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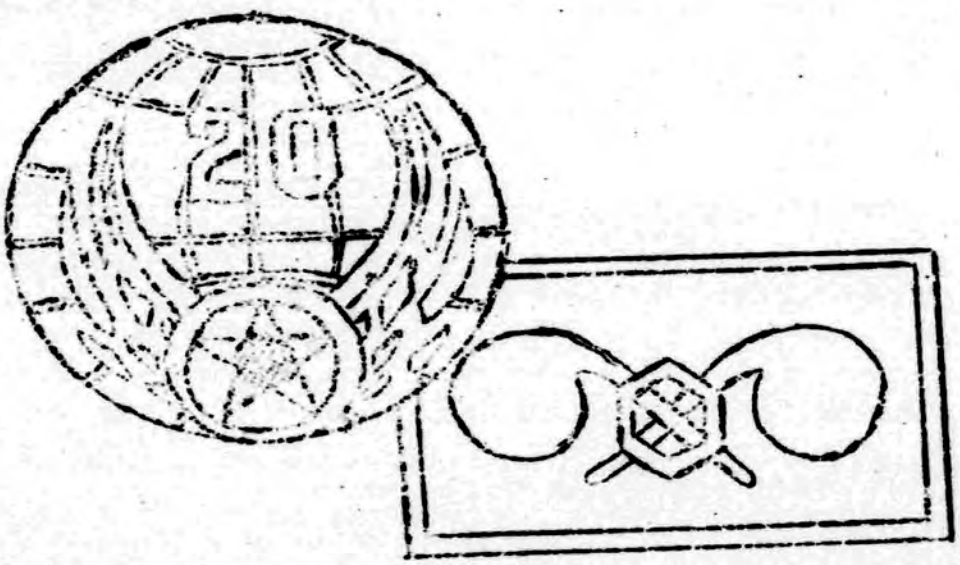
HEADQUARTERS
XXI BOMBER COMMAND
Office of the Chemical Officer
APO 234, c/o Postmaster
San Francisco, California

CHEMICAL WARFARE DIGEST



NUMBER 3

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NO. 3.

Contents

I. AIR CHEMICAL OPERATIONS

1. Summary of Incendiary Missions. (Secret) This command has now made both day and night maximum effort incendiary strikes against Japanese cities and industrial areas. These efforts involve the employment of over 32,000 tons of incendiary bombs against targets ranging in nature from congested urban areas to heavy industry in the cities of Tokyo, Kawasaki, Yokahoma, Nagoya, Osaka and Kobe. The results have been a total of over 83 square miles of these cities destroyed and destruction or damage to 147 AAF numbered targets in 13 strikes.

On the following page is a chart which summarizes these incendiary operations. Many points of interest to C/S personnel have been noted in these missions. It must be emphasized that many of the tactics used are new to the Army Air Forces and that it is not possible at this time to draw firm conclusions on many points. However, the following factors are evident and bear careful consideration in the employment of incendiary bombs.

a. Mass employment of incendiaries yields returns that are proportionally much greater than returns from small scale operations. When a large area is saturated with incendiary bombs the enemy is forced to disperse his fire defenses over this area and he is denied the possibility of concentrating his fire fighting efforts in any one area. Also, the advantage is gained of one fire supporting another and of one conflagration supporting another to the extent that the resulting damage becomes proportionally greater.

b. The attack should be made in the shortest possible period of time. This not only weakens the enemy's anti-aircraft and fighter defenses, but also weakens his fire defenses. When ten thousand incendiary bombs fall in five minutes the effect is much greater than if the same number of bombs fell in thirty minutes.

c. Smoke and the thermals caused by intensive fires are major factors in making an incendiary attack. In night low level attacks thermals may force aircraft from their bombing runs or even cause serious damage or loss of the aircraft. In more than one instance aircraft of this command have been thrown into violent changes of altitude or have even been turned upside down by the exceedingly turbulent air. Smoke, either in the daytime or at night will obscure aiming points and hinder accurate bombing. The axis of attack, ground wind direction, sequence of attacking aiming points, total time of attack, bombing altitude and method of withdrawal are all factors which must be carefully considered because of the effect of smoke and thermals.

d. The M47A2 incendiary bomb makes an excellent munition for use by pathfinder aircraft on night attacks. These pathfinders have the responsibility of hitting and marking each aiming point prior to the attack by the main striking force. The use of the M47A2 incendiary bomb with the T-19 cluster adapter permits a B-29 to carry a maximum load of 184 bombs thus providing the necessary fire power to not only mark the target with flame, but also to set a concentration of appliance fires.

e. The M69 bomb carried in aimable clusters has proved itself to be ideally suited for the destruction of Japanese Urban areas and in several instances has caused severe damage or total destruction to industrial plants.

