirt. To protect personnel from accidentally activated 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 sunlight.
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. Destroy unsafe fuzes in accordance with instructions contained in chapter 11.
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 pins 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.

NONPERSISTENT GAS BOMB, GB, 500-POUND MK 94 MOD 0

Assembly drawing	1380220
Loading drawing	1380978
List of drawings	LD 165800
Length of assembled bomb (in.) (with fuze)	88.79
Body diameter (in.)	10.75
Fin assembly drawing	1380512
Fin span (in.)	15.06
Weight of empty bomb body (lb.)	278
Filling	GB
Filling weight (lb.)	108
Weight of assembled bomb (lb.)	441
Arming wire assembly	M6A2
Arming wire retainer installation drawing	1516513
Burster	
Assembly drawing	1380977
Explosive	HBX-1
Weight (lb.)	16.1
Nose fuze	MK 243; AN-M139A1; AN-M140A1; AN-M103A1; AN-M168 (VT); AN-M166E1 (VT)
Tail fuze	AN-M195
Tail fuze adapter drawing	1296899
Adapter-booster	M115A1
Color code	Three green bands on gray background

DESCRIPTION

The 500-lb Nonpersistent GB Gas Bomb Mk 94 Mod 0, figure 4-1, 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. Three green bands are painted around the body between the two suspension lugs, and the marking GB-GAS and identifying nomenclature are stenciled in green on the gray body.

The major components of the bomb are body section, fin assembly, arming wire, nose fuze, long-stem tail fuze, burster tube with charge, suspension and hoisting lugs. The body is of steel construction with a minimum wall thickness of 0.4

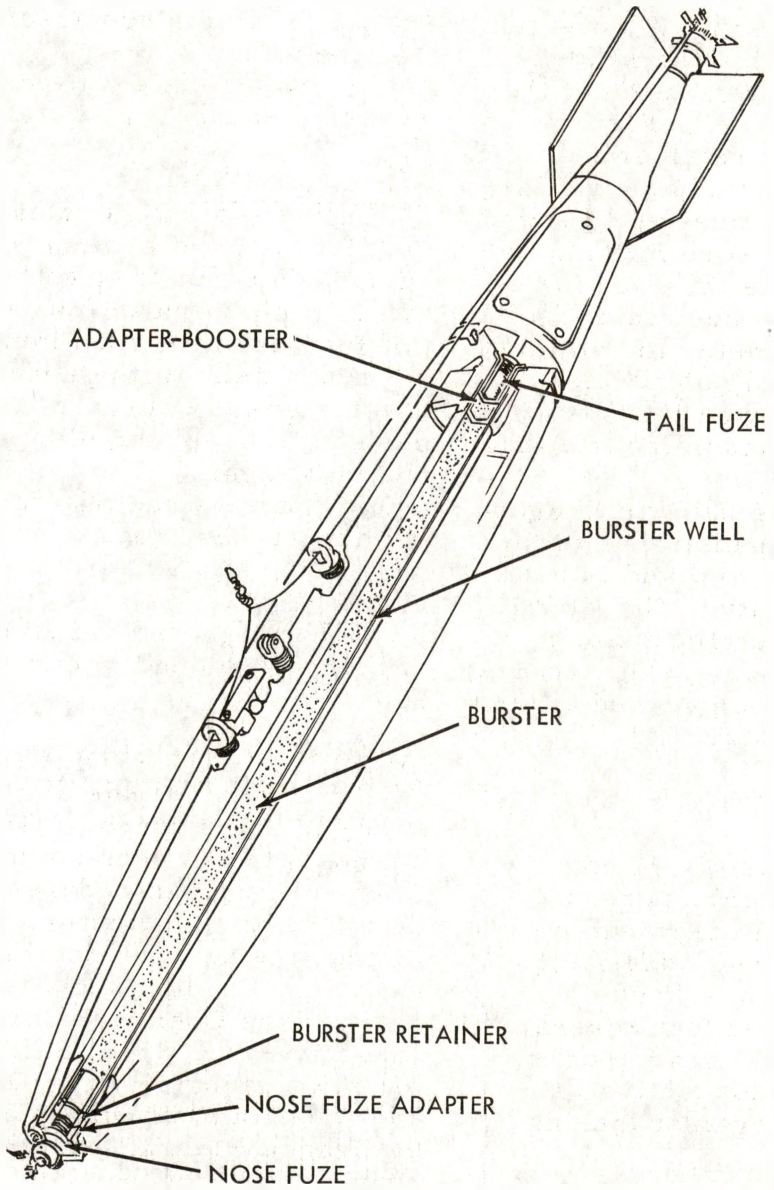

Figure 4-1 Nonpersistent Gas Bomb, GB, 500-Pound MK 94, Mod 0

inches. 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 adapter-booster M115A1, 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. At the tail end of the body there is a step of smaller diameter to retain the burster. An M115A1 adapter-booster is then screwed into the aft wall of the body to accommodate the tail fuze.

When the bomb is filled with agent a void is left for expansion. Helium is injected into this void and is used to check seal integrity. The filling hole is closed by installation of a steel ball as a primary seal, and a steel plate, resistance welded to the body, as the secondary seal.

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.

BOMB ASSEMBLY

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, fuzes, adapter-booster, arming wires, fin assembly, and hoisting lug are packaged and shipped separately. The suspension lugs are packaged and shipped in the fin assembly crate.

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.

FUNCTIONING

When the bomb is released from the aircraft, the arming wires are withdrawn permitting both fuzes to arm. Both the nose fuze and the tail fuze detonate upon impact. The nose fuze sets off the adapter-booster and the burster which explodes the bomb and disperses the chemical agent. The tail fuze acts upon impact as back-up to detonate the adapter-booster.

PACKAGING

An air-tight individual container is being developed to carry the bomb body.

SHIPMENT AND STORAGE

Field tests for the shipboard handling and storage of GB-filled bombs have not been completed. Consequently, procedures for handling, storage, detection, and protection are not included in this publication. Pending such inclusion, refer to the Chemical Corps Safety Directive No. 385-8, Safety Criteria for Processing, Filling, Handling, and Decontamination of GB, issued by Headquarters, Department of the Army, Office of the Chief Chemical Officer, Washington 25, D. C. Additional information pertinent to the subject is contained in TM 3-220, TM 3-250, TM 3-290, TM 3-400, and FM 3-8. See chapter 11 for shore storage of GB bombs.

Chapter 5

CHEMICAL CARTRIDGES AND PROJECTILES (USMC)

INTRODUCTION

Chemical cartridges and projectiles are ordnance rounds which contain a chemical filling and are designed to be fired from mortars, howitzers and heavy caliber guns and rifles. The chemical filling may be toxic chemical agents or incapacitating agents, screening smoke or incendiary agents. This chapter deals with seven basic types of chemical rounds suitable for ordnance authorized for use by the United States Marine Corps. 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 Army publication TM3-200, Capabilities and Employment of Toxic Chemicals. The standard metric unit of area, the 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.

PERSISTENT GAS HOWITZER CARTRIDGE, HD, 105MM, M60

Drawing	75-1-109
Projectile weight (lb.)	33.46
Filler weight (lb.)	2.96
Filling efficiency (pct.)	8.83
Complete round wt. (lb.)	43.27
Projectile length (in.)	19.47, with fuze
Complete round length (in.)	31.10
Maximum diameter (mm.)	105
Fuze	PD-M51A5 (see note)
Burster casing	M5
Burster charge (lb.)	0.51, HE
Propelling charge (lb.)	M1, - 2.75
Cartridge case	M14, M14B1
Primer	M28A2 (alternate M28B2)
Muzzle velocity (f.p.s.)	1550
Maximum range (m.)	11,100
Used with	M2A1, M2A2, M4, M4A1, and M49 howitzers
Chemical storage group	A
Handling safety	See TM3-250
Color code	Two green bands on gray background

DESCRIPTION

The Persistent Gas Howitzer Cartridge, HD, 105mm, M60, figure 5-1, is designed to provide a toxic chemical offensive capability using Levinstein mustard or distilled mustard agent.

The cartridge is a semi-fixed, central burst, H or HD gas round used for anti-personnel effects. The M60, which resembles the HE round in external appearance, is boat-tailed and the nose is ogival and 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 casing is thin-walled steel tubing extending from the adapter to the rear of the round cavity. A burster charge ruptures the casing to disperse the contents. PD fuses provide super-quick or delay action. The round is used with M2 series, M4 series, and M49 105mm howitzers by the U. S. Marine Corps.

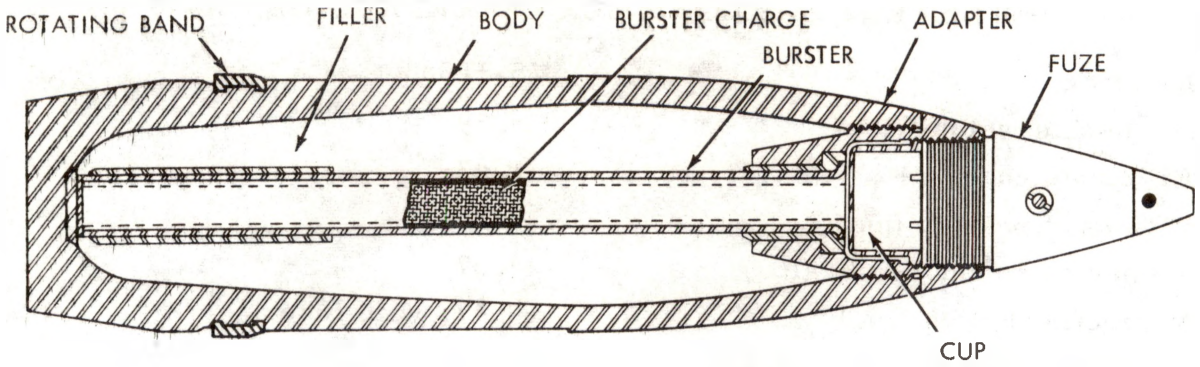

Figure 5-1 Persistent Gas Howitzer Cartridge, HD, 105mm, M60

NOTE: Stocks on hand with fuze PD-M51A4, and M57 (ltd. std.) will be issued until exhausted. M51A5 is assembled with booster. M21A4, and M57 are assembled with boosters. M22 and M51A5 have .05 second delay fuzes.

NONPERSISTENT GAS HOWITZER CARTRIDGE, GB, M360

Drawing	75-1-363
Projectile weight (lb.)	35.59
Filler weight (lb.)	1.63
Filling efficiency (pct.)	3.66
Complete round weight (lb.)	44.57
Projectile length (in.)	19.47, with fuze
Complete round length (in.)	31.18
Maximum diameter (in.)	4.132
Fuze	PD-M508 (see note)
Burster charge	M40 (1.9 lb. tetrytol)
Burster casing	M16
Primer	M28A2 (alternate M28B2)
Cartridge case	M14
Propelling charge (lb.)	M1-2.75
Muzzle velocity (f.p.s.)	1550
Maximum range (m.)	11,300
Used with	M2A1, M2A2, M4, M4A1, and M49 howitzers
Handling safety	See TM 3-250
Chemical storage group	A
Color code	Three green bands on gray background

DESCRIPTION

The Nonpersistent Gas Howitzer Cartridge, GB, M360, figure 5-2, is designed to provide a toxic chemical offensive capability using GB nerve agent. The cartridge is a semi-fixed, central burst GB gas round used for anti-personnel effects. The M360, which resembles the HE round in external appearance, is boat-tailed, and the nose is ogival and 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 burster casing is thin-walled steel tubing extending from the adapter to the rear of the round cavity. A burster charge ruptures the casing to disperse the contents. The cartridge is used with PD fuze to provide super-quick or delay action. The round is used with M2 series, M4 series, and M49 105mm howitzers by the U. S. Marine Corps.

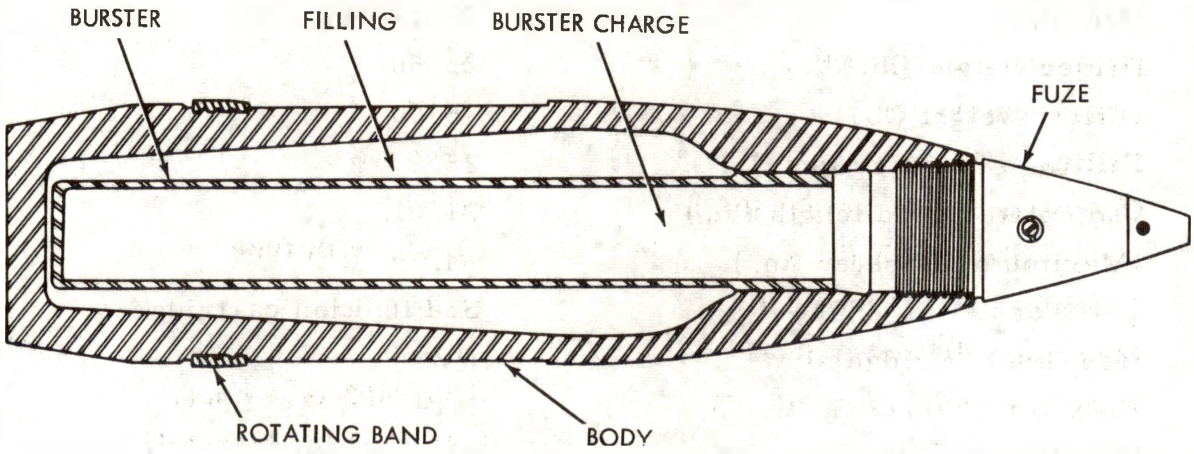

Figure 5-2 Nonpersistent Gas Howitzer Cartridge, GB, M360

NOTE: Stocks on hand with fuze PD-M51A4, M51A5, and M57 (ltd. std.) will be issued until exhausted. M51A5 is assembled with booster M21A4, and M57 with booster M22. M51A5 is a .05 second delay fuze.

PERSISTENT GAS MORTAR CARTRIDGE, HD, 4.2-INCH, M2 or M2A1

Drawing	75-1-284
Fired weight (lb.)	25.50
Filler weight (lb.)	6.00
Filling efficiency (pct.)	25.6
Complete round length (in.)	21.01
Maximum diameter (in.)	4.19
Primer	See ignition cartridge
Ignition cartridge	M2
Burster charge	M14
Muzzle velocity (f.p.s.)	820
Maximum range (m.)	3940
Used with	M30 mortar 4.2 in.
Handling safety	See TM 3-250
Chemical storage group	A
Color code	Two green bands on gray background

DESCRIPTION

The Nonpersistent Gas Mortar Cartridge, HD, 4.2-Inch, M2 or M2A1, figure 5-3, is designed to provide toxic chemical offensive capability using distilled mustard agent. This cartridge is a semi-fixed, central burst, spin stabilized munition which is filled with HD. The major components are a body, fuze, burster, propellant, ignition cartridge, primer, adapter, and filling. The burster tube extends the length of the body cavity.

Stabilization is accomplished by a rotating disk on the base of the shell which engages the rifling of the mortar. The base of the shell is externally threaded to receive the propellant holder, the propelling charge, and the ignition cartridge. It is used with 4.2 inch mortars M30 by the U. S. Marine Corps... The cartridge is similar in appearance to M329.

Firing HD, the 4.2-inch mortar can be effectively employed in terrain contamination missions within range limitations. The platoon can cover medium size targets in short firing times, depending on meterological and terrain conditions in the target area. HD will circumvent the protective mask and produce casualties among troops protected from normal HE fires.

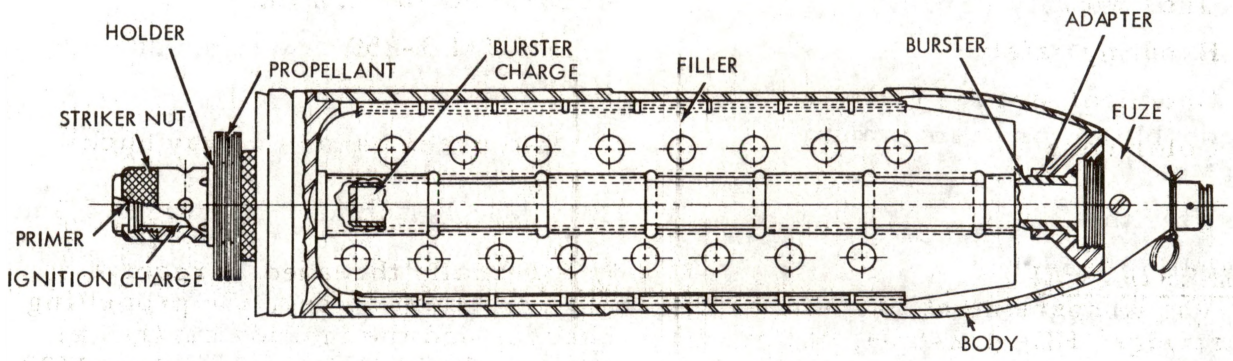

Figure 5-3 Persistent Gas Mortar Cartridge, HD, 4.2-Inch, M2 or M2A1

NONPERSISTENT GAS HOWITZER PROJECTILE, GB, 155MM, M121A1

Assembly drawing	75-14-656
Load drawing	73-1-264
Fired weight (lb.)	101.23
Filler weight (lb.)	6.5
Filling efficiency (pct.)	6.43
Overall length (in.)	27.54 with fuze (28.80 without fuze)
Maximum diameter (in.)	6.098
Fuze	PD-M508
Primer	MK 2A4
Burster	M37 (2 lb. HE)
Propelling charge	M3 (5.5 lb.), or M4A1 (13.19 lb.)
Muzzle velocity (f.p.s.)	1850
Range (m.)	9,850 with M3 charge; 14,920 with M4A1
Probable error at maximum range (m.)	38
Used with	M1, M1A1, and M45 howitzer 155mm
Handling safety	See TM 3-250
Chemical storage group	A
Color code	Three green bands on gray background

DESCRIPTION

The Nonpersistent Gas Howitzer Projectile, GB, 155mm, M121A1, figure 5-4, is designed to provide toxic chemical offensive capability. The projectile is a separate loaded, central burst, GB nerve agent-filled round, which can be used for anti-personnel effects. It is similar to the HE round except for the filling and the burster. The burster casing is one piece, extending the full length of the projectile cavity and is a press-fit into the body. The burster charge contained in a thin tube, is held in the burster casing by the fuze well cup.

The adapter on the forward end is screwed into the body and is threaded to receive the PD fuze. The body is thin-walled steel with a nose formed to a long ogive. The single rotating band is located about 3.5 inches in front of the base. It is used with M1, M1A1, and M45 155mm howitzers by the U. S. Marine Corps.

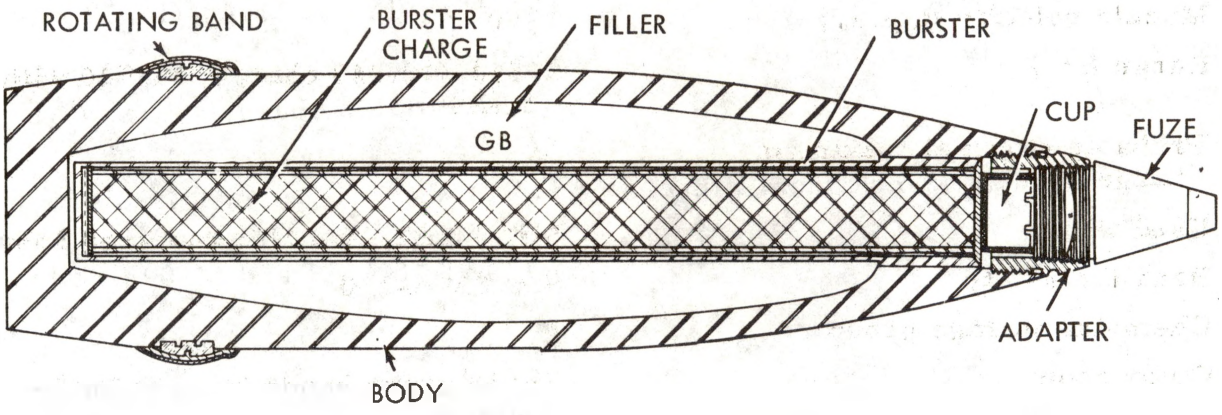

Figure 5-4 Nonpersistent Gas Howitzer Projectile, GB, 155mm, M121A1

PERSISTENT GAS HOWITZER PROJECTILE, VX, 155MM, M121 or M121A1

Assembly drawing	75-14-656
Load drawing	73-1-264
Fired weight (lb.)	101.23 (approx.)
Filler weight (lb.)	6.5
Filling efficiency (pct.)	6.43
Overall length (in.)	27.54, with fuze
Diameter (in.)	6.098
Fuze	PD-M508 or VT-M514A1
Burster	M37 with M15 casing. Composition B, 2.72 lb.
Primer	Mk 2A4
Propelling Charge	M3 (5.50 lb.) or M4A1 (13.19 lb.)
Muzzle velocity (f.p.s.)	1850
Range (m.)	9,850 with M3 charge: 14,955 with M4A1
Probable error at maximum range (m.)	34
Used with	M114A1, M44A1 and M109 howitzer 155mm
Handling safety	See TM 3-250
Chemical storage group	A
Color code	Three green bands on gray background

DESCRIPTION

The Persistent Gas Howitzer Projectile, VX, 155mm, M121 or M121A1, figure 5-5, designed to provide toxic chemical offensive capability. This projectile is a separate-loaded, central burst, VX nerve agent-filled round, which can be used for anti-personnel effects. It is similar to the HE round except for the filling and the burster. The burster casing is one piece, extending the full length of the projectile cavity and is a pressfit into the body. The burster charge, contained in a thin tube, is held in the burster casing by the fuze well cup.