This bomb gives best results when used in sufficient mass to thoroughly saturate the target area. Best results have been obtained with an intervalometer setting of 50 feet between clusters and it has been found that 100 feet does not give the required density. When dropped from altitudes below 10,000 feet the E-46 incendiary cluster may be opened at 2,500 feet above the target and the E-28 and E-36 clusters may be opened at 2,000 feet. The reason for the 500 foot difference is to allow full use of existing bombing tables without interpolation.

f. The M50 series magnesium bomb may be used successfully against many Japanese targets. This bomb has a higher terminal velocity than the M-69 and has therefore been thought to be impractical for employment against urban areas in the Empire. It must be remembered that all Japanese structures are not flimsy wooden buildings. Also when M-17 clusters of M50 bombs are dropped from low altitudes extreme striking velocities are not reached. The multiple hits obtained from 110 bombs per M-17 cluster is a definite advantage. The fact that 10 to 20 per cent of the bombs in M17A1 clusters contain explosive heads is also a factor which favors this munition in many instances. The use of M-50 series bombs by this command has not been extensive enough to draw sweeping conclusions, however when used under proper conditions this munition has many superior fire raising qualtities.

g. B-10 shackles should not be used with the T-19 cluster adapter in multiple suspension of M47A2 incendiary bombs. This shackle will not release properly unless there is a direct downwind pull on the latch pawl. Releases from the B-7 shackle have been entirely satisfactory.

SUMMARY OF INCENDIARY MISSIONS

No.	Date	A/C AB	Tons Bombs Airborne	Tons on Target	No. Each Type Dropped on Target M76	M47	M17	E48	E46	E36	E28	Sq Mi Dest	City
40	9 Mar	325	1980.4	1665.0		3683			3548		4971	15.80	Tokyo
41	11 Mar	310	1940.7	1789.8		3274			3939		5337	2.05	Nagoya
42	13 Mar	298	1885.0	1732.6		1586			3357	1872	1167	8.10	Osaka
43	16 Mar	331	2508.2	2308.7	1499		5122		1538	1775	301	3.00	Kobe
44	18 Mar	310	2002.8	1838.3	1974	27789	458		905	327	219	2.95	Nagoya
67	13 Apr	352	2189.7	2037.7		6447			9077			10.70	Tokyo
68	15 Apr	220	1243.0	1072.4		8925			3823			9.60	Kawasaki & S. Tokyo
69	15 Apr	118	819.3	754.4		9280			2172				
174	14 May	524	2829.9	2515.1					22358	261		3.10	N. Nagoya
176	16 May	519	4218.8	3609.0		3677	13627		378			3.80	S. Nagoya
181	23 May	514	3947.7	3645.7		22544	195		13836	314		18.60	S. Tokyo and C. Tokyo
183	26 May	498	3560.7	3258.0	1390	18380	3814	11	6569	39			
186	29 May	517	2929.5	2569.6		22224	82		8666	270	25	6.90	Yokohama
Total		4836	32055.7	28796.3	4863	127809	23308	11	70168	7858	12020	84.60	

NOTE: AB - Airborne

2. 55 Gallon Oil Drum Incendiary (Secret) During the past month over 8,000 55 gallon napalm fire bombs have been manufactured by Chemical Companies. Tests have also been conducted to determine the most efficient handling procedures, optimum dropping altitudes and to assemble necessary data for the compilation of a bombing table suitable for B-29 air speeds. The following points are of interest:

a. 55 gallon oil drum incendiaries may be transported successfully from the bomb dump to the airplane in Chemical Service Truck, M-1; Bomb Service Trucks, M-27 or M-6; or Bomb Trailer, M-5. Standard handling equipment may be used in unloading trucks and trailers and in hoisting this munition into the bomb bay.

b. The tail fin assembly and M-13 or M-14 igniter are installed on the line in order to prevent damage during bomb dump handling and transportation. Fitting of the tail fin can be expedited if drums and the tail assembly are paired off and marked by Chemical Companies during initial manufacturing.

c. Safety pins should not be pulled from igniters until the bomber is airborne and preferably not until approaching the target.

d. 16 drums may be loaded per B-29 using two stations on the outside racks. In addition mixed loads may be carried as follows:

(1) If 55 gallon napalm drums are hung on stations 2 and 6, one aimable cluster can be hung on station No. 8

16 napalm drums	6640 lbs
8 E46 clusters	3400
	10040 lbs

(2) If a drum is hung on station No. 2, aimable clusters can be hung on stations 3, 6, and 8.

8 napalm drums	3320 lbs
24 E46 clusters	10200
	13520 lbs

(3) If a drum is suspended at station No. 2, M47 bombs can be hung on station 3, 6, and 8.

8 napalm drums	3320 lbs
136 M47 bombs	9384
	12704 lbs

3. Standardization of Incendiary Clusters. (Unclassified) The OCCMS advises that the present E-46 500 pound size incendiary cluster containing 38 M-69 bombs has been recommended for standardization as Cluster, Aimable, Incendiary Bomb, M-19. A new cluster to be known as Cluster, Aimable Incendiary Bomb, M-21 containing 38 M69X bombs has also been recommended for standardization. Both of these munitions are clustered in the M-23 cluster adapter, heretofore known as the E-23 cluster adapter.