The adapter on the forward end is screwed into the body and is threaded to receive the PD fuze. The body is thin-walled steel with a nose formed to a long ogive. The single rotating band is located about 3.5 inches in front of the base. It is used with M1, M1A1, and M45 howitzers by the U. S. Marine corps. This shell is the same as M121 (GB) except for the agent. The exact operative effects of VX munitions are of a confidential nature and still subject to development.

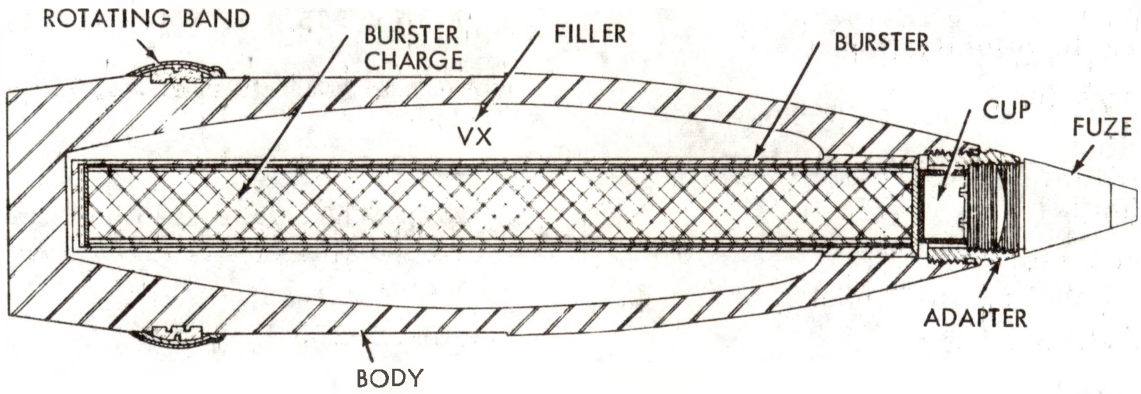

Figure 5-5 Persistent Gas Howitzer Projectile, VX, 155mm, M121 or M121A1

PERSISTENT GAS HOWITZER PROJECTILE, HD, 155MM, M110

Assembly drawing	75-14-317
Load drawing	73-1-179
Fired weight (lb.)	92.5
Filler weight (lb.)	9.7
Filling efficiency (pct.)	10.50
Overall length (in.)	27.54, with fuze
Maximum diameter (in.)	6.098
Fuze	M51A5 (see note)
Burster casing	M1
Burster charge	M6 (0.83 lb.)
Primer	Mk 2A4
Propelling charge	M3 (5.5 lb.) or M4A1 (13.19 lb.)
Cartridge	None
Muzzle velocity (f.p.s.)	1850
Maximum range (m.)	14,920
Used with	M1, M1A1, and M45 howitzer 155mm
Handling safety	See TM 3-250
Note	Other fuze combinations TSQ-M55; MT-M67; or PD-M51A4
Chemical storage group	A
Color code	Two green bands on gray background

DESCRIPTION

The Persistent Gas Howitzer Projectile, HD, 155mm, M110, figure 5-6, is designed to provide toxic chemical offensive capability. The projectile is a separate loaded, central burst gas round used for anti-personnel effects. It is similar to the standard HE round except for the HD, distilled mustard agent filling, burster tube, and burster charge. The burster charge, contained in a thin metal tube, is held in place in the burster casing by a fuze well cup. The forward end of the burster casing is assembled to the adapter in the nose of the round and extends the full length of the projectile. The adapter is threaded to receive a PD fuze. The body is of thin-walled steel with a nose formed to a long ogive. A single rotating band is located about 3.5 inches in front of the base. It is used with M1, M1A1, and M45 155mm howitzers by the U. S. Marine Corps.

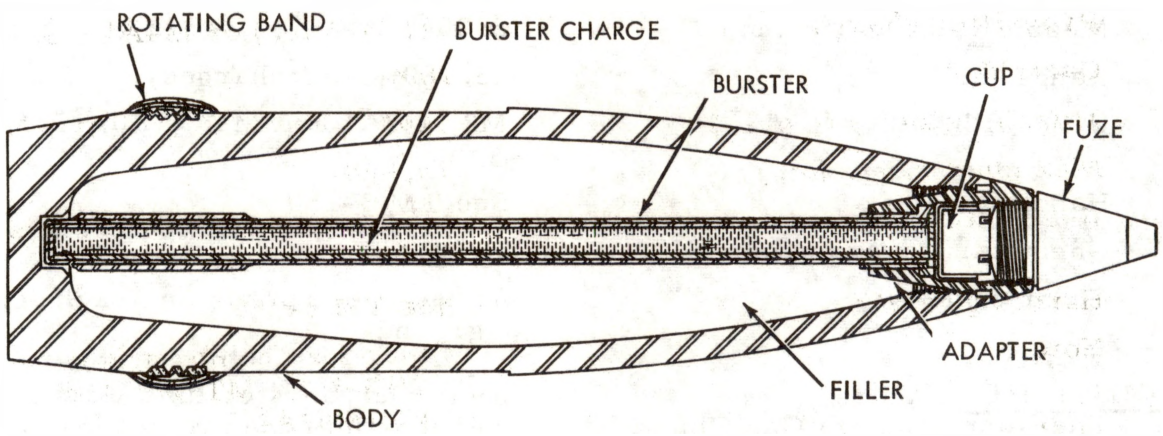

Figure 5-6 Persistent Gas Howitzer Projectile, HD, 155 mm, M110

NONPERSISTENT GAS GUN CARTRIDGE, GB, 155MM, M122

Drawing	75-14-704
Fired weight (lb.)	97.78
Filler weight (lb.)	6.5
Filling efficiency (pct.)	6.65
Overall length (in.)	27.54, with fuze
Maximum diameter (in.)	6.098
Fuze	PD-M508
Primer	Mk 2A4
Burster casing	M16
Burster charge	M37 (4.7 lb. HE)
Propelling charge	M19 (31.60 lb.)
Muzzle velocity (f. p. s.)	2800
Range (m.)	23,480 (supercharged)
Used with	M2, M2A1 and M46 (T80) 155mm. gun
Handling safety	See TM 3-250
Chemical storage group	A
Color code	Three green bands on gray background

DESCRIPTION

The Nonpersistent Gas Gun Cartridge, GB, 155mm. M122, figure 5-7, is designed to provide toxic chemical offensive capability. The projectile is a separate loaded central burst GB nerve agent round similar to the HE round, and is used for anti-personnel effects. There is a 2-inch wide rotating band located near the base of the projectile. An aluminum burster tube extends the full length of the projectile cavity and is supported at the forward end by an adapter, which also holds a PD fuze. The base is boat-tailed. Upon impact the PD fuze ignites the burster charge which explodes the projectile and releases the filling. This projectile is used with 155mm guns M2 or M46 by the U. S. Marine Corps.

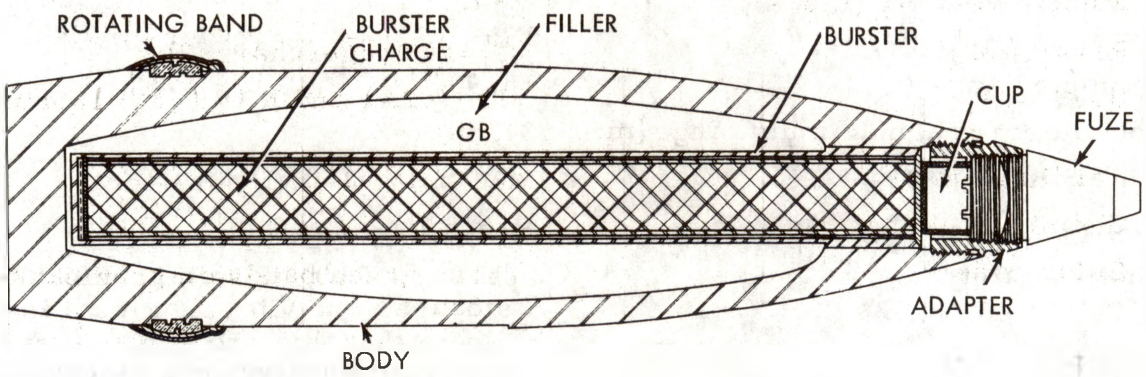

Figure 5-7 Nonpersistent Gas Gun Cartridge, GB, 155mm, M122

NONPERSISTENT GAS HOWITZER PROJECTILE, GB, 8-INCH, M426

Fired weight (lb.)	200
Filler weight (lb.)	15.7
Filling efficiency (pct.)	7.85
Overall length (in.)	35.11, with fuze
Maximum diameter (in.)	7.99
Fuze	PD-M51A5
Primer	Mk 2A4
Burster charge (lb.)	6.95 (composition B)
Supp. charge	0.263 (HE)
Propelling charge	M2 (28.30 lb.) M1 (13.30 lb.)
Maximum rated pressure (p.s.i.)	33,000
Muzzle velocity (f.p.s.)	1950
Maximum range (m.)	16,900
Probable error at maximum range (m.)	37.4
Used with	M2, M2A1 8-inch howitzer
Closure	Press fit
Handling safety	See TM 3-250, Rough handling, storage, and vibration tests indicate that this projectile is safe for normal military handling shipping and storage.
Chemical storage group	A
Color code	Three green bands on gray background

DESCRIPTION

The 8-inch Nonpersistent Gas Howitzer Projectile, GB, M426, figure 5-8, is designed to provide toxic chemical offensive capability. The projectile is a one-piece, separate loaded, central burst gas round for GB nerve agent. It is similar to the HE round in external configuration but has a burster tube, burster charge, and a supplemental charge. the burster tube extends the full length of the cavity and is a press fit. A single rotating band is located about 6.06 inches from the base end and has two cannelures or grooves. The adapter assembled to the nose end is threaded to receive a PD fuze. It is used with the 8-inch M2 or M2A1 8-inch howitzers by the U.S. Marine Corps.

The shell is similar in design to other standard chemical munitions. Firing tables FT-8-J-1 of M106-HE projectile can be used for the M426.

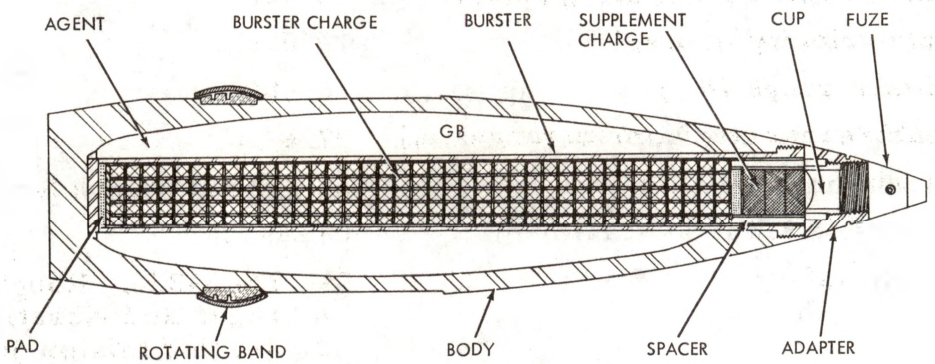

Figure 5-8 Nonpersistent Gas Howitzer Projectile, GB, 8-Inch, M426

PERSISTENT GAS HOWITZER PROJECTILE, VX, 8-INCH, M426

Weight (lb.)	200 (approx.)
Filler weight (lb.)	14.1
Filling efficiency (pct.)	7.05
Overall length (in.)	35.11
Maximum diameter (in.)	7.99
Fuze	PD51A5
Primer	Mk 2A4
Burster	6.95 lb. Composition B
Filler/burster ratio (nom.)	2:1
Burster type	Central bursting
Propelling charge (lb.)	M1 - 13.30 M2 - 28.30
Supplemental charge (lb.)	0.263
Maximum rated pressure (p.s.i.)	33,000
Muzzle velocity (f.p.s.)	1950
Maximum range (m.)	16,900
Probable error at maximum range (m.)	18
Used with	M2, M2A1 8-inch howitzers
Closure	Press fit
Handling safety	Rough handling, vibration, drop and other tests indicate that the T174 is safe for normal military handling and storage. See TM 3-250.
Chemical storage group	A
Color code	Three green bands on gray background

DESCRIPTION

The 8-inch Persistent Gas Howitzer Projectile, VX, M426, figure 5-9, is designed to provide toxic chemical offensive capability. The projectile is a one-piece, separate loaded, central burst gas round for VX nerve agent. It is similar to the HE round in external configuration, but has a burster tube, burster charge, and a supplemental charge. The burster tube extends the full length of the cavity and is a press fit. A single rotating band is located

about 6.06 inches from the base end and has two cannelures or grooves. The adapter assembled to the nose end is threaded to receive a PD or VT fuze. The VT fuze is used for air burst. It is used with M2 or M2A1 8-inch howitzers by the U. S. Marine Corps.

The projectile is similar in design to M106 HE filled munitions. It permits the use of firing table FT-8-J-1 which is used with the HE 106 projectile. It differs from the 8-inch GB projectile only in fuzing. The complete operational effects of this VX-filled projectile have not yet been fully evaluated, and available data is of a confidential nature.

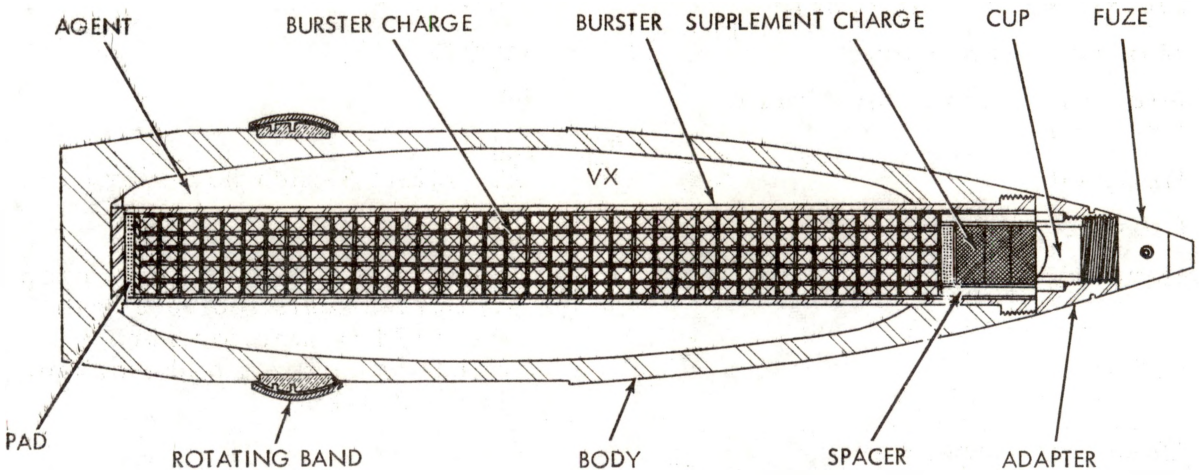

Figure 5-9 Persistent Gas Howitzer Projectile, VX, 8-Inch M426

Chapter 6

CHEMICAL DISPERSERS AND SMOKE GENERATORS

INTRODUCTION

Chemical dispersers are pump or pressure operated mechanisms designed to disseminate chemical agents in dry or liquid form from aircraft or vehicles or by personnel on foot. The disperser covered in this chapter is a hand held type with a pressure supply that can be carried on the user's back. The disperser is designed to provide riot control and training capability.

Smoke generators are devices designed for mounting on the stern of a ship to activate chemical smoke mixtures and release them into the atmosphere in the form of screening smoke curtains to render ships poor targets to opposing gunfire and conceal their movements.

PORTABLE RIOT CONTROL AGENT DISPERSER, M3

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

DESCRIPTION

Portable Riot Control Agent Disperser, M3, figure 6-1, is designed to be carried on the operator's back to disseminate various dry riot control agents through a gun group that controls the flow and directs the agent 40 feet ahead. 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 agent. A pipe and cap assembly is screwed into the top of each agent tank. Each

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 p. s. i. 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 p. s. i. 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 p. s. i.

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 the dry riot control agents previously tabulated, or for training purposes, talc may be substituted.

OPERATION

GENERAL. To operate the disperser, personnel must first don protective masks and M3 gloves, button up collars and cuffs of field clothing, and tuck trouser legs into boot tops. 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.

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 shut-off valve.

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 p. s. i. At least one of the cylinders must have a pressure reading in excess of 1700 p. s. i. 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 p. s. i.
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.

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.

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.

NOTE: 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.

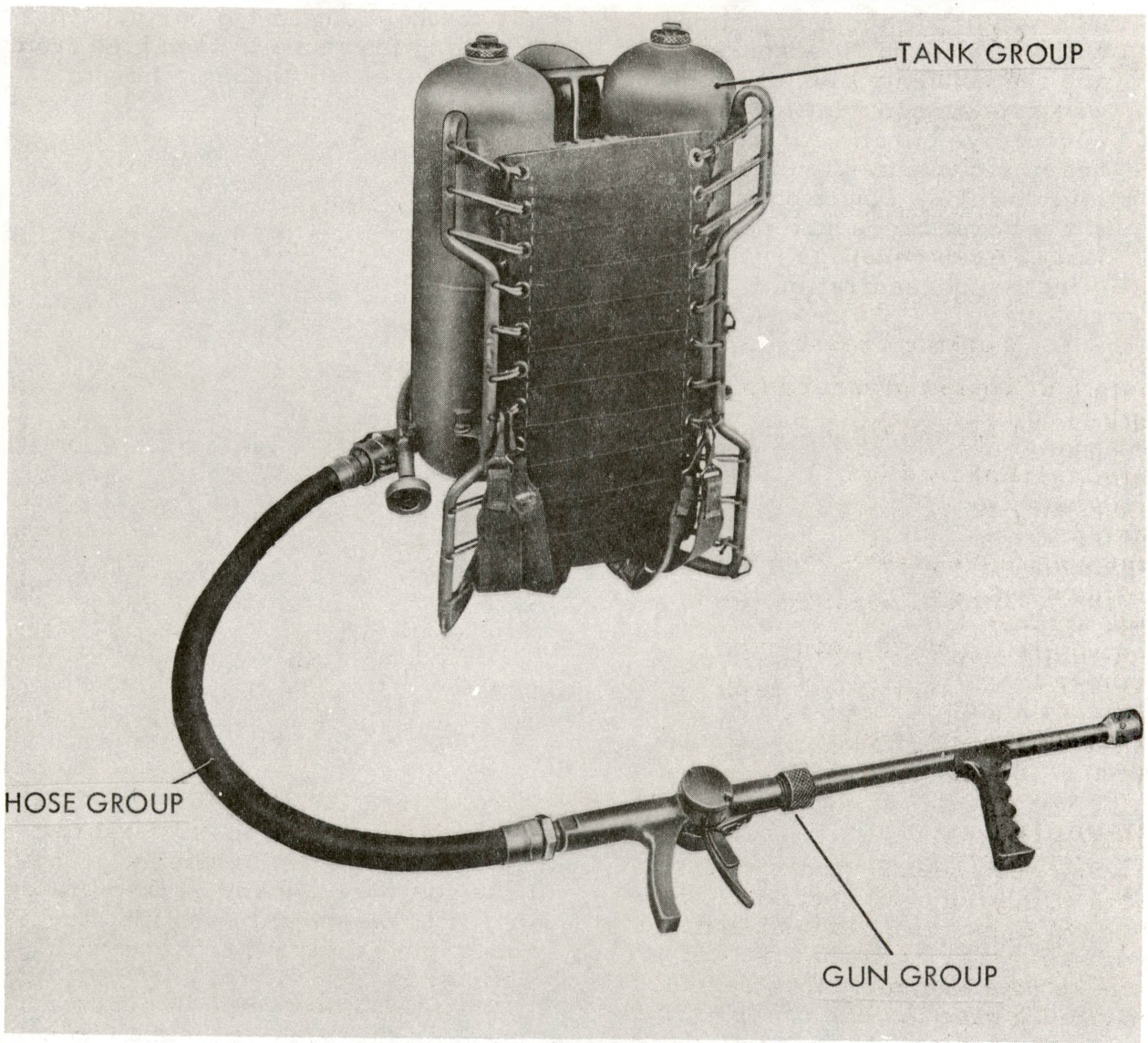

Figure 6-1 Portable Riot Control Agent Disperser, M3

SMOKE SCREEN GENERATOR, MK 6 MOD 0

General arrangement drawing	389078
List of drawings	SK 108772
Length (in.)	56.69
Diameter (in.)	16
Overall height, less pipe (in.)	17.42
Weight (lb.)	
Empty	209
Full	544
Tank	Mk 2 All Mods
Smoke agent	FM (See Appendix A)
Capacity (gal.)	33
Working pressure (p.s.i.)	480
Tested pressure (p.s.i.)	800
FM load (lb.)	310
FM load (gal.)	22
CO_2 load (lb.)	16
Commercial tank designation	ICC 3A480
Tank dimensions (in.)	
Length (less cap)	53.50
Length (with cap)	60
Diameter	14.92
Tank weight empty (lb.)	193

DESCRIPTION

Smoke Screen Generator, Mk 6 Mod 0, figure 6-2, consists of Smoke Screen Generator Tank Mk 2 fitted with a manual control valve and a smoke pipe assembly that operates normally with any one of four different size nozzles. It will also operate without a nozzle. An integral part of the control valve is a dip-tube and valve assembly that extends into the tank and, in effect, converts it into a steel syphon bottle.

The smoke pipe extends from the dip tube and valve and is screwed into place. It consists of a length of pipe with four nozzles and a rubber nipple secured to it by chains. The nipple fits over the end of the smoke pipe, with or without a nozzle, to protect the generator from water when not in use.

When the smoke pipe is not attached, the threads of the exit hole in the dip-tube and valve assembly are protected by a shipping plug.

The generator is mounted on wood cradle blocks bolted to the deck. It is secured by two hold-down straps which are attached to the deck by means of eyebolts, nuts, and washers. The straps are 25 inches apart.

The cradle blocks have deck pads between them and the deck, which can be altered to give the desired camber in athwartship or fore-and-aft mounting. The rear of the tank is braced by a special clamp assembly to prevent rotation of the generator tank. The generator is filled with smoke agent using Navy Filling Equipment Mk 1 Mod 4 which transfers the agent from a 55-gallon drum while the smoke generator is supported in a tilting rack on a 1000-pound platform scale.

Smoke screen density control is determined by the size of the nozzle used. The discharge time varies with the pressure and with the temperature. For example, the discharge time with the No. 5 nozzle (the smallest) is 12 3/4 minutes at 75° F., but it is about 25 minutes at 45° F. In the table of discharge, Table 10-1, rated time versus nozzle size is fairly accurate at a temperature of 75° F., using FM smoke mixture.

Table 6-1

SMOKE GENERATOR DISCHARGE RATES

Nozzle Designation	Rated Time of Discharge (min.)
5	12 3/4
4	8
3	5 3/4
2	3 1/4
Exhaust tube without nozzle	2 1/4

SMOKE SCREEN GENERATOR TANK MK 2 MODS 0, 1, AND 3

The smoke generator tank, which is a component of smoke Screen Generator Mk 6 Mod 0, can be obtained separately as a storage vessel. The tank is a full spun ammonia cylinder with a capacity of 33 gallons, commercially designated as ICC-3A480. The tank has a brass valve with a copper siphon sweated into it with soft solder. The exhaust tube is stainless steel, and the four nozzles are brass. Chained to the exhaust valve is a rubber cap which fits into the end of the tube or onto the end of the nozzles to prevent water from entering the tube when the generator attachments are not in use.

OPERATION

To operate the filled Mk 6 generator, proceed as follows:

1. Put on protective gloves, boots or overshoes, and other protective gear.
2. With the valve closed, remove the rubber nipple from the smoke pipe and screw on the desired nozzle.
3. Replace the rubber nipple over the desired nozzle.
4. Unscrew the transit cap from the tank.
5. Check that the valve is closed; then remove the exit shipping plug.
6. Insert the smoke pipe assembly into the exit hole in the valve with an open-end wrench.
7. Attach the control valve wrench to the valve.

8. Make sure that all personnel are clear of the exhaust area and, by means of the control valve wrench, open the valve.

9. When closing the valve after discharge, do not use force.

10. Replace the rubber nipple over the end of the nozzle.

MAINTENANCE AND STOWAGE

The rubber nipple will provide ample protection for the smoke pipe. It must be replaced on the nozzle after use and kept there whenever the generator is not being used.

The only parts to be serviced are the valve, the smoke pipe, and the nozzles. These parts should be kept clean, and the threads oiled or greased. When time and conditions permit, the smoke pipe should be removed and thoroughly washed and dried. The valve outlet should also be washed. Fresh water is preferred, if available. In cleaning, care should be exercised to prevent damage to the threads and to the flared seat fitting at the connecting end of the smoke pipe. When the smoke pipe is not attached to the valve, and when use of the generator is not contemplated, the exit shipping plug and the transit cap should be replaced to protect the valve.

The generator should be stowed topside and protected from heat and the effects of bad weather.

The instructions given in Appendix A, on FM smoke agent are applicable to individual tanks. The paint on the tank should be kept in good condition to prevent corrosion. The tank should be stowed topside and protected from heat and the effects of bad weather.

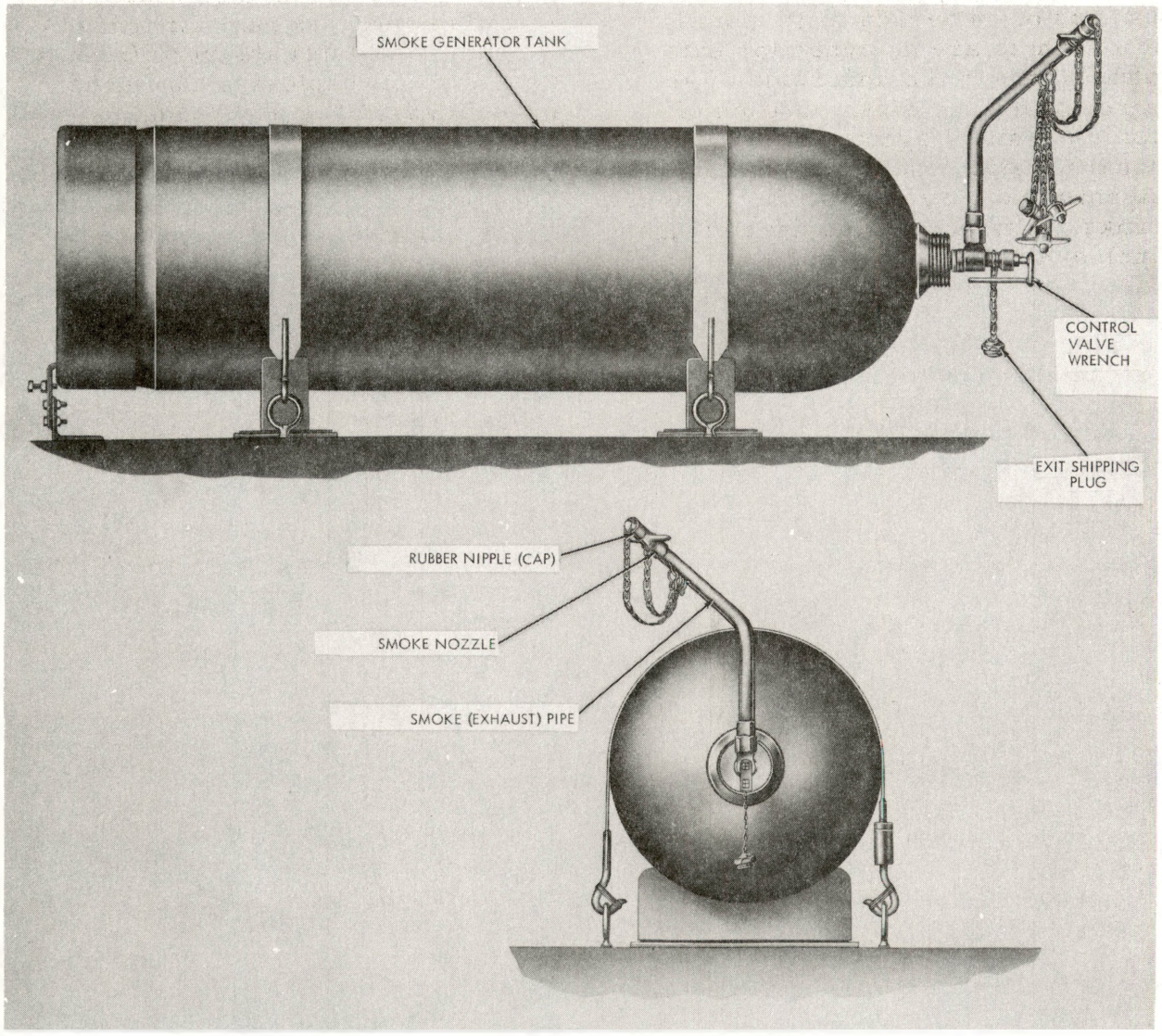

Figure 6-2 Smoke Screen Generator, Mk 6 Mod 0

Chapter 7

CHEMICAL SPRAY TANKS

INTRODUCTION

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 2.

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.

LIQUID AIRCRAFT SPRAY TANK, AERO 14B

Assembly Drawing	BuAer, 54A50E1
Filled weight (lb.)	Up to 1554
Empty weight (lb.)	660
Void (pct.)	10%
Overall length (in.)	190.0
Maximum diameter (in.)	22.0
Agent capacity (gal.)	84
Tank pressure (p. s. i.)	1800
Operating pressure (p. s. i.)	100
Suspension	2 lugs, 30 in. apart
Used with	Aircraft A-1, A-4, and AF-1E
Dispensing rate (g. p. s.)	6 to 20
Shipping weight (lb.)	
Center section container (with spray tank empty)	909
Center section container (with spray tank filled)	1810, max.
Components container	650
Shipping cubage	
Center section container (cu. ft.)	85
Components container (cu. in.)	66
Range	Range of aircraft
Filling unit used	Filling Unit, Chemical Tank, Mk 3 Mod 0

DESCRIPTION

The liquid Aircraft Spray Tank, Aero 14B, figure 7-1, is designed to provide chemical offensive capability as a pressure spray, single fluid, air-to-surface system. The spray tank is a pressure-controlled, combination storage and airborne dispersion medium for various liquid agents such as VX and GB nerve agents.

The major components are nose section, center section, tail section, pressure control system, and the tail pipe assembly. An 1800-p. s. i. tank is located in the nose, and a regulator reduces the tank pressure to 10 p. s. i. for operation. The discharge nozzle is located at the rear of the tail section. Four removable fins are bolted on 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.

Tanks are attached to the underside of the aircraft by two integral lugs spaced 30 inches apart.

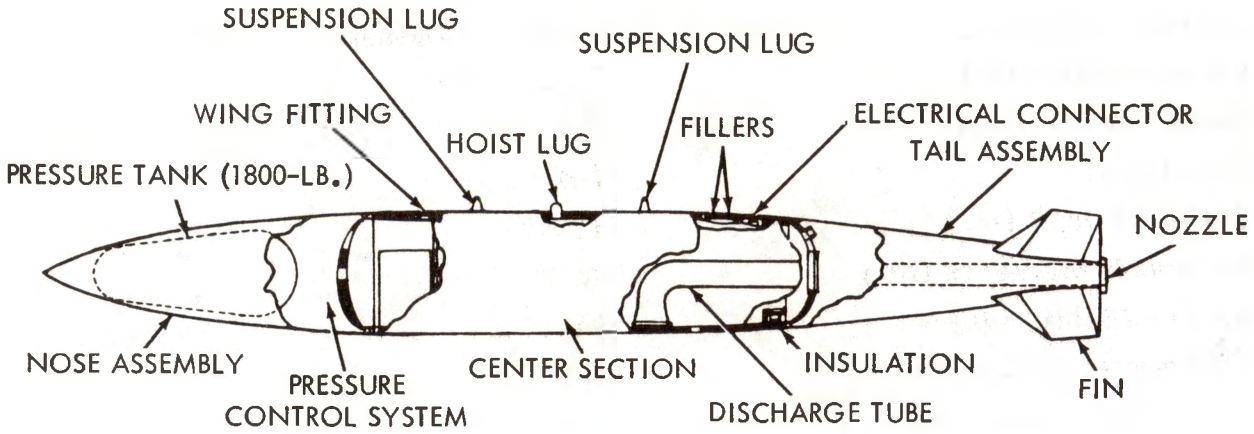

Figure 7-1 Liquid Aircraft Spray Tank, Aero 14B

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.

Six to twenty gallons of liquid per second can be disseminated in continuous or intermittent bursts.

OPERATION

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.

Application, restrictions, and additional information is contained in Operation, Service and Overhaul Instructions with Illustrated Parts Breakdown Handbook, NAVWEPS 11-45-600 (Unclassified), and NAVWEPS 11-45-601 (Secret).

AIRBORNE SPRAY TANK, AERO 15A

Assembly Drawing	BuAer 57A9821
Empty weight (lb.)	111
Filled weight (lb.)	375
Agent weight (lb.)	260
Overall length (in.)	57.75
Maximum diameter (in.)	22.0
Boom length (in.)	26.4
Net agent capacity (gal.)	31
Bottle pressure (p. s. i.)	800 at 70° F.
Operating pressure (p. s. i.)	50
Suspension	2 lugs 14 in. apart
Used with	Helicopter UH-34
Dispensing rate (g. p. m.)	4 to 20
Center of gravity loaded	At station 34.10 inches
Pressure bottle diameter (in.)	15.18
Electrical requirements	27 watts inductive, 24 volts d. c. 37 watts inductive, 28 volts d. c.
Range	Range of aircraft
Control box	
Weight (lb.)	0.75
Height (in.)	3
Width (in.)	5.75
Depth (in.)	2.812

DESCRIPTION

The Airborne Spray Tank, Aero 15A, figure 7-2, is a system designed to disseminate insecticide 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.

The tank 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 p. s. i. on the agent storage reservoir. To disseminate the agent from the tank the pilot activates the spray tank control box switch.

A low pressure gauge is mounted in a cutout in the nose fairing, and

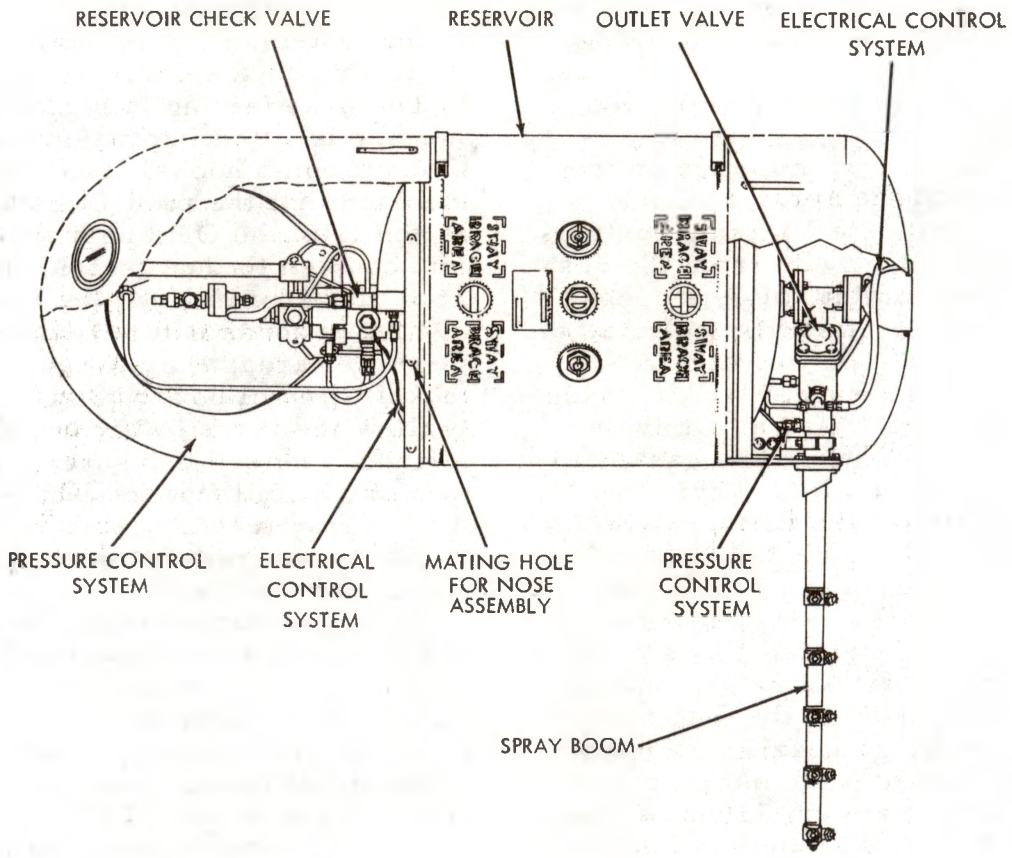

Figure 7-2 Airborne Spray Tank, AERO 15A

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 p. s. i. to expel agent from the reservoir. The relief valve is set at 75 p. s. i. ,

and the rupture disc is set at 110 p. s. i. 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.

OPERATION

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 variables 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 smaller 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.

Applications, restrictions, and additional information are contained in Operation, Service and Overhaul Instructions with Illustrated Parts Breakdown Handbook, NAVWEPS 11-45-602.

AIRCRAFT CHEMICAL TANK MK 12 MOD 0

List of Drawings	LD 546080
Weight empty (lb.)	350
Weight full (lb.)	1000
Length (in.)	108
Outside diameter (in.)	14
Inside Diameter (in.)	12
Agent capacity (gal.)	38 (approx.)
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 in. apart 2 lugs 30 in. 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 (lb.)	583
Shipping cubage (cu. ft.)	39.5
Filling unit used	Filling Unit, Vacuum Chemical, Mk 1 Mod 0
Smoke coverage	1200 foot curtain

DESCRIPTION

The Aircraft Chemical Tank, Mk 12 Mod 0, figure 7-3, is designed to generate smoke screen from aircraft. It provides a chemical smoke agent capability for high performance aircraft. The tank is mounted on wing bomb racks.

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 1/8-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

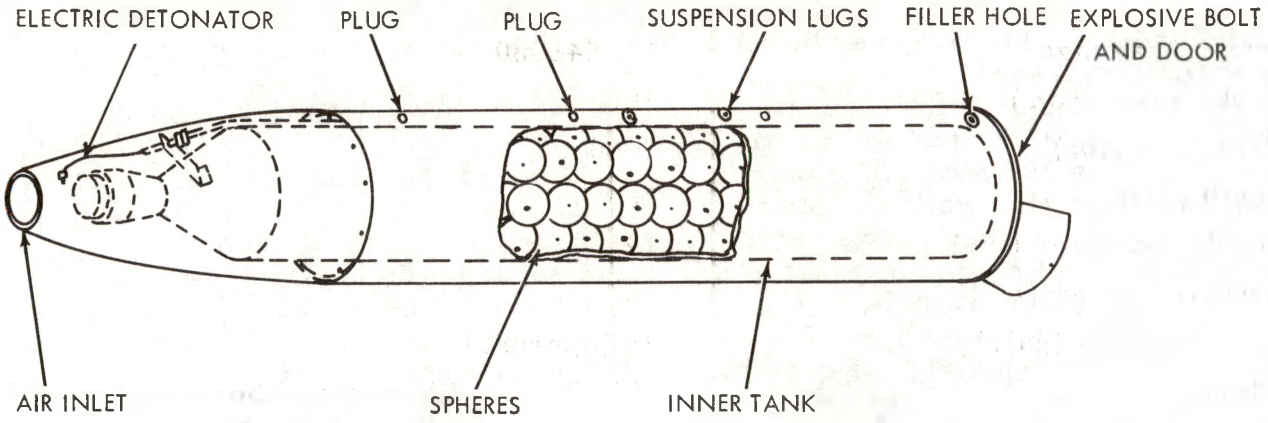

Figure 7-3 Aircraft Chemical Tank, Mk 12 Mod 0

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 fittings 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 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.

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.

Additional information, applications, and restrictions are contained in Operation and Maintenance Instructions with Illustrated Parts Breakdown Handbook, NAVWEPS 11-45-605.

Chapter 8

CHEMICAL AGENT BULK CONTAINERS

INTRODUCTION

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 8-1 is a typical external view of the three bulk containers discussed in this chapter. Figure 8-2 shows the distinguishing characteristics of the three types described. Army publication, TM 3-255, Chemical Filling and Handling Equipment, gives more detailed instructions for filling, venting, and draining 1-ton containers.

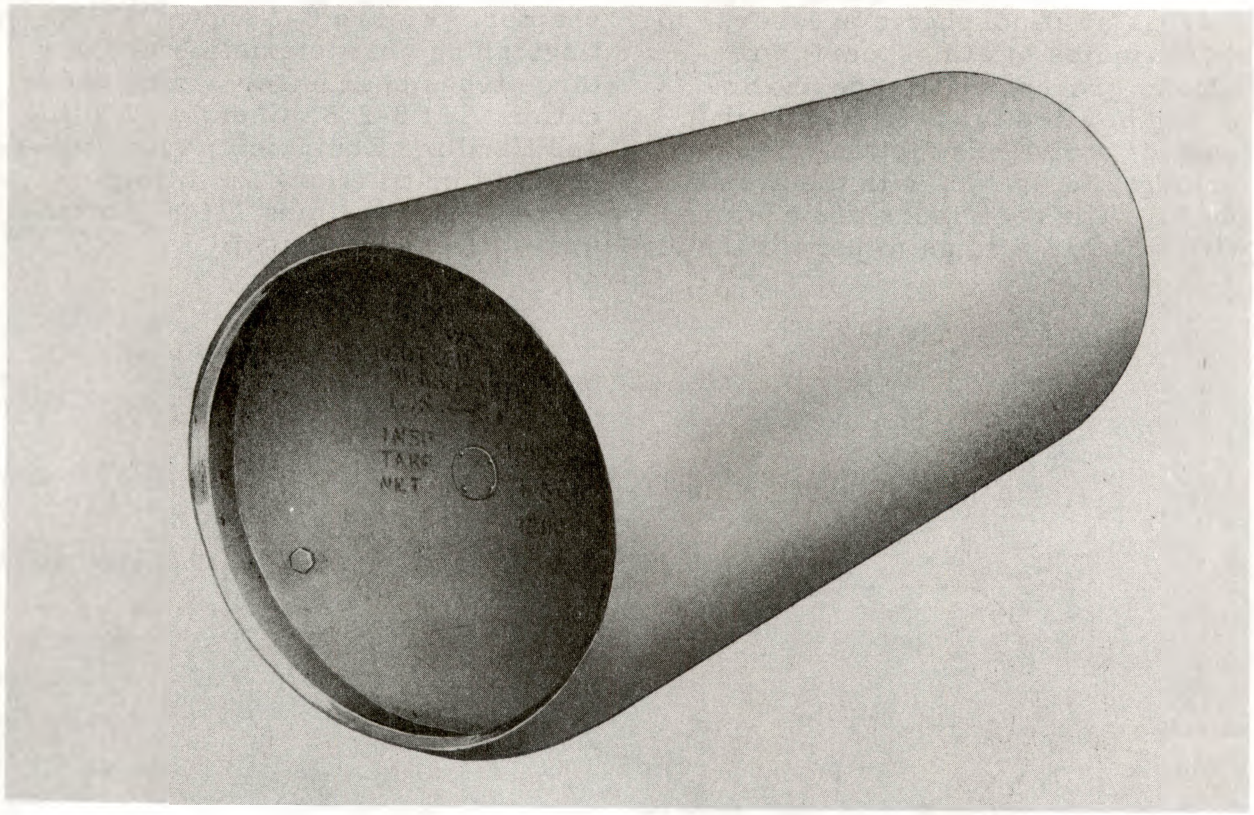

Figure 8-1 1-Ton Container - Typical Types A, D, or E

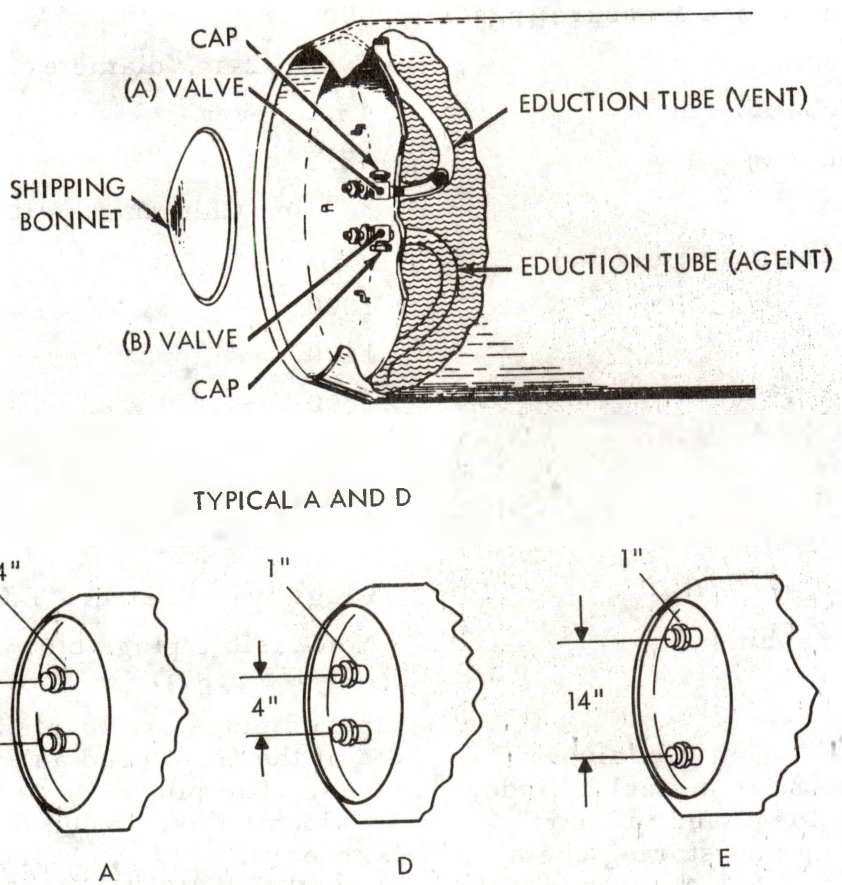

Figure 8-2 Typical Front Head Views, 1 Ton Containers

1 - TON CONTAINER TYPE A

Maximum gross weight (lb.)	3500
Weight empty (lb.)	1600
Length (in.)	81.5
Diameter (in.)	30.5
Wall thickness (in.)	0.406
Capacity (gal.)	170
Maximum internal pressure (p.s.i.)	500
Eduction tubes	Two 1/2-in. diameter, on front
Eduction tube spacing	4 in. apart
Cubage (cu. ft.)	42.7
Valve type	3/4-in. Chlorine Institute type valve
Maximum agent stored (lb.)	
AC	1000
CG	1600
CK	1600
Cl	1600
Use	For agents gaseous at 1 atmosphere
Safety plug limits	
For chlorine	Plugs fusible at 175°F.
For other agents	Non-fusible plugs blowing out at 375 p.s.i.

DESCRIPTION

The Type A 1-Ton Container, figures 8-1, 8-2, is a steel cylinder 81-1/2 inches long used primarily for transporting and storing chemicals that are gaseous at atmospheric pressure. The container can be filled with 170 gallons of agent, provided that the maximum allowable weight of 3,500 pounds is not exceeded. The 13/32-inch side walls can withstand a maximum internal pressure of 500 p.s.i.

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 p.s.i. 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-1 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.

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 alined vertically, and is then chocked to prevent further rolling. When the valves are alined 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.

PRECAUTIONS

GENERAL. 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 throughly familiar with the characteristics of the chemical being handled and the equipment being used. Have first aid supplies and equipment available for instant use. See NAVMED P-5041 for information on treatment of casualties.

PROTECTIVE CLOTHING. See that all personnel handling chemical agents are equipped with protective masks (TM 3-4240-202-15) and protective clothing (TM 3-304).

DECONTAMINATION. Have on hand decontaminating materials and apparatus required for the chemical being handled. See TM 3-220 for information on decontamination.

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 the receptacle is dry, and 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.

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.

VALVE REPLACEMENT

Use an M1 valve replacement mechanism to replace Chlorine Institute valves in a filled type A container when the pressure in the container exceeds 50 p. s. i. The valve replacement mechanism can also be used on the type A container when the pressure is lower than 50 p. s. i. This operation is to be performed by a trained crew. See TM 3-255 for specific instructions.

1-TON CONTAINER TYPE D

Maximum gross weight (lb.)	3500
Weight empty (lb.)	1600
Length (in.)	81.5
Diameter (in.)	30.5
Wall thickness (in.)	0.406
Capacity (gal.)	170
Maximum internal pressure (p.s.i.)	500
Eduction tubes	Two 1-in. diameter, on front
Eduction tube spacing	4 in. apart
Cubage (cu. ft.)	42.7
Valve	1 in. Chlorine Institute type valve, or, 1 in. angle type
Maximum agent stored (lb.)	
Chlorine valve	
AC	1000
CG	1600
CK	1600
Cl	1600
Angle valve	
GB	1600
H	1800
HD	1800
HNI	1800
HT	1800
VX	1500
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 p.s.i.

DESCRIPTION

The Type D 1-Ton Container, figures 8-1, 8-2, is a steel cylinder 81-1/2 inches long used primarily for transporting and storing chemical agents that are either liquid or gaseous at atmospheric pressure. It 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 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 the 1-ton 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 of the front head, and three similar plugs are set in the rear head. Fusible plugs are used for storing chlorine and nonfusible, pressure-ruptured plugs are used for all other chemicals.

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.

1- TON CONTAINER TYPE E

Maximum gross weight (lb.)	3500
Weight empty (lb.)	900
Length (in.)	82.5
Diameter (in.)	30
Wall thickness (in.)	0.281
Capacity (gal.)	170
Maximum internal pressure (p.s.i.)	500
Eduction tubes	Two 1-in. diameter, on front
Eduction tube spacing	14 in. apart
Cubage (cu. ft.)	42.7
Valve	1 in. Chlorine Institute type valve, or, 1 in. angle valve
Maximum agent stored (lb.)	
Chlorine valve	
AC	1000
CG	1600
CK	1600
Cl	1600
Angle valve	
GB	1600
H	1800
HD	1800
HN1	1800
HT	1800
VX	1500
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 p.s.i.

DESCRIPTION

The Type E 1-Ton Container, figures 8-1, 8-2, is a steel cylinder 82-1/2 inches long used as a substitute for either Type A or Type D containers for the storage and transport of gaseous agents or liquid chemical agents. It is approximately the same size as the other two types and has the same capacity. It weighs 900 pounds empty, as compared with the 1600-pound empty weight of the types A and D. The walls are of 9/32-inch thick steel. Protective housings welded to the front and rear ends of the container project beyond the front and rear heads.

FRONT HEAD. 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.

EDUCTION TUBES. Two 1-inch inside-diameter steel eduction tubes extend into the container from the front head.

VALVES. 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.

VALVE-OPEING WRENCH. A valve-opeing wrench is furnished with the type E container.

REAR HEAD. 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.

IDENTIFICATION. The nomenclature of the container, the water capacity in pounds, the serial number, the date the container was tested, and an inspector's stamp are marked on the front rim and on a nameplate fastened to the center of the rear head.

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 is used for removing or replacing angle valves on Type E containers.

Chapter 9

CHEMICAL FILLING EQUIPMENT

INTRODUCTION

This chapter describes equipment required for filling chemical spray tanks with liquid chemical agents. The equipment makes it possible to transfer stored chemical agents from their 1-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.

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VACUUM CHEMICAL FILLING UNIT, MK 1 MOD 0

List of Drawings	LD 586320
Weight (lb.)	110
Length (in.)	33.25
Height (in.)	20
Width (in.)	25.25
Filling time (min.)	10 approximately
Vacuum drawn	28 in. of mercury
Shipping weight (lb.)	225
Shipping cubage (cu. ft.)	20.5
Pump rating	1 h.p., 115 volts a.c., 60 cycles
Frame material	Tubular aluminum
Hose lines	Teflon
Filter limits	10 fillings

DESCRIPTION

Vacuum Chemical Filling Unit, Mk 1 Mod 0, figure 9-1, is an electric motor driven vacuum system designed for filling smoke or toxic spray tanks, in particular for Aircraft Chemical Tank, Mk 12 Mod 0. The filling unit can be used to evacuate air from the Mk 12 tank and fill the evacuated reservoir with smoke agent. The filling unit is also equipped to filter solid particles of foreign matter, gross liquid smoke droplets, and chemical fumes from the air prior to exhausting into the atmosphere.

A 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. The filling unit is portable and is contained within a welded tubular steel frame which both protects the equipment and provides a hand hold for carrying. 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.

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 reservoir provides a volume reserve as well as enabling proper maintenance and testing of the filling units.

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

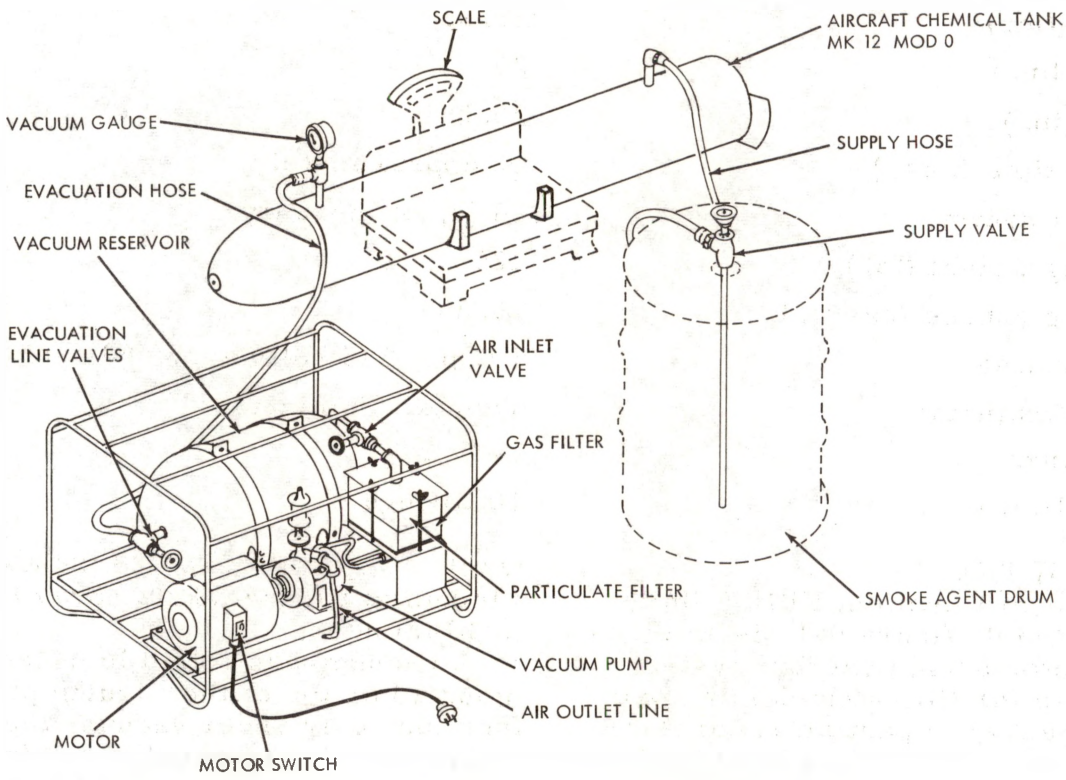

Figure 9-1 Vacuum Chemical Filling Unit, Mk 1 Mod 0

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.

Application, restrictions, and additional information is contained in Operation and Service Instructions with Illustrated Parts Breakdown Handbook NAVWEPS 11-45-606.

CHEMICAL TANK FILLING UNIT, MK 2 MOD 0

List of drawings	LD 539243
Unit weight (lb.)	35
Capacity	1 pint per one-way stroke 1 quart per full cycle stroke 15 g.p.m., approximately
Material	
Pump body	Aluminum
Cylinder line	Stainless steel
Suction, Discharge valves	Stainless steel
Piston	Teflon
Hose	Teflon in stainless steel casing
Hose fitting	Stainless
Filling time (min.)	20 (approx.)

DESCRIPTION

The Chemical Tank Filling Unit, Mk 2 Mod 0, figure 9-2, is a hand-operated piston pump for filling Aero 14B Liquid Aircraft Spray Tank with smoke agent or other agents. The unit consists of a hand-operated piston pump, filling and vapor vent hoses. The hose is of teflon sheathed in flexible stainless steel. The pump is deep anodized aluminum with teflon piston and stainless steel discharge valves. The pump is designed so that it will not explode when FS smoke agent and water are mixed in it, and it is sufficiently durable to withstand the corrosive action of the acid smoke agent. It is of lightweight construction to permit field operation, but can be used for land or carrier based aircraft.

OPERATION

The suction pipe of the filling unit is installed in the threaded bung hole of the 55-gallon drum of agent and screwed tight. The adapter on the output end of the unit is screwed into the filling hole on the Aero 14B spray tank or other disseminating unit to be filled. The pump is operated by hand for approximately 20 minutes until the spray tank is filled. The filling unit pumps 1 quart per full cycle of stroke. The vent hose returns toxic vapors to the 55-gallon drum.

Application and additional information is contained in U.S. Army Technical Instruction TI 664-12.

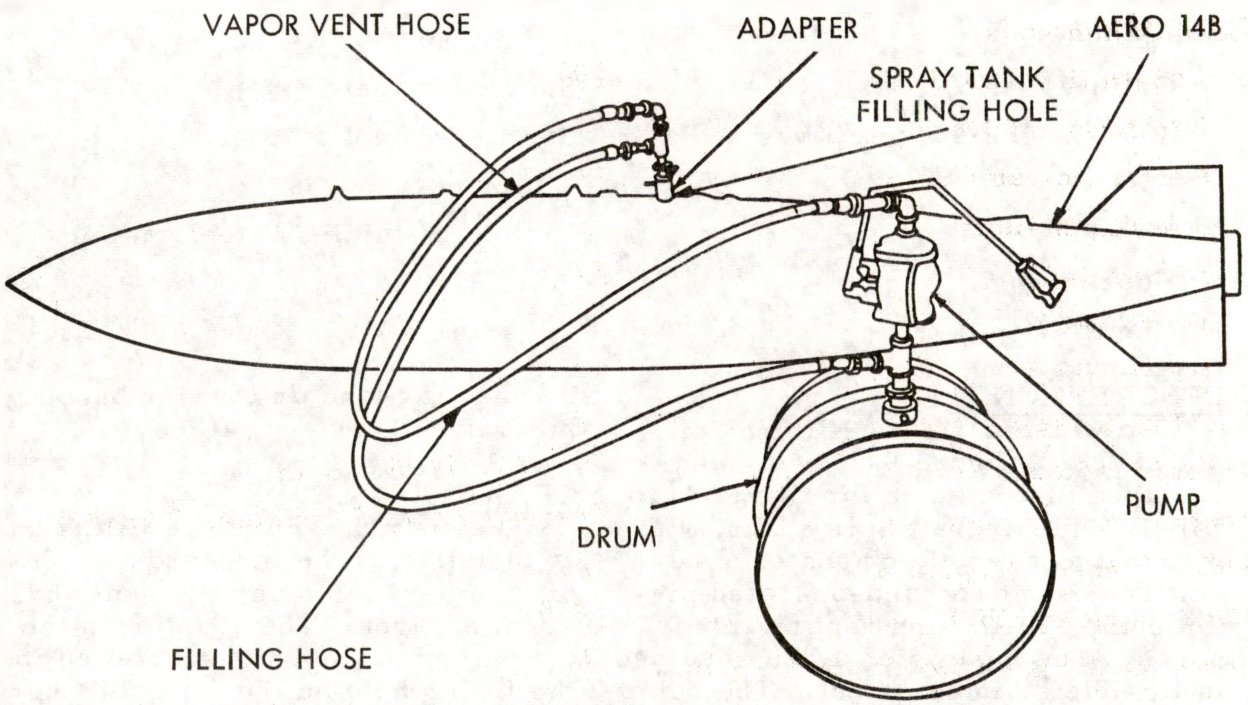

Figure 9-2. Chemical Tank Filling Unit, Mk 2, Mod 0

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CHEMICAL TANK FILLING UNIT, MK 3 MOD 0

List of Drawings	LD 2486429
Reactor dimensions	
Outside diameter (in. approx.)	34
Height (in. approx.)	51.4
Weight (lb. approx.)	1500
Stand dimensions	
Length (in. approx.)	100
Width (in. approx.)	52
Height (in. approx.)	77
Cradle dimensions	
Length (in.)	24
Width (in.)	26
Height (in.)	6
Reactor capacity (gal.)	100
Reactor motor rating	20 h.p., 1800 r.p.m.
Reactor motor input	220-440 volts, 60 cycles, 3 phase
Reactor speed (r.p.m.)	350
Scale capacity (lb.)	3000
Pump motor gear box speed (r.p.m.)	45
Container Pressure	5 to 8 p.s.i. pressure in 1-ton container

DESCRIPTION

The Chemical Tank Filling Unit, Mk 3 Mod 0, figure 9-3, is a portable unit for field-filling the Aero 14B Airborne Spray Tank with either VX, GB, or thickened GB agent. The unit 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 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

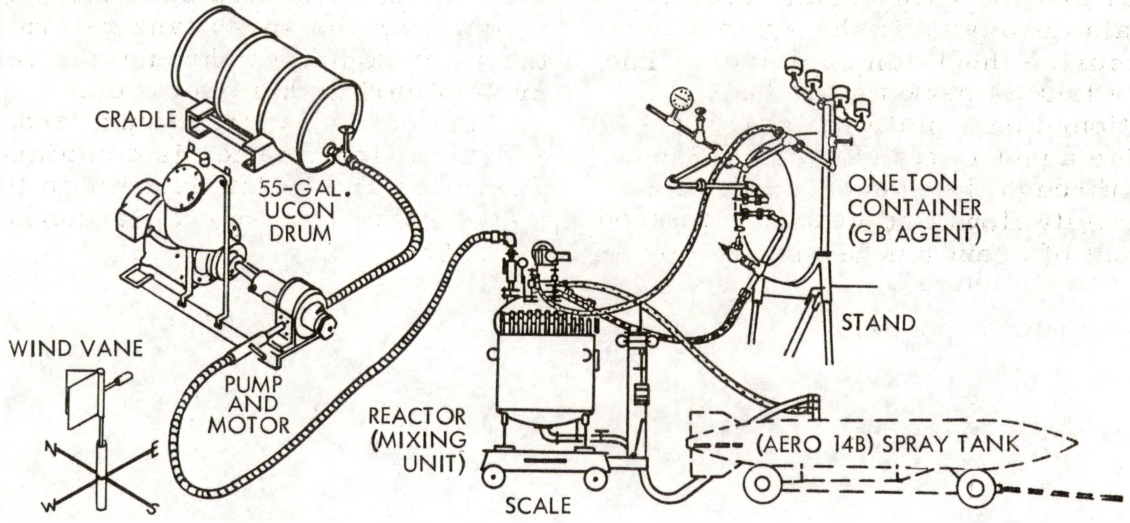

Figure 9-3 Chemical Tank Filling Unit, Mk 3 Mod 0

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 r.p.m. 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 r.p.m. 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 r.p.m. A switch starts and stops operation of the pump.

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 return to the 1-ton container through the vent system during this operation.

Application, restrictions, and additional information is contained in Operation and Maintenance with Illustrated Parts Breakdown Handbook OP 3296.

Chapter 10

TRAINING DEVICES

INTRODUCTION

This chapter describes the instructional devices 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. Two kits used for the distribution of weak concentrations of authentic toxic chemical agents are described in Appendix A. This chapter also contains data on an aerosol dispenser which sprays a simulant biological agent to give personnel training in detecting the presence and growth of a live but harmless biological agent.

CN TRAINING SPRAY GUN MK 1 MOD O

General arrangement drawing	267708
Drawing list	SK 58336
Length (in.)	16.0
Diameter (in.)	2.0
Weight, filled (lb.)	4.0
CN Spray Gun Charging Device	
Mk	1
Mod	0
General arrangement dwg	267713
List of drawings	SK 58337
Flask	CO_2 cylinder ICC-3E
Capacity (cu. in.)	26.5
Capacity (cc.)	420
Lacrimatory solution	CN in $C_2H_3Cl_3$
Amount of solution (cc.)	200
CN (by weight)	1 part
1.1.1. Trichlorethane (by weight)	10 parts
Expellent charge	
Type	Liquid CO_2
Weight (oz.)	5 1/2 to 6 1/2

GENERAL

CN Training Spray Gun Mk 1 Mod O, figure 10-1, 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.

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.

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

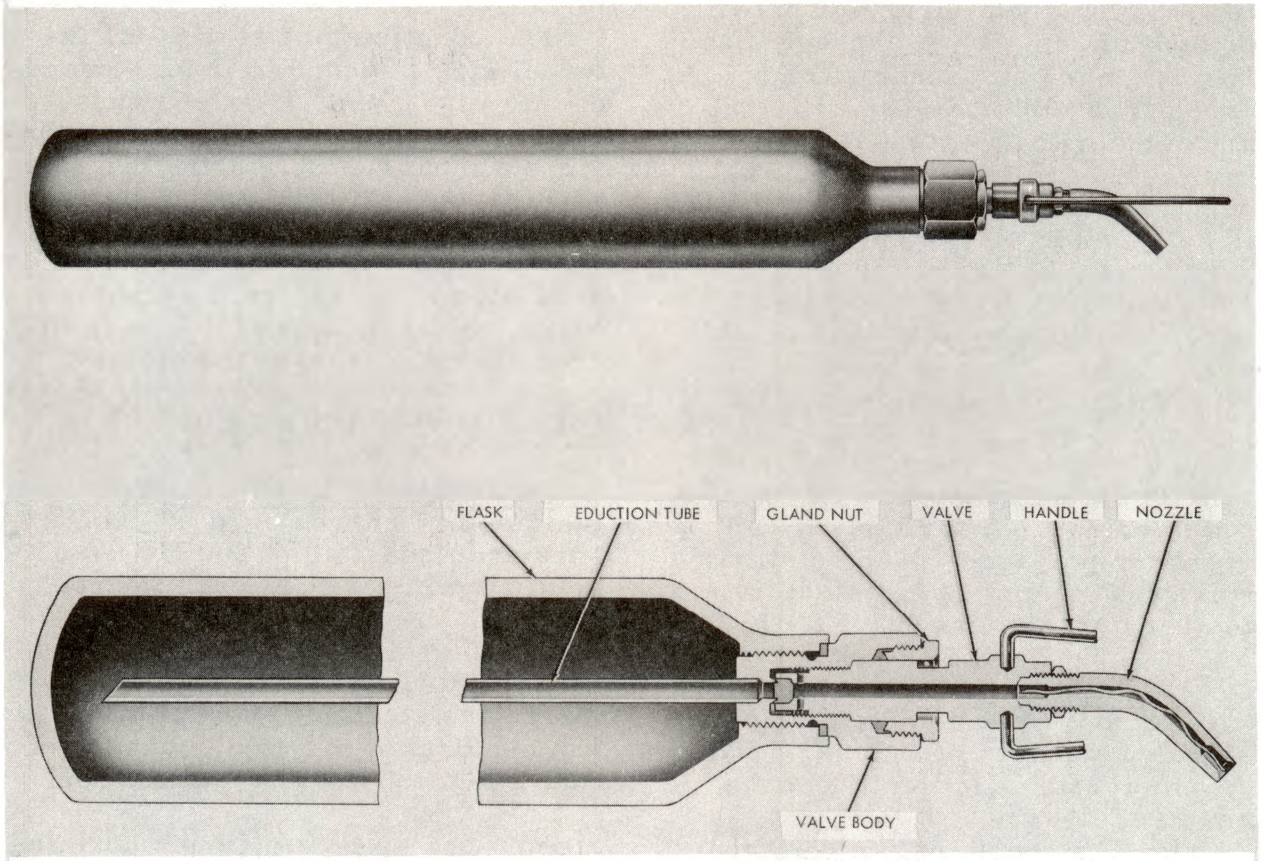

Figure 10-1 CN Training Spray Gun Mk 1 Mod 0

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.

DESCRIPTION

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 (420cc.), 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, has 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.

FILLING THE SPRAY GUN

EQUIPMENT NEEDED. The lacrimatory charge used in this spray gun consists of 200 cc. of a solution of 1 part CN and 10 parts $C_2H_3Cl_3$ (by weight).

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.

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.

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.

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.

PREPARATION OF THE 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. Spilled solution should be wiped up with rags and thrown overboard. 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.

FILLING OF 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.

VACUUM METHOD. This method requires a source of vacuum equivalent to about 25 inches of mercury (12.25 P.S.I.). 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:

Graduated glass measuring cylinder	255 cc.
Beaker	250 cc.
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.

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.

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 CO_2 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 operations 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.

OPERATION

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.

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.

SAFETY PRECAUTIONS

Safety precautions for training devices are presented in chapter 11, along with cautions as to the use of the device near heated boiler surfaces and open flames.

SIMULANT AGENT DISPENSER, BG-1, 12- OUNCE, AN-M1

Weight (oz.)	12
Agent weight (grams)	2
Freon weight (grams)	300
Filled weight (grams)	393
Package data	24 per box
Diameter (in.)	2.87
Internal pressure (p.s.i.)	84.82
Color code	Blue with white lettering
Void (pct.)	20%
Organism size	0.7 to 0.8 by 2 to 3 micron rods
Spore size	0.6 to 0.9 micron
Valve orifice (in.)	0.016
Status	Std. -A USA; USN available

DESCRIPTION

The Simulant Agent Dispenser, BG-1, 12- Ounce, AN-M1, figure 10-2, is a commercial insecticide aerosol bomb-type container filled with live biological agents suspended in Freon. It is designed to provide training in contamination and detection and to provide an evaluation of trainees' efforts to decontaminate. 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.

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

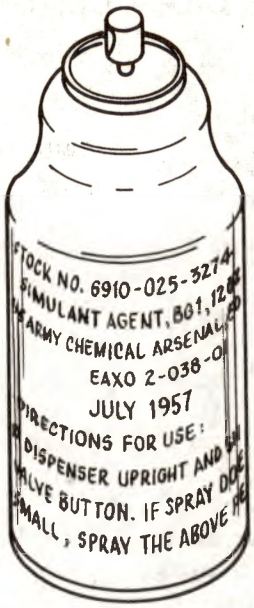

Figure 10-2 Simulant Agent Disperser, BG-1, 12-Ounce, AN-M1

students are to perform the decontamination exercises.

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.

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.

CAPSULE, CN

Specification	MIL-C-10777
Federal Stock Number	1365-277-3049
Package data	50 per can
	25 cans per box
	16 lb. per box
Capsule size	00

The CN Capsule, figure 10-3, 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. The capsule is a number 00 pharmaceutical type gelatin capsule filled with approximately one gram of CN, or chloroacetophenone. The 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.

This capsule will gradually be replaced by a plastic wrapped CN Pellet, M2, of 93 percent CN and 7 percent zinc oxide binder, with a weight of 1 gram. The CN pellet has the Federal Stock Number 1365-383-3909, specification MIL-P-14240.

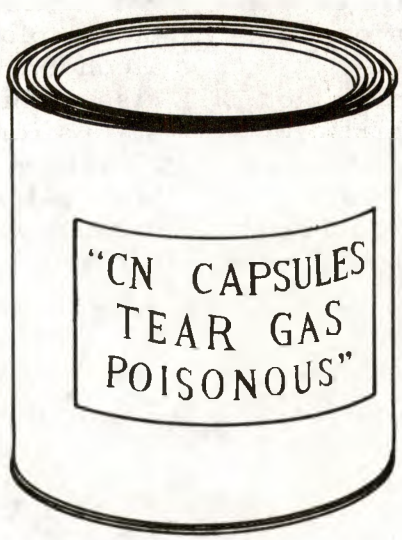

Figure 10-3 Capsule, CN

CS CHEMICAL AGENT CAPSULE

Specification	MIL-C-51015A
Federal stock number	1365-690-6656
Weight (grams)	1 ± 0.1
Composition (pct.) CS	100
Package data	50 per can
	5 cans per fiberboard box
	5 boxes per wood box
Shipping cubage (cu. ft.)	1.0
Shipping weight (lb.)	49
Capsule size	00

The CS Chemical Agent Capsule, figure 10-4, is a training item designed to familiarize personnel with the effects of CS riot control agent, a powerful tear and cough 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.

The capsule is a number 00 pharmaceutical type gelatin capsule filled with one grain of CS, or chlorobenzalmalononitrile. The 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.

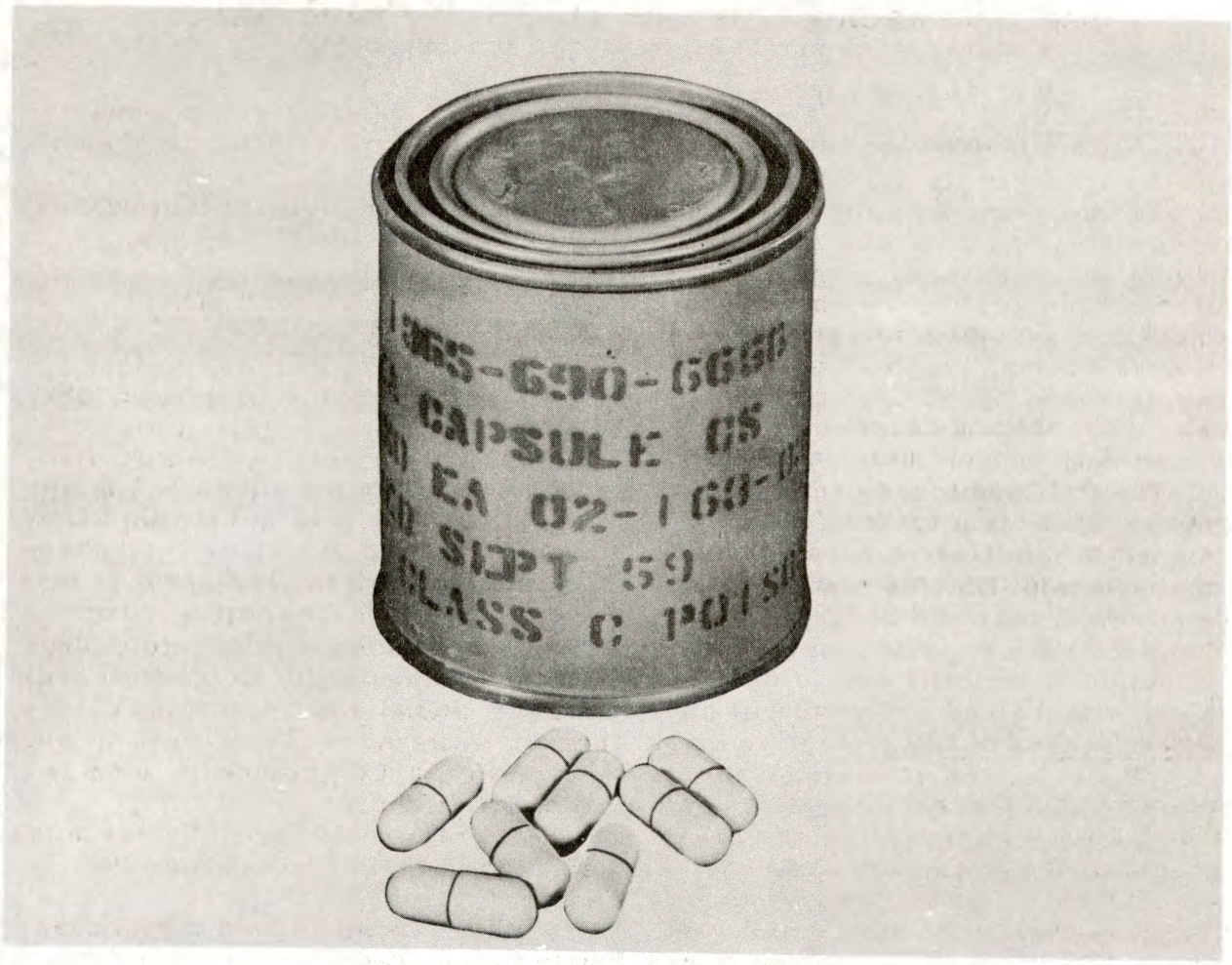

Figure 10-4 CS Chemical Agent Capsule

Chapter 11

SAFETY PRECAUTIONS AND DISPOSAL INSTRUCTIONS

INTRODUCTION

This chapter contains safety precautions required in handling liquid and gaseous chemical agents in bulk quantities and certain specific types of chemical munitions. General precautions for storage, shipment, and handling of munitions are presented. Disposal instructions for smoke and toxic chemical munitions are included. Storage instructions for the wide variety of riot agents are presented with the description of the agent itself in chapter 2. The other agents in regular use have a decontamination and first aid section following each specific listing in chapter 2.

CHEMICAL AGENT STORAGE GROUP CLASSIFICATIONS

Chemical agents are classified tactically into several groups: toxic chemical (casualty) agents, irritant (riot control) agents, smokes, and incendiaries. Chemical agents and hazardous chemicals having similar storage and shipment characteristics are grouped together as follows:

1. Group A. This group includes all chemical agents for which protective clothing and protective mask are required, such as blister and nerve agents.

2. Group B. This group includes all toxic chemical agents for which the protective mask alone is required, as well as nonburning screening smokes and nonburning mixtures of irritant agent.

3. Group C. This group consists of spontaneously flammable agents, white phosphorus, and plasticized white phosphorus.

4. Group D. This group consists of readily flammable materials such as incendiaries, oils, solvents, and micropulverized, burning type riot agents.

SAFETY PRECAUTIONS FOR CHEMICAL GRENADES

When using any of the chemical grenades described in chapter 3, 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.

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. When using chemical grenades for training, keep equipment for fighting fires handy, since grenades may start fires in underbrush and fields.

6. If the lever or arming sleeve of a grenade is released accidentally or comes off in handling, throw the grenade and take cover. If the grenade is dropped, persons endangered should drop flat on the ground and cover faces and heads. Make no attempt to pick up activated grenades.

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.

SAFETY PRECAUTIONS FOR TRAINING DEVICES

Observe the following precautions in the use of CN Training Spray Gun Mk 1 Mod 0, described in chapter 10:

1. When using the spray gun, do not refill or recharge a flask without first ascertaining whether or not it is empty. If for any reason the CO_2 has escaped and the carbon tetrachloride evaporated from the solution, the valve assembly should be removed by unscrewing the valve body from the flask and the solidified CN should be removed with a sharp tool, taking care not to puncture or damage the flask.

2. Under no circumstances should a flask be subjected to a vacuum before its contents have been completely exhausted.

3. Do not use the lacrimatory solution in CN Training Spray Gun Mk 1 Mod 0 against open flames, hot boiler fronts, or uninsulated steam pipes. Do not use lacrimatory solutions containing carbon tetrachloride aboard ships. The carbon tetrachloride, if present, may break down into gases which are poisonous.

4. Prepare the lacrimatory solution or fill the flasks in a hood or other well-ventilated place. Otherwise, a suitable location out of doors will suffice.

5. Remove spilled solution from the skin with a cloth wet with a decontaminant solution composed of 5 percent NaOH, 20 percent H_2O, and 75 percent carbitol, all by weight. Follow with a liberal application of soap and water.

6. Personnel getting CN in the eyes should be given first aid by having them face into the wind with the eyes open until some relief is obtained. The eyes should then be flushed with copious amounts of water or a 2-percent boric acid solution prior to seeking medical attention.

7. Do not aim the spray from CN Training Spray Gun Mk 1 Mod 0 toward the faces of any personnel.

8. Protective masks should be available at all times, and should be worn when the concentration of CN solution or carbon tetrachloride vapors is noticeable.

SAFETY PRECAUTIONS FOR FIGHTING FIRES IN CHEMICAL MUNITIONS

1. Fires in group A and B storage areas require the evacuation of all personnel not necessary to combat the blaze. Fire fighters should confine their efforts to preventing fires from spreading. Personnel should be evacuated upwind, of fires.

2. If a fire involves or threatens buildings in which FS is stored, all persons within the danger zone shall be notified to vacate until all danger is passed.

3. Fires in magazines containing FS shall not be fought.

4. Outside storage areas containing group C munitions fitted with

fuze or burster and packed in containers should be abandoned if the fire cannot be controlled by remotely operated equipment. Fires in magazines shall not be fought.

5. Personnel with portable extinguishers should not be permitted in magazines containing Group C munitions after a fire gains headway, unless they are equipped with lifelines to prevent them from becoming lost in smoke while combatting the flames.

6. Use fog nozzles on fire hose. If fog nozzles are not available, use the lowest water pressure that will be effective, since a high velocity stream of water tends to spread the fire.

7. Fire fighters in areas containing group D munitions should confine their efforts to preventing fires from spreading in magazine or storage areas. Fires in magazines shall not be fought. Fires of HC mixture must be deluged with water, since small volumes of water are ineffective and may increase the fire. Fires among group D munitions may be smothered by sand in their early stages. Foam is effective against some Group D munitions fires.

SAFETY MEASURES, LIQUID AND VAPOR AGENT CONTAMINATION

GENERAL

Storage areas for blister agents and nerve agents should be separate from each other and from storage areas of all other chemical agents. (See TM-3-250.) The storage area for nerve agents should be enclosed by cyclone type fencing if practicable and should always be well guarded. The following safety measures should be observed:

1. Dangerous areas should be placarded with suitable signs and warnings.

2. A suitable nerve-agent-alarm system should be established to warn of the presence of toxic vapors.

3. Parking areas for vehicles should be designated upwind of the prevailing wind direction.

4. Sanitary facilities and showers should be provided upwind of the prevailing wind direction.

5. Decontamination points and clothing exchanges should be conveniently located upwind of the prevailing wind direction. Emergency decontamination points should be located within the storage area; these should provide water and soap. Arrangements should be made for decontamination and reimpregnation of contaminated protective clothing.

6. Proper permeable protective clothing should be worn when handling HD. Impermeable protective clothing should be worn when handling nerve agents. Protective masks should be worn when handling choking and blood agents.

7. Decontaminating material and equipment should be conveniently located at points around the storage area.

8. A suitable area should be designated for disposal of chemical agents and contaminated containers that cannot be salvaged.

9. A suitable reserve of protective masks, filter elements and canisters, clothing, decontaminants and first aid supplies should be established for use in emergencies.

10. Personnel should be checked before entering the storage area to ensure that they are wearing the appropriate protective clothing and equipment. See TM 3-4240-202-15 and TM 3-304.

NERVE AGENT VAPOR PRECAUTIONS

Nerve agents present a serious vapor hazard to personnel in addition

to their liquid contamination hazard. The following safety measures should be observed:

1. A sufficient number of detection devices should be employed to reveal any escaped nerve agent vapor within the storage area. The devices should be placed strategically around the storage area at 1/4 - to 1/2 mile radius so that the downwind hazard may be evaluated. The automatic alarms constantly sample air and give audible and visual signals when a nerve agent is present in the air at concentrations above the limits for which the alarm has been set. The automatic detector is a more certain method of air sampling than the observation of confined rabbits, pigeons, or canary birds for signs of disability or death. Pin-pointing of the animals' eyes is a sign of escaping nerve agent.

2. Personnel should not be permitted to enter the nerve-agent storage area alone, nor should be left alone while working. Personnel having cuts and abrasions should be checked by medical personnel to ensure that these injuries are satisfactorily covered before they are permitted to work in the area. Immediately upon completion of daily duty, personnel should be given a physical check by a qualified technician to determine whether or not pupillary contraction or any other symptom of nerve agent poisoning exists. Showers or baths should then be required, followed by a change of clothing. If nerve agent symptoms are discovered, the subject should be immediately referred to a physician. It is also suggested that another check be made about 2 hours after the first check for late development of symptoms from low level exposure.

3. Personnel should be checked for proper impermeable protective clothing (as specified in TM 3-304) and first aid equipment when entering the area. Exposure should be restricted to the minimum number of persons for the minimum time. Periodic check on the exposure of canisters in protective masks should be performed and a record kept in accordance with FM 21-40. Wind vanes should be kept in storage areas out of doors. No eating, drinking or smoking should be permitted in storage areas.

STORAGE AND HANDLING OF LIQUID AGENTS, GROUP A

GENERAL

Group A chemical agents are very dangerous. Their effects on personnel may be noticeable within a few minutes in the case of nerve agents. Immediate first aid, followed by prompt medical treatment is necessary. Group A chemical agent handling requires protective masks and protective clothing.

In filling a container, leave sufficient void to allow for expansion of the agent. One-ton containers are filled to a maximum of 170 gallons (total capacity is 190 gallons), which allows about a 10-percent void. Similarly, 55-gallon drums are filled with 50 gallons of liquid.

HD BLISTER AGENT. HD is stable in containers at temperature under 252° F., and has no action on metals. It is usually a liquid in temperate climates. It is normally stored in 1-ton containers. The valves on each container should be in horizontal alignment to prevent sludge from clogging the lower eduction tube.

The ICC classification of HD is "Extremely Dangerous Poison, Class A". Shipments must be labeled as poison gas, DA Label 69. Leakage of HD is detected by its odor, which is like garlic or horseradish, or by the use of detector paper, crayon or chemical agent detector kit. Routine inspection should be made for leaks, breaks or other defects in containers.

Pressure testing and venting of containers should be performed every 6 months or more frequently in tropic or desert conditions.

HD can become polymerized or "sick" in storage; this condition can be detected during venting if it is observed that a pint of liquid flows before any vapor rises from the slurry bucket under the improvised venting pipe.

GB, VX NERVE AGENT. Nerve agents are highly toxic and must be separated from other Group A agents. When personnel are working in areas where these agents are stored in 1-ton containers, either one 400-gallon power-driven decontaminating apparatus, or two 200-gallon decontaminating units must be present and filled with a 10-percent caustic solution. Two 55-gallon drums, one filled with 5-percent sodium carbonate solution and one filled with clear water, must also be available for personnel decontamination. The ICC shipping classification of GB and VX are "Extremely Dangerous Poison, Class A" and shipping containers must be properly labeled with DA Label 69. The agents are odorless and can be detected by the use of a chemical agent detector kit, automatic alarms and pigeons, canaries and rabbits.

STORAGE AND HANDLING OF LIQUID AGENTS, GROUP B

GENERAL

Group B chemical agents can be gaseous toxic chemicals for which the protective mask is sufficient precaution or nonburning smoke agents such as FS, or burning mixtures of irritant agents in solution, or in micropulverized solid form. Some of the agents stored under high pressure present storage and shipping dangers because of internal pressures which can cause containers to rupture or explode.

PRESSURIZED STORAGE. Containers with agents of high volatility under high pressure must not come in contact with fire, sparks or electrical circuits, any one of which could cause an explosion. They should not be stored with group D flammable burning mixtures nor near such flammables as oils, gasoline, and waste. Containers of chemical agents should not be used as rollers or supports, or for any purpose other than storage. Valves must be opened slowly with the prescribed wrench or tool. Valves should be slowly and carefully cracked before opening fully. The 1-ton container should not be exposed to the hot sun. Shaded areas, sheds or underground storage areas should be used to protect unstable chemical agents such as CK. Surveillance measures for Group B agents vary with the agent. CK, for example, requires periodic sampling. All agents call for routine check for leakage, breaks and other defects in valves.

CG, PHOSGENE. Phosgene is stable in dry steel containers but corrodes wet metals vigorously. The ICC classification of phosgene is "Extremely Dangerous Poison, Class A", and must be labeled as poison gas, DA label 69. Leakage may be detected by the fresh hay odor. Fumes from a bottle of ammonia will cause invisible phosgene vapors to form white fumes. Test papers and test kits can detect concentrations in the air. Normal storage and surveillance routines apply.

CK BLOOD AGENT. CK is stable when stored in 1-ton steel containers and stabilized with 5 percent by weight anhydrous tetrasodium-pyrophosphate. It is slowly hydrolized by water. When deteriorated to a certain stage, CK may explode with great violence. It is not a fire hazard, but should not be stored near gasoline or oil. The ICC classification of

cyanogen chloride is "Extremely Dangerous Poison, Class A." DA label 69 is required. CK is detectable by a chemical paper kit, although eye and respiratory irritation are signs of escaped agent. Routine storage and surveillance measures apply. A SNVR (soluble nonvolatile residual test) is the most conclusive indication of CK deterioration.

FS SMOKE AGENT. FS consists of about 55 percent sulfur trioxide dissolved in 45 percent chlorosulfonic acid, by weight. FS is stable when stored in dry metal drums. It vigorously corrodes metals in the presence of moisture. When in contact with water it reacts violently, generating large quantities of smoke. It must be stored away from flamables. It is not a fire hazard itself, but can cause fires by coming in contact with other materials. The ICC classification is "Corrosive Liquid", and calls for DA Label 13, "Caution - Acid - Do Not Drop". FS has a strong, acrid odor and produces quantities of dense white smoke. Only a high concentration calls for a protective mask. Personnel handling FS should wear protective goggles, rubber gloves, aprons with sleeves, and boots. Storage containers should be washed with a decontaminating solution and then thoroughly washed with water. Routine surveillance measures apply. When FS is spilled, destroy it by repeated dousing with water, taking care to avoid injury from droplets that are likely to be scattered by the violent reaction with water. Never allow a small amount of water to contact a large amount of FS mixture. If any liquid FS comes into contact with any part of the body, wipe it off immediately and wash the body with an abundance of water, then rewash with a weak solution of bicarbonate of soda, or ammonia in water. Remove contaminated clothing before washing the body with water.

FS STORAGE. FS is stowed in 55-gallon steel drums. It is stable inside these drums, where it is concentrated, but fumes leaking out past the bunghole plugs will react with moisture in the air to form a corrosive mist that will eat away the outside of the drums.

The drums should be painted on the outside with an acid-proof and weatherproof paint. They should be stowed in well-ventilated magazines ashore. (Outdoor stowage is permissible if the outer surfaces of the drums are kept well painted.) They should be kept on racks at least 4 to 6 inches off the ground or the floor, because FS vapors are heavy and hug the ground.

Aboard ship the drums should be stowed topside only, but they must be protected from the sun and from salt water spray. They must be constantly inspected for signs of corrosion, leakage, and paint deterioration.

The drums should be vented when they have been subjected to direct sunlight or abnormally high temperatures for a protracted period of time. They must also be vented when actually bulging because of pressure (this calls for extreme caution on the part of personnel doing the venting), or when the drums are to be opened. When venting is necessary, the drums to be vented should be removed from the place of stowage to prevent contamination of the remaining drums. When it is desired to open FS drums, they should be removed far enough from the place of stowage so that the corrosive vapors released when the plug is removed will not be able to contaminate the other drums.

When a drum begins to leak, the FS should be transferred to any empty nonleaking drum. If no suitable empty drums are available, the leaking drum should be disposed of

in order to avoid corrosion of the other drums.

DISPOSAL INSTRUCTIONS

This publication does not constitute authority for the disposal of chemical munitions or components by dumping, burning, detonating, sale, scrapping, or any other means, except in any emergency when in the Commanding Officer's opinion immediate action is necessary to prevent injury, loss of life, or damage to property or equipment.

Normally, unserviceable or defective ammunition is turned in to a shore establishment in accordance with prevailing munition instructions.

However, when circumstances dictate and ammunition must be jettisoned, the appropriate provisions of OP 5 and NAVORD Instruction 8026.1 of 12 April 1963, Procedures for Disposal of Ammunition by Dumping in Deep Water, apply. Chemical munitions, exclusive of pyrotechnics, must be dumped in deep water over 1000 fathoms in depth and at least 10 miles from shore, and packaging to acquire negative buoyancy must be assured. The package to be disposed of must have a minimum unit weight of 94 pounds per cubic foot. These criteria constitute procedure for planned disposal by dumping. Instructions may arise from ship or fleet operations that require deviation from the above; however, such deviation must be authorized by the Commanding Officer or his authorized representative.

OP 5 and Chemical Corps directive 385-17 give disposal instructions for shore activities.

To prevent chemical filled bombs stored ashore from being captured by an enemy, the bombs should be evacuated, if possible, when there is no opportunity for deep water dumping. If evacuation is impossible, munitions filled with toxic agents will not be destroyed without specific authority, since their destruction will contaminate the area; and if toxic agents have not been used in the theatre, such action may provide an enemy with the basis of a claim that toxic chemical operations have been initiated by our forces. Fuzes should be destroyed, if possible. However, chemical weapons may be abandoned as a last resort if their use by an enemy is considered unlikely.

SHIPMENT AND STORAGE OF CHEMICAL FILLED BOMBS AND PROJECTILES

Chemical filled bombs and projectiles are stored within the continental United States under stringent safety rules. In theatres of operation, safety requirements are of high importance but are tempered to suit the tactical situation. Bombs are usually stored in buildings constructed for the purpose. Outside the continental United States, bombs are stored in open stacks when buildings are not available.

Quantity-distance tables specify what quantities of ammunition may be stored at stated distances from inhabited buildings, railways and public highways, and establish separating distances between magazines and operating buildings containing specified quantities of explosive and ammunition.

Table 11-1 is a quantity-distance table for class 2 chemical bombs. Ammunition and explosives are further classified into 17 lettered storage - compatibility groups.

All chemical bombs are either in class 2, 4 or 11. Bombs in chemical storage compatibility groups C and D when not assembled with explosive components are in class 2.

Bombs of all chemical storage groups when assembled with explosive components are in class 4. Bombs containing a maximum of 500,000

Table 11-1

QUANTITY-DISTANCE TABLE, SHORE STORAGE OF CLASS 2 CHEMICAL BOMBS (BOMBS WITHOUT FUZES INSTALLED)

Quantity of Filling (pounds)		Distance in Feet* From Nearest Facility		
From	To	From inhabited building or munitions stacked in open	From public highway or public railway	From magazine
100	1000	75	75	50
1000	5000	115	115	75
5000	10,000	1501	150	100
10,000	20,000	190	190	125
20,000	30,000	215	215	145
30,000	40,000	235	235	155
40,000	50,000	250	250	165
50,000	60,000	260	260	175
60,000	70,000	270	270	185
70,000	80,000	280	280	190
80,000	90,000	295	295	195
90,000	100,000	300	300	200
100,000	200,000	375	375	250
200,000	300,000	450	450	300
300,000	400,000	525	525	350
400,000	500,000	600	600	400

* Between munitions of different classes, distance must be that of class requiring greatest separation.

pounds of explosives may be stored at one location. The storage locations except for GB and VX-filled bombs must be at least 1,200 feet from the nearest inhabited building, public highway, railway or stacked open munitions, and at least 300 feet from the nearest magazine containing class 4 ammunition. Because of their toxicity special provision must be made for storing GB or VX bombs. Storage areas for GB or VX-filled bombs must be at least 1 1/2 miles from inhabited areas or publicly traveled routes. Within areas under military control, nerve agent bombs must be at least 3,000 feet from occupied areas. If the location is near munitions of different classes, the minimum separation must be that of the class requiring the greatest separation.

Bombs in chemical storage groups A and B when not assembled with explosive components are in class 11. Except for GB or VX-filled bombs, no quantity-distance requirements are established for class 11, since these munitions do not constitute an explosive hazard. For GB or VX-filled bombs, quantity-distance requirements are the same as for class 4 bombs.

Bombs in storage must be inspected periodically for rusted exteriors and leaking fillings. A periodic surveillance must also be made to evaluate the serviceability of bombs and clusters in storage under procedures prescribed in Army Publication SR 742-507-1.

Shipments of bombs within the zone of interior must be made in strict compliance with the provisions of Army Publications AR 55-155, AR 55-225 and SR's of the 55-155 series, and Chemical Corps Safety Directive 385-2. These requirements specify that shipments be made in accordance with regulations, State laws, and instructions promulgated by the Association of American Railroads. Bombs, bomb clusters, and their components are packed for shipment in boxes, crates, shipping bands, or shipping guards.

SHIPBOARD STORAGE OF CHEMICAL FILLED BOMBS. Precautions for the shipboard storage of chemical-filled bombs have not been fully determined. Interim procedures and magazine arrangement data will be supplied with each particular type of bomb at the time it is supplied to a ship.

APPENDIX A

ITEMS OF LITTLE OR NO USAGE

This appendix contains information on chemical agents and smoke agents that are of little or no use at the present time in the Navy but still available in some munitions. Also included is data on bombs and training equipment that were once used and may still be available in some supply stores.

FM--TITANIUM TETRACHLORIDE

Action on metals	Corrosive; no action on steel if FM is dry; vigorous action if FM is moist, FM smoke is corrosive.
Boiling point	275° F.
Chemical name	Titanium tetrachloride
Chemical storage group	B
Decomposition temperature	None below boiling point of 275° F.
Decontaminants	Any alkali in solid or solution form
Formula	$TiCl_4$
Freezing point	Minus 22° F.
Hydrolysis products	Solid TiOCl and HCl; also $Ti(OH)_4$ if sufficient water is present
Munitions markings	FM SMOKE in black on light green background
Odor	Acrid
Rate of action	Rapid
Rate of hydrolysis	Reacts immediately with water or water vapor
Specific gravity	1.7 at 68° F.
Stability in storage	Stable in steel containers if FM is dry

DESCRIPTION

FM is a liquid compound, titanium tetrachloride, which can be atomized by detonation or by spraying into the air. When it is thus atomized, it hydrolizes and the smoke soon becomes a composition of solid and liquid particles.

Carbon dioxide is used with FM to produce pressure. At times a small percentage of other chemicals is added to the compound. The smoke mixture is corrosive and is a colorless to light-yellow liquid that weighs 14 pounds per gallon.

FM reacts vigorously with the moisture in the air to form a dense, white, persistent smoke cloud of finely divided titanium hydrate particles and mist of hydrochloric acid vapor. The formation of the solid particles sometimes clogs spraying apparatus. For this reason it has been replaced to a large extent by FS.

When FM is in a dry state, it has no reaction on steel. If FM is moist, however, it will have a strong corrosive effect on steel.

FM smoke increases in density as the humidity increases. Although a good smoke is produced with average humidity, it tends to dissipate more rapidly than when the humidity is above average.

While FM smoke is considered, under normal conditions, as nontoxic, the liquid burns the skin like a strong acid. The smoke is mildly irritating to the nose and throat at the concentrations found in a smoke cloud, but a protective mask is only required for a heavy concentration.

DECONTAMINATION

Observe the following precautions when handling FM in bulk quantities:

1. Personnel handling FM drums or munitions must wear protective gloves and boots.
2. Personnel handling FM during filling operations, or at other times when this agent could splash on them, should wear goggles, protective aprons or clothing, gloves, and boots.
3. It is preferable for personnel operating in an FM smoke cloud to wear protective masks. It is mandatory that masks be worn when the cloud is in a confined space with high concentrations of FM smoke.
4. When FM is spilled, it must be destroyed by repeated dousing with water. Care must be taken to avoid injury from droplets that are likely to be scattered by the violent reaction of FM with water. For this reason, a small amount of water should never be allowed to contact a large amount of FM mixture. If any liquid FM comes into contact with any part of the body, it should be immediately wiped off and the body washed with an abundance of water, then rewashed with a weak solution of bicarbonate of soda or ammonia in water. Contaminated clothing should be removed before washing the body with water or serious burns are likely to result.

STOWAGE

FM is stowed in 55-gallon steel drums. It is stable inside these drums, where it is concentrated, but fumes leaking out past the bunghole plugs will react with moisture in the air to form a corrosive mist that will eat away the outside of the drums.

The drums should be painted on the outside with an acid- and weatherproof paint. They should be stowed in well-ventilated magazines ashore. (Outdoor stowage is permissible if the outer surfaces of the drums are kept well painted). They should be kept on racks at least 4 to 6 inches off the ground or the floor, as FM vapors are heavy and hug the ground.

Aboard ship the drums should be stowed topside only, but they must be protected from the sun and from salt water spray and constantly inspected for signs of corrosion, leakage, and paint deterioration.

The drums should be vented when they have been subjected to direct sunlight or abnormally high temperatures for a protracted period of time. They must also be vented when bulging because of pressure (this calls for extreme caution on the part of personnel doing the venting), or when the drums are to be opened. When venting is necessary, the drums to be vented should be removed from the place of stowage to prevent contamination of the remaining drums. When it is desired to open FM drums, they should be removed far enough from the place of stowage so that the corrosive vapors released when the plug is removed will not be able to contaminate other drums.

When a drum begins to leak badly, the FM should be transferred to any empty nonleaking drum. If no suitable empty drums are available, the leaking drums should be disposed of in order to avoid corroding other drums.

FIRE FIGHTING

If a fire involves or threatens buildings in which FM is stored, all persons within the danger zone shall be notified to vacate until all danger is passed. Fires in magazines shall not be fought. Since a fire involving chemical ammunition is dangerous to the inhabitants of the vicinity, special precautions must be taken to prevent fires in areas where this chemical ammunition is stored. FM is nonflammable, but may cause fires if spilled on flammable material. This is especially true under damp conditions.

CNB - CHLOROACETOPHENONE

Action on metals or other materials	Slight
Boiling point	Variable
Chemical name	Solution of CN, benzine and carbon tetrachloride
Chemical storage group	B * D **
Decomposition	Stable to boiling point
Decontaminants	Aeration sufficient in field
Formula	CN 10% (by wt); carbon tetrachloride-45%; Benzine-45%
Freezing point	CN crystals separate at 19° F.
Munitions markings	CNB RIOT and one band, all in red on gray background
Odor	Like benzine
Persistency	Nonpersistent
Rate of action	Rapid
Rate that body throws off effects (detoxification)	Rapid if poisonous amounts of benzine have not been inhaled.
Stability in storage	Adequate

* When in bulk or as a chemical filler in munitions.

** When mixed with a solid propellant.

DESCRIPTION OF CNB

CNB is a solution of CN in benzine and carbon tetrachloride. It has a low CN content and was intended for use in training by the Army. In view of adverse effects of benzine and carbon tetrachloride, Navy CN stocks will no longer be used. CN can be decontaminated in the presence of the solvents used in CNB by means of a solution of 5 percent sodium hydroxide, 20 percent water, and 75 percent carbitol, all by weight.

HANDLING OF CNB

Chemical munitions containing CNB are issued filled and sealed. They must be handled with care in order to prevent deformation of containers and possible leakage due to loosening of plugs and other closures.

STOWAGE OF CNB

Chemical munitions containing CNB should preferably be stowed separately. If separate stowage is not available, they may be stowed with other munitions filled with different types of chemical agent. Refer to the Ammunition Hazard Classifications and Weights (NAVWEPS OP 1631, 2nd Rev.).

CG - PHOSGENE - CHOKING AGENT

Action of metals	Corrodes wet metals only
Boiling point	47° F.
Chemical name	Carbonyl chloride
Chemical storage group	B
Decomposition point	1472° F.
Decontaminants	DS2 decontaminant or water followed by mild alkali solution - material only
Formula	$COCl_2$
Freezing point	244° F.
Munition marking	One green band on gray background
Odor	Fresh cut hay or green corn
Percent expected fatalities	6%
Persistency	Nonpersistent
Physical state	Colorless gas; condensed to liquid form for loading in munitions
Rate of action	Varies with concentration, from immediate symptoms to 3-hour delayed effects
Rate of detoxification	Varies with concentration
Specific gravity	1.392 at 68° F.
Stability in storage	Stable in dry steel containers, but corrodes wet metals vigorously

DESCRIPTION

CG agent, Phosgene, is a choking gas of low persistency. It exerts its effects solely on the lungs, and results in damage to capillaries. Its symptoms are irritation of the respiratory tract, uncontrollable coughing, choking, tightness in the chest, pulmonary edema, fever, lacrimation, nausea, headache, and prostration. It causes seepage of watery fluid into the air cells; if the dose has been lethal, they become so flooded that air is excluded and the victim is choked by oxygen deficiency. If the dose has been less than lethal, this fluid may be reabsorbed, the air cell walls heal, and the victim recovers. Most deaths occur within 24 hours. Phosgene has the odor of fresh cut hay, grass, or green tomatoes. It is suited for use as a delayed or immediate action agent. The median lethal dosage is 3200 mg-min/m^3 and the median incapacitating dosage is 1600 mg-min/m^3. The effects of CG are cumulative.

The agent was used in liquid form in bursting-type 500-pound or 1000-pound bombs and bursting-type 4.2-inch mortar cartridges for dissemination as a vapor. Phosgene was used extensively in World War I, and more than 80 percent of the World War I gas fatalities were caused by CG. Although not now so important as it has been, phosgene is covered here as a potential agent for munitions.

DECONTAMINATION

Individuals exposed to CG agent should hold their breath, put on protective masks immediately, and loosen clothing. If undue shortness of breath occurs, the individual should rest as quietly as possible in fresh air and avoid unnecessary movement. Treatment consists of rest, warmth, oxygen therapy, and antibiotics when needed. Decontamination of CG vapor from the body is not required.

Low concentrations that are not particularly irritating may produce serious symptoms several hours later. In any case, the severity of the poisoning will not be apparent for 3 to 4 hours. Serious cases require medical care.

Material contacted by CG vapor is decontaminated with DS2 decontaminating agent or water, followed by alkali solution (5- to 10-percent solution of caustic soda, washing soda, baking soda, or household ammonia).

CK - CYANOGEN CHLORIDE - BLOOD AGENT

Action on metals	Attacks steel, iron and silver very slowly, No effect on lead.
Boiling point	57° F.
Chemical name	Cyanogen chloride
Chemical storage group	B
Decomposition point	Above 212° F may explode at certain point of deterioration.
Decontaminants	DS2 or NaOH lye solution
Formula	CNCl
Freezing point	21° F.
Munition marking	One green band on gray background
Odor	Irritating odor like peach kernels; however, because the irritating and lacrimatory properties are so great, the odor may go unnoticed.
Percent expected fatalities	Not disclosed
Persistency	Low, but CK vapor may persist in jungle and forest for some time under suitable conditions
Physical state	Colorless, heavy, volatile liquid. Vapor is heavier than air
Rate of action	Immediate to several minutes
Rate of detoxification	Recovery prompt, but residual damage to central nervous system may persist for weeks or become permanent
Specific gravity	1.218
Stability in storage	Stable in steel containers when stabilized with 5% anhydrous tetrasodiumpyrophosphate

DESCRIPTION

CK agent is a colorless, heavy, highly-volatile liquid, which forms a vapor heavier than air. CK is employed as a quick-acting casualty agent. In liquid form was used in 500-pound and 1000-pound bursting type bombs for vapor dissemination. Although not now so important, CK is covered here as a potential filler agent for munitions.

The CK agent paralyzes the central nervous system, and in even low concentrations, irritates the eyes and respiratory tract. It produces intense irritation of the lungs which leads to a very quick edema. This irritation may cause involuntary holding of the breath. Death from acute poisoning 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.

DECONTAMINATION

No decontamination of material exposed to CK vapor is needed. For decontamination of material contaminated with CK liquid, use DS2 decontaminating agent or sodium hydroxide solution.

Individuals contacted by CK-agent should put on protective masks immediately if any irritation of the eyes, nose or throat is noticed, without waiting to detect the agent's scent. Squeeze an ampule of amyl nitrite until it pops, insert it under the eyepiece inside the protective mask facepiece, and inhale the fumes. As many as 8 ampules may be used at 3-minute intervals. Treatment must be instituted at once. Artificial respiration must be used, and the individual kept warm and quiet and given liquids to drink.

AC - HYDROGEN CYANIDE - BLOOD AGENT

Action on metals	Little or none
Boiling point	79° F.
Chemical name	Hydrogen cyanide
Chemical storage group	B
Decomposition point	Above 150° F.
Decontaminants	Not reqiured
Formula	HCN
Freezing point	7° F.
Munitions marking	One green band on gray background
Odor	Peach kernels or bitter almonds
Persistency	Non-persistent
Physical state	Gaseous
Rate of action	Rapid. Lethal effects within 15 minutes
Rate of detoxification	Rapidly detoxified by body if concentration is weak
Specific gravity	0.901
Stability in storage	Stable

DESCRIPTION

Hydrogen cyanide, AC agent, is a gas which dissolves in water and acts as a very weak acid. It is made by treating a cyanide such as potassium cyanide, KCN, with sulfuric acid and is commercially useful as a fumigant and rat poison.

Hydrogen cyanide is a blood agent, and is absorbed into the body primarily by breathing. It interferes with utilization of oxygen by the body tissues by inhibiting the enzyme cytochrome oxidase, and causes a marked stimulation of the breathing rate. Death occurs within 15 minutes of receiving a lethal dosage. It is suitable for use as a quick-acting casualty agent; its odor is like that of peach kernels. The median lethal dosage and the median incapacitating dosage of this agent vary widely with concentration because of the rather high rate at which AC is detoxified by the body itself. For example, at 200 mg/m^3 concentration, the LCt_{50} is approximately 2,000 $mg\text{-}min/m^3$, while at 150 mg/m^3 the LCt_{50} jumps to 4500 $mg\text{-}min/m^3$ (LCt_{50} is a mathematical value representing a dosage of chemical agent that will prove fatal to 50 percent of the persons exposed in the area specified). 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.

DECONTAMINATION

No decontamination procedures are required for personnel or material contacted by AC. Individuals exposed to AC agent should put on protective masks immediately as soon as the use

of gas is suspected. Amyl nitrate ampules, if available, should be broken and placed inside the eye pieces of the mask.

PERSISTENT GAS BOMB, HD, 115-POUND, M70A1

Model	M70A1
Drawing	82-0-83 D14-5-1187
Fin assembly model	AN-M103A1
Length of assembled bomb (in.)	51.5
Body diameter (in.)	8.0
Fin span (in.)	11.0
Weight empty (lb.)	55.0
Filling	Distilled mustard (HD)
Filling weight (lb.)	60.6
Weight of fin assembly (lb.)	5.6
Weight assembled (lb.)	128.1
Arming-wire assembly	Mk 1 or AN-M6A2
Burster	M10
Nose Fuze	AN-M158
Color code	Two green bands on gray background

DESCRIPTION

The M70A1 persistent gas bomb, figure A-1, is approximately 51-1/2 inches long and weighs 128 pounds when assembled into a complete round. It is 8-3/32 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. This bomb is no longer in use. Navy stocks are undergoing disposal.

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, M102A1, 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. An 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

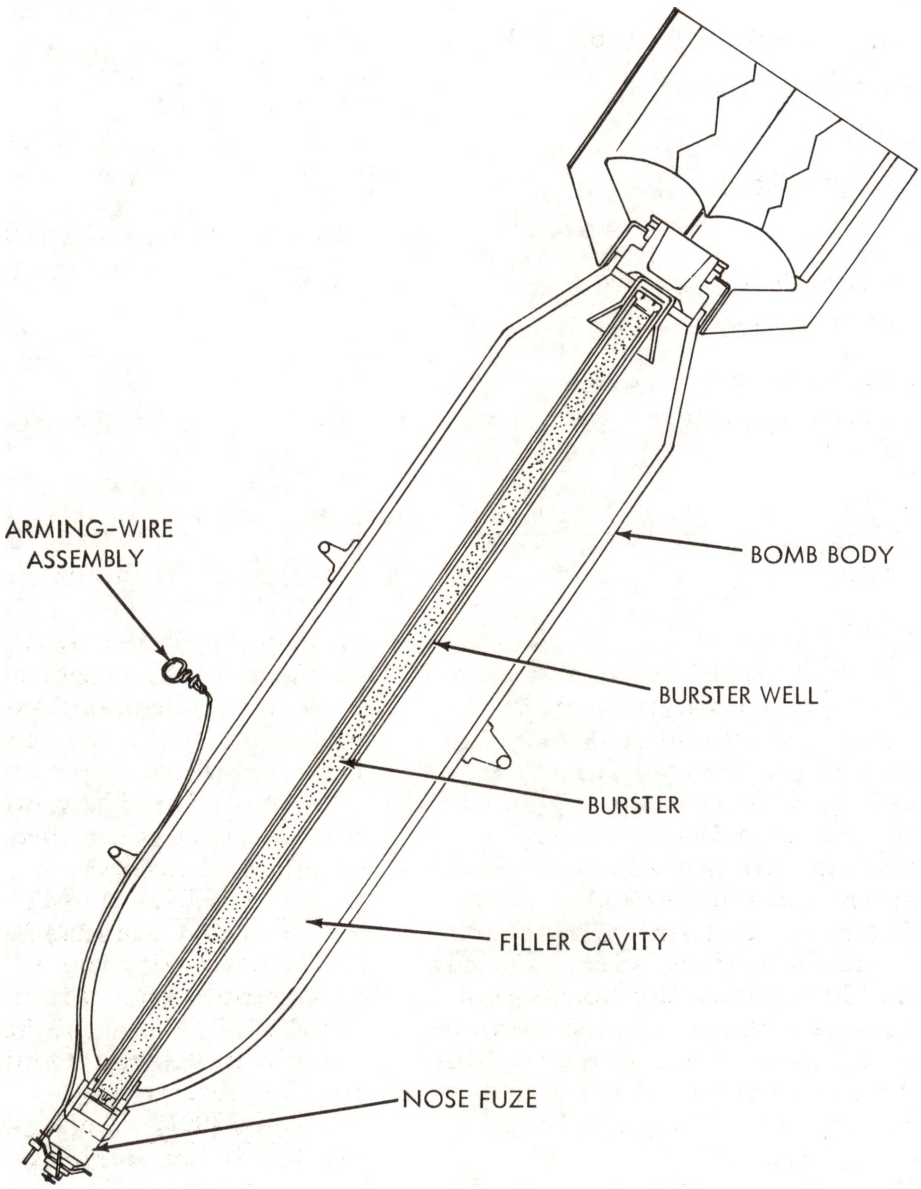

Figure A-1. Persistent Gas Bomb, HD, 115-Pound, M70A1

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.

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.

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. Aline 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.

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.

FUNCTIONING

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.

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.

PACKING

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 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.

SHIPMENT AND STORAGE

Shipping requirements are discussed in chapter 11. The M70A1 bomb is in storage group A for chemical munitions. See chapter 11 for information on storing chemical bombs.

NONPERSISTENT GAS BOMB, CG or CK, 500-POUND, AN-M78

Model	AN-M78
Drawing	82-0-115
Fin assembly model	AN-M109A1
Length of assembled bomb (in.)	59.25
Body diameter (in.)	14.18
Fin span (in.)	18.94
Weight empty (lb.)	260.0
Filling	Phosgene (CG) or Cyanogen chloride (CK)
Filling weight (lb.)	
CG	205.0
CK	176.0
Weight of fin assembly (lb.)	18.6
Weight assembled (lb.)	
Filled with CG	495.0
Filled with CK	466.0
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
Color code	One green band on gray background

DESCRIPTION

The AN-M78 nonpersistent gas bomb, figure A-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 19-3/16 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.

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. This bomb is no longer in use by the Navy.

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 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

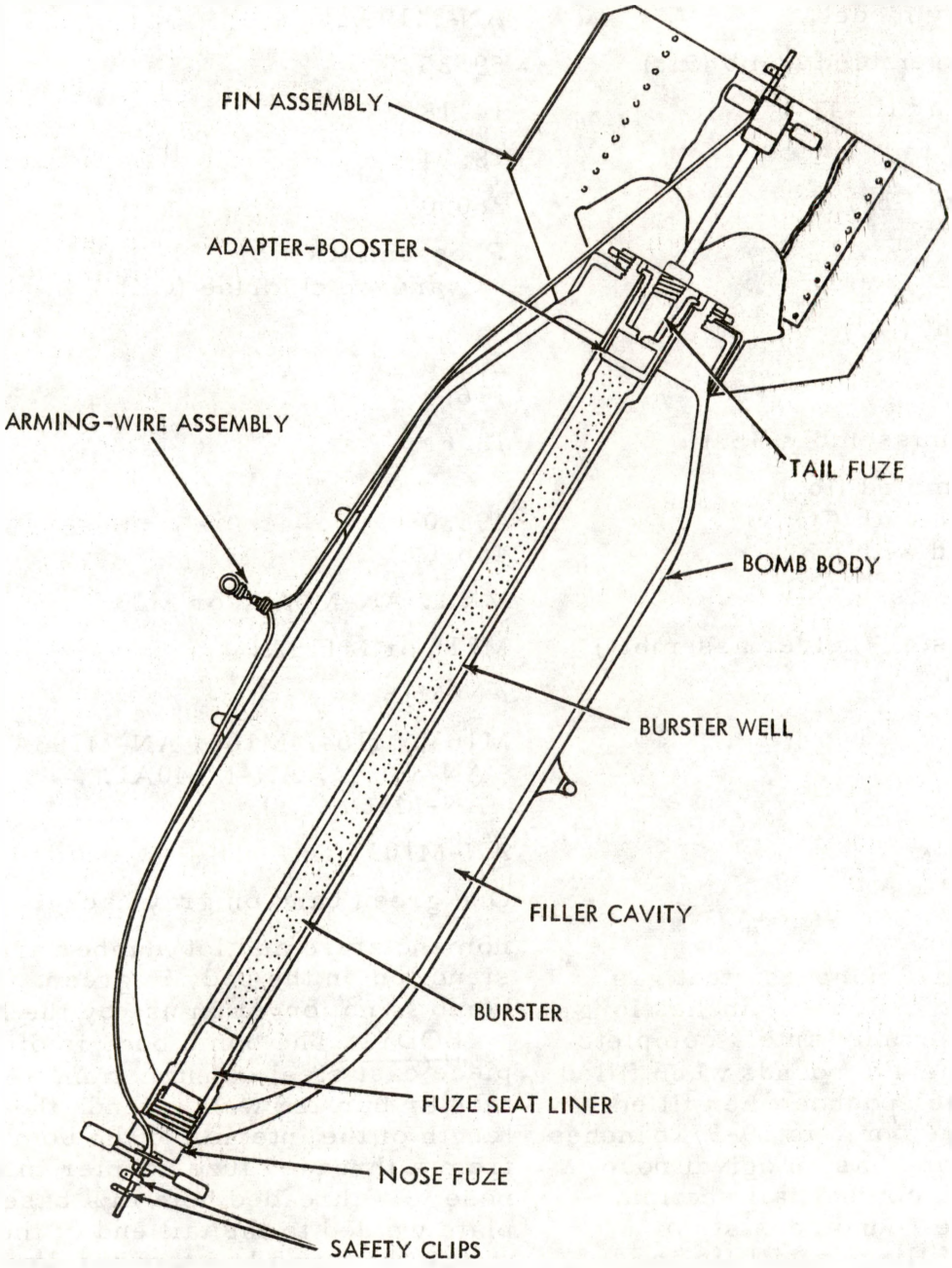

Figure A-2 Nonpersistent Gas Bomb, CG or CK, 500-Pound, AN-M78

closed by a nose plug, and the 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 nondelay nose fuze is an 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 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 this bomb.

BOMB ASSEMBLY

WARNING

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

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 at the tail end of the burster well.

AFTER LOADING THE AIRCRAFT. Adjust the nose and tail fuzes for instaneous 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.

FUNCTIONING

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.

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 should undertake disarming and disposal of fuzes.

PACKING

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 wire are packed separately.

SHIPMENT AND STORAGE

Shipping requirements are discussed in chapter 11. The AN-M78 bomb is in storage group B for chemical munitions. See chapter 11 for information on storing chemical bombs. See TB CW 22 for information on venting the bomb.

NONPERSISTENT GAS BOMB, CG, CK, or AC, 1000-POUND, AN-M79

Model	AN-M79
Drawing	82-0-98
Fin assembly model	AN-M113A1
Length of assembled bomb (in.)	69.5
Body diameter (in.)	18.8
Fin span (in.)	25.4
Weight empty (lb.)	485.0
Filling	Phosgene (CG), cyanogen chloride (CK), or hydrocyanic acid (AC)
Filling weight (lb.)	
CG	415.0
CK	315.0
AC	195.0
Weight of fin assembly (lb.)	21.5
Weight assembled (lb.)	
Filled with CG	927.0
Filled with CK	873.0
Filled with AC	717.0
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-M140A1, AN-M168 (VT)
Tail fuze	M162, AN-M102A2
Color code	One green band on gray background

DESCRIPTION

The AN-M79 nonpersistent gas bomb, figure A-3, is 69-1/2 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 18-3/4 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. This bomb is no longer in use by the Navy.

BODY. The bomb body is of one piece cast-steel construction. A tubular burster well extends the

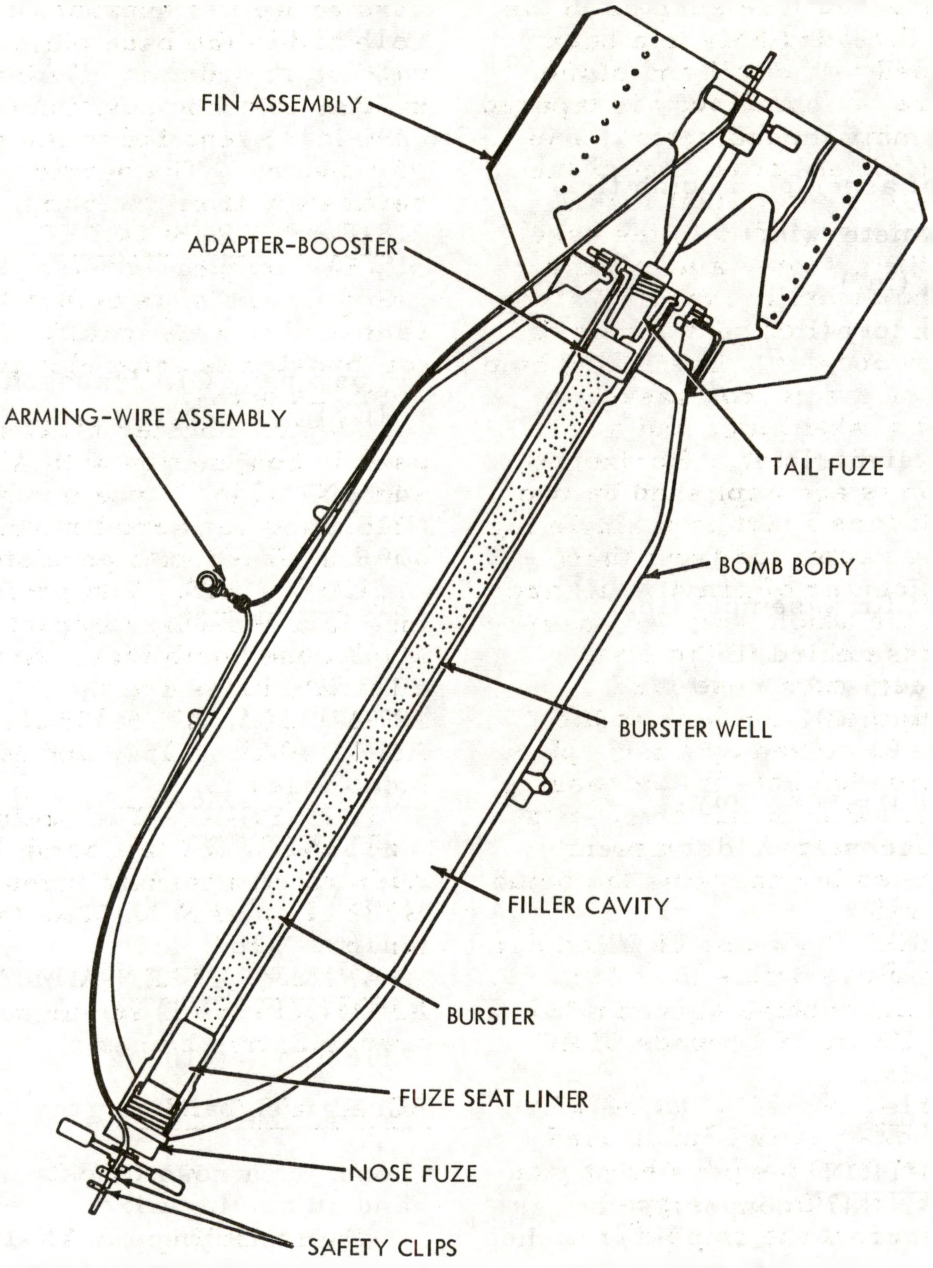

Figure A-3. Nonpersistent Gas Bomb, AC, CG, or CK, 1000-Pound AN-M79

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 smaller 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 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.

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.

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 alinement 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.

AFTER LOADING THE 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.

FUNCTIONING

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.

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.

PACKING

The AN-M79 bomb is protected for shipping by shipping bands. The bomb, with shipping bands installed, weighs 939 pounds when filled with CG, 875 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.

SHIPMENT AND STORAGE

Shipping requirements are discussed in chapter 11. The AN-M79 bomb is in storage group B for chemical munitions. See chapter 11 for information on storing chemical bombs. See TB CW22 for information on venting the bomb.

INSTRUCTIONAL GAS IDENTIFICATION SET, M1

Specification	MIL-S-10333
Dimensions (in.)	
Length	30
Height	11.5
Width	14.3
Package date	Wooden box
Weight (lb.)	71
Cubage (cu. ft.)	2.77

DESCRIPTION

The Instructional Gas Identification Set, M1, figure A-4, is a wooden packing box containing actual chemical agents in individual glass bottles with glass stoppers ground to make an air tight fit. The set is coloquially referred to as a sniff set. Each bottle is etched on the side to show the symbol of the agent. There are seven bottles in all with agents as follows:

Two of mustard (H) (Each bottle contains 25 cc. of mustard adsorbed by 90 cc. of activated charcoal.)

One of Phosgene (CG) (The bottle contains 3 grams of solid Triphosgene. Phosgene evaporates from this solid.)

One of Chlorpicrin (PS) (The bottle contains 25 cc. of Chlorpicrin adsorbed by 90 cc. of activated charcoal.)

One of Chloracetophenone (CN) (The bottle contains 15 grams of solid Chloroacetophenone.)

One of Lewisite (L) (The bottle contains 25 cc. of Lewisite adsorbed by 90 cc. of activated charcoal.)

One of Adamsite (DM) (The bottle contains 15 grams of solid Adamsite in a cloth bag.)

The chemical agents Lewisite and Chlorpicrin are no longer in use, but may be found in these instructional sets which are still carried in some stores. Bottles in some cases may bear the former markings of HS instead of H, and M-1 instead of L.

Activated charcoal is used as an adsorbent 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 of the can. In compliance with ICC regulations, each bottle is surrounded by sawdust or wood pulp within the can, and each can is surrounded by 1 inch of wood pulp when placed in its section in the packing box.

The packing box is a sectioned wooden box with a hinged top. The complete unit weighs 71 pounds. The set is classified in the Interstate Commerce Commission Regulations as Class A, and must be identified by DA Label 69, "Extremely Dangerous Poison". For this reason, the

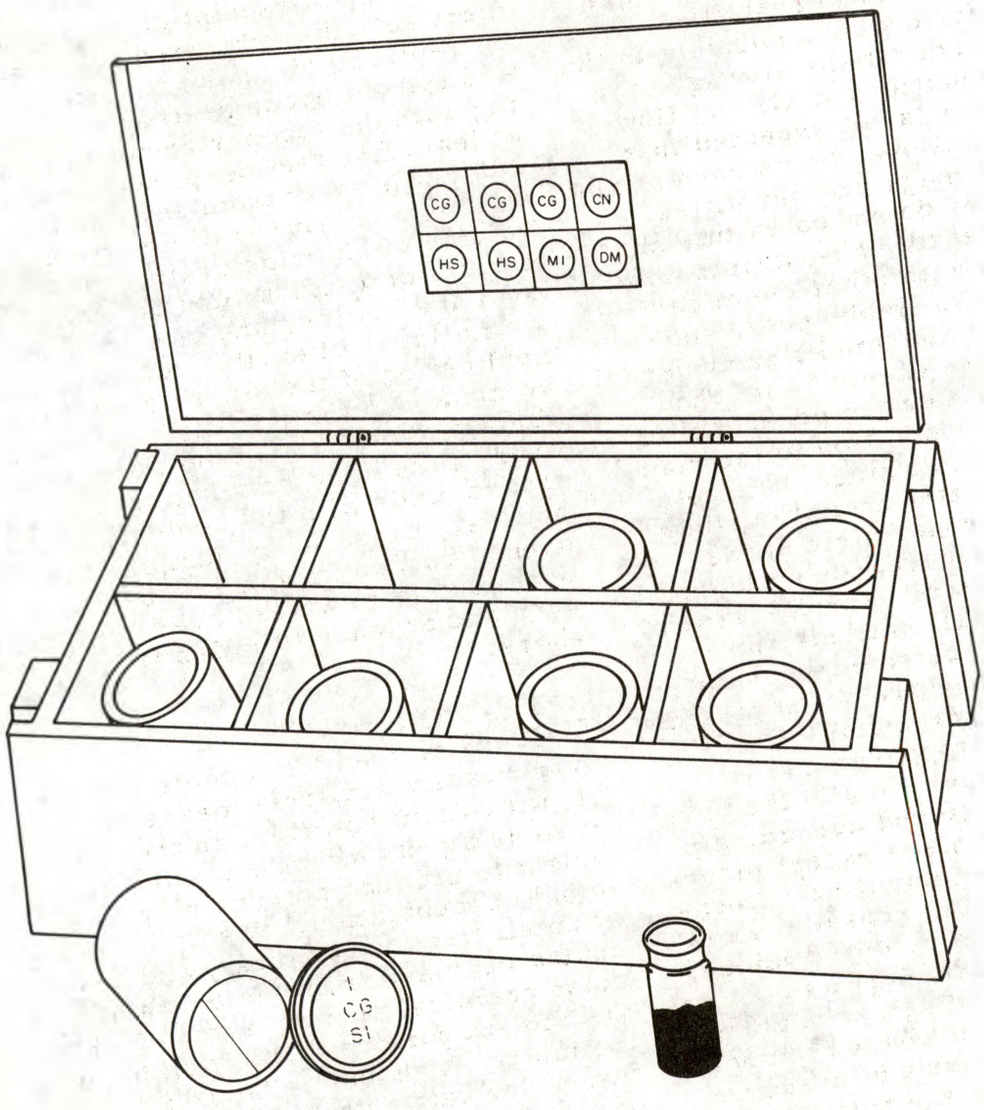

Figure A-4. Instructional Gas Identification Set, M1

instructional set must never be reshipped by commercial carrier unless packaged with the label specified, and no more than 10 gas identification kits of any type can be shipped in one Railway Express Car, unless a waiver is obtained.

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 class room 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. Disposal by dumping the opened bottles in weighted sacks is permissible in waters over 150 fathoms deep and at least 10 miles from shore.

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 putrification. 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 A-1 summarizes the characteristics of the different agents as they appear to the average person.

TABLE A-1 - 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/l	None
Mustard (Purified)	HD	Garlic, Horse Radish	.001 Mg/l	None
Nitrogen Mustard	MN	Very slight Fish Odor	High Concentrations Only	None
Lewisite	L	Geraniums	.0014 Mg/l (Crude)	Sneezing; Nasal irritation
Phosgene	CG	Hay, Silage, or Green Corn	.004 Mg/l	Thin White Cloud Produced Coughing; Tightness in Chest; Eye irritation
Diphosgene	DP	Hay, Silage, or Green Corn	.009 Mg/l	Thin White Cloud Produced Coughing; Tightness in Chest; Eye Irritation
Chlorpicrin	PS	Fly Paper	.007 Mg/l	Lacrimination; Vomiting
Hydrocyanic Acid	AC	Almond Flavoring or Peach Kernels	.034 Mg/l	None
Cyanogen Chloride	CK	Pungent	.007 Mg/l	Lacrimation
Arsine	SA	Faint Garlic-like Odor	.1 Mg/l	None
Adamsite	DM	Irritating in Low Concentrations; Coal Smoke in High Concentrations	High Concentrations Only	Canary Yellow Smoke Haze; Headache; Vomiting; Nausea

TABLE A-1 - IDENTIFYING CHARACTERISTICS OF INSTRUCTIONAL SET OF AGENTS (Continued)

Common Name of Agent	Symbol	Odor	Odor Detectable At	Other Immediate Effect
Diphenyl Chlorarsine	DC	Irritating in Low Concentrations; Like Shoe Polish in High Concentrations	High Concentrations Only	Sneezing; Vomiting; Headache
Chloracetophenone	CN	Apple Blossoms	.0001 Mg/l	Lacrimination, 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.

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 pressure 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 time, 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.

INSTRUCTIONAL SET 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, and apply ICC Poison gas label DA 69 to the box.

GAS IDENTIFICATION DETONATION SET, M1

Specification	MIL-S-11149
Drawing	D18-21-22
Dimensions (in.)	
Cylinder diameter	6.75
Flange diameter	9.25
Length	40.25
Package data	1 steel cylinder
Weight (lb.)	110
Cubage (cu. ft.)	2.1
Contents	48 tubes
Chemical agents included	HD, L, PS, CG
Federal Stock Number	6910-025-3273
Detonation Accessories Set Specification	MIL-S-12398
Drawing	D18-21-36
Federal Stock Number	6910-368-6153

DESCRIPTION

The Gas Identification Detonation Set, M1, figure A-5, consists of a cylindrical forged-steel shipping container in which there are 12 tubes each of chloroform solutions of the toxic chemical agents HD, L, PS, and CG, in screw-top fiberboard cylinders. Twelve cylinders are packed in each of four metal containers. The shipping container is sealed with a steel cover bolted over a lead gasket. The chemical agent samples are disseminated by the blasting mechanism provided with the associated Gas Identification Set Detoration Accessories Set, M1. The detonating equipment set provides a set of wrenches for removing the bolts on the shipping container. The authentic samples of toxic chemical agents are used to train personnel in their detection and recognition.

The agents in each multiple container are as follows:

3 tubes, H, each containing 40 cc. of 5% solution of H (Mustard) in chloroform

3 tubes, L, each containing 40 cc. of 5% solution of L (Lewisite) in chloroform

3 tubes, PS, each containing 40 cc. of 50% solution of PS, (Chlorpicrin) in chloroform

3 tubes CG, each containing 40 cc. of 100% CG (Phosgene)

However agents L and PS are no longer in use in any service and are not covered in the main body of this publication.

The metal containers include 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 faced 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 p.s.i. internal pressure when bolted tight. The nuts are hexagonal and can be removed with

a standard 1 1/4-inch wrench or a monkey 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. The Naval Ammunition Depot will repack the number of metal boxes corresponding to the quantity requested. 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.

The Set, Gas Identification, Detonation, M1 may be stored at depots with inert material where there is no possibility of fire hazard, or with other chemical ammunition of types 3 and 4, according to OP 5. They must be stored, however, with all due regard to regulations governing trespassing by unauthorized personnel. At training stations, they may be stored in any convenient place where they will not be tampered with. 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.

Electric Detonators must be stored in standard, earth-covered detonator or fuze-type magazines in which no other ammunition or material is stored. They shall not be located in the same compartment with, or near, radio apparatus or antenna leads. At training activities where such storage space is not available, small quantities, (never more than 350), may be stored in any dry shelter but must not be left, kept, or stored where unauthorized persons have access to them, where they are exposed to the direct rays of the sun, heating pipes, or any undue temperatures (over 100°F.), with or near, radio apparatus or antenna leads, or in dwellings, offices, or other inhabited buildings.

Excess detonators should not be retained at training activities where magazine stowage is not available but should be disposed of by detonation. When quantities of less than 10 are detonated, they should be detonated individually in a pit 1 foot deep from a distance of at least 25 yards. Sizeable quantities may be detonated in a metal can such as a 5-gallon paint can. This should be placed in a pit about 4 feet deep and approximately the size of the drum, in a location removed at least 300 feet from any building, magazine, or structure, and not less than 500 feet from private property or public highway. Up to 10 detonators at one time may be detonated by tying in a bundle and connecting one of the detonators to a blasting machine. The machine should be operated at a distance of at least 200 feet from the pit and behind suitable cover. After the explosion, sufficient time (at least 5 minutes) must elapse before proceeding to the scene, especially in case of a misfire; and the circuit must be broken in such a manner that it cannot be accidentally closed while personnel are not under cover.

The set itself is packed in accordance with ICC regulations and may be

Figure A-5. Gas Identification Detonation Set, M1

shipped by commercial carrier. It must be labeled with the Poison Gas label, DA 69. Under no circumstances are the contents of the steel cylinder to be shipped other than in the steel container. If it is necessary to return a partial set, the shipments must be made in the steel container tightly bolted and any voided space completely filled with cushioning material. Overseas shipments must be made in accordance with OP 5. The detonators must be shipped in accordance with regulations covering relatively safe explosives in the ICC Regulations; overseas shipments, in accordance with OP 5.

Should it be necessary to dispose of tubes from detonation sets, the tubes may be detonated individually or in series, but should be placed in a pit and the decontamination procedure followed.

In no case are cylinders to be emptied upon receipt and returned although instructions on Army shipping tickets may so state. Such instructions apply to cylinders issued for use by the Army and are not to be followed for those issued for Navy use. Containers are to be retained and unexpended tubes replaced in them after each use until all the tubes are expended. At ex-continental activities the empty cylinders may be disposed of in accordance with existing procedures for the area for disposal of scrap metal.

OPERATION

INSTALLATION. The Set, Gas Identification, Detonation, M1, 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. Requests for these sets are to be made by letter in accordance with established procedures for Chemical Warfare training material. Partial replacements are never to be requested.

The accessories set is issued for use with the detonation 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. Therefore, it is mandatory that only the Detonator, Electric, No. 8, be used with this set.

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). Some detonators may be shipped with a small lead disc shunt shorting the detonator leads just in front of the detonator. This disc must be removed in order that the current may fire the detonator. It should be removed just prior to attaching to the tube. Hook-up with the exploder box varies for small classes or for larger classes. 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.

The number of samples of an agent necessary to give a satisfactory demonstration and test will be determined by the officer in charge of the demonstration. Under normal weather conditions, one sample is considered sufficient for a group of 20 persons. For larger groups, or for demonstrations under adverse weather conditions, a larger number of samples of a particular agent will be required. 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 exploder box 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.

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 by the earth. This earth is contaminated and should be handled with caution. Do not allow the students to approach within 15 yards down wind 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.

PRECAUTIONS FOR THE DETONATION SET

Observe the following precautions when using the gas 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.

ACCESSORIES SET

The Gas Identification Detonation Accessories Set, M1, Federal Stock Number 6910-368-6153, is packed in a wooden box and consists of wrenches, wire, pliers and a blasting device. The wrenches can be used to open sealed shipping containers of the M1 or other gas identification sets. The box weighs 77 pounds and is 19.5 inches long by 11.5 inches wide by 12 inches high.

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