4. M47A3 Incendiary Bomb. (Confidential) The Air Chemical Officer has forwarded the following information regarding the M47A3 incendiary bomb:

a. Weight.
   (1) 73 lbs when equipped with an AN-M-13-M9 Burster-Igniter and AN-M126A1 fuze.
   (2) 70 lbs when equipped with an AN-M12 burster and an AN-M126A1 fuze.

b. Overall length unfuzed is 49.9 inches. The tail fin on the M47A3 is 3 inches longer than on the M47A2.

c. The location of the lugs with respect to the nose is identical to the AN-M47A2

5. Standization of the T-19 Cluster Adapter (Confidential) The T-19 cluster adapter originally designed and tested by the XXI Bomber Command Chemical Section for use with M47A2 incendiary bombs has now been standardized as the Adapter, Cluster M-24. The Ordnance Department is charged with procurement, storage, and issue. In this command to facilitate the handling and loading of M47A2 incendiary bombs Chemical Companies, Air Operations will continue to receive, store, and issue these cluster adapters. The Chemical Section will likewise continue efforts to expedite the delivery of this item and to make any necessary changes in its employment and design.

6. Test of Distress Signals. (Confidential) In an effort to determine the relative merits of the HC AN-M8 smoke grenade and Mark 1 Mod 0 Naval hand distress smoke signal for use in life rafts as an aid in air-sea rescue activities, the 73rd Wing was directed to conduct tests covering; a. Immersion, b. Visibility, c. Duration of smoke signal, d. Safety.

The following results were obtained.

Characteristic	Mark 1 Mod 0	HC-AN-M8
a. Ability to withstand protracted immersion.	a. No misfires in 10 signals immersed in salt water 2 to 11 days.	a. 50% (approximately) misfires of grenades immersed 1-5 days, even in "waterproof cases".
b. Visibility of Smoke.	b. Dense orange smoke of 17 sec. duration; highly visible from aircraft against blue of sea; cannot be confused with whitecaps.	b. Dense white smoke of 2½ min. duration; highly visible in calm seas; not tested against a heavy sea with numerous whitecaps. but in that case probably would offer less contrast
c. Safety	c. Signals entirely safe to be used aboard life raft. Container becomes too hot to hold only after compound has burned out.	c. Grenades primer showers sparks dangerously Container cannot be hand held during firing. Both characteristics constitute serious hazard to crews and life raft.

d.	Spontaneous ignition when moist.	d. None observed in immersion tests.	d. None observed in immersion tests.
e.	Size and adaptability	e. Small size permits stowage of many signals in the raft, and adaptation to the small spaces between larger objects.	e. Greater bulk (especially in case) permits storage of two or at most three in the life rafts, and makes them demand large spaces.

Conclusions drawn by the 73rd Wing follow:

a. The Mark 1 Mod 0 Signal is equal to the HC AN/M-8 Grenade in

(1) Ability to withstand immersion.

(2) Safety.

(3) Adaptability.

b. The Mark 1 Mod 0 Signal is equal to the HC/M-8 Grenade in visibility.

c. The Mark 1 Mod 0 Signal is inferior to the HC/M-8 in duration, but considering the difference in size, about equal smoke is put out for equal volume occupied in packs.

It is planned to issue instructions that Mark 1 Mod 0 hand signals will be used in life rafts but that four (4) HC grenades will be placed in each A/C. Appropriate instructions will be issued by this headquarters at such time as Mark 1 Mod 0 signals are available for use.

7. B-29 Smoke Operations (Secret) Assembly of B-29 formations on proper lead aircraft has been a constant problem in our day light operations. The problem has been two fold: first, one of marking the assembly point, and second, one of identifying the lead aircraft. Smoke is being used in solving both phases of the problem. M47A2 WP filled bombs dropped from lead aircraft are being employed to mark the assembly point while a smoke generator designed and tested by the Chemical Section is being used to identify lead aircraft.

After extensive tests a procedure has been worked out for these smoke operations. Recommended procedures are that various group formation assembly points be identified by the number of smoke bombs dropped and by variations in fuze settings. For example one group may drop one M47A2 WP bomb fuzed to burst 8 seconds below the airplane. A second group may drop two bombs fuzed for 8 and 10 seconds. A third group may drop three bombs fuzed for 8, 10, and 12 seconds. The results of this procedure are that distinct smoke clouds are made in the sky and the number of clouds indicated the location of the assembly point.

Squadron lead aircraft are identified by expelling colored smoke from a specially constructed B-29 smoke generator which employs M-18 colored grenades. One squadron leader identifies himself by producing a red smoke trail. Another

one produces green smoke and still another lays out a trail of violet smoke. Thru these procedures aircraft are first guided to the group assembly point by M47A2 WP bombs and then are guided to the proper lead aircraft by means of colored smoke.

The Smoke Generator known in this command as the Lasse is manufactured from empty M-69 bomb cases containing M-18 colored grenades fired by means of electric squibs. The generator is mounted inside the fuselage in a manner which will permit the smoke to be expelled thru a tube extending from the photo electric cell hatch just aft of bulkhead 834 in B-29 aircraft. On the following page is a drawing showing essential construction details of this smoke generator.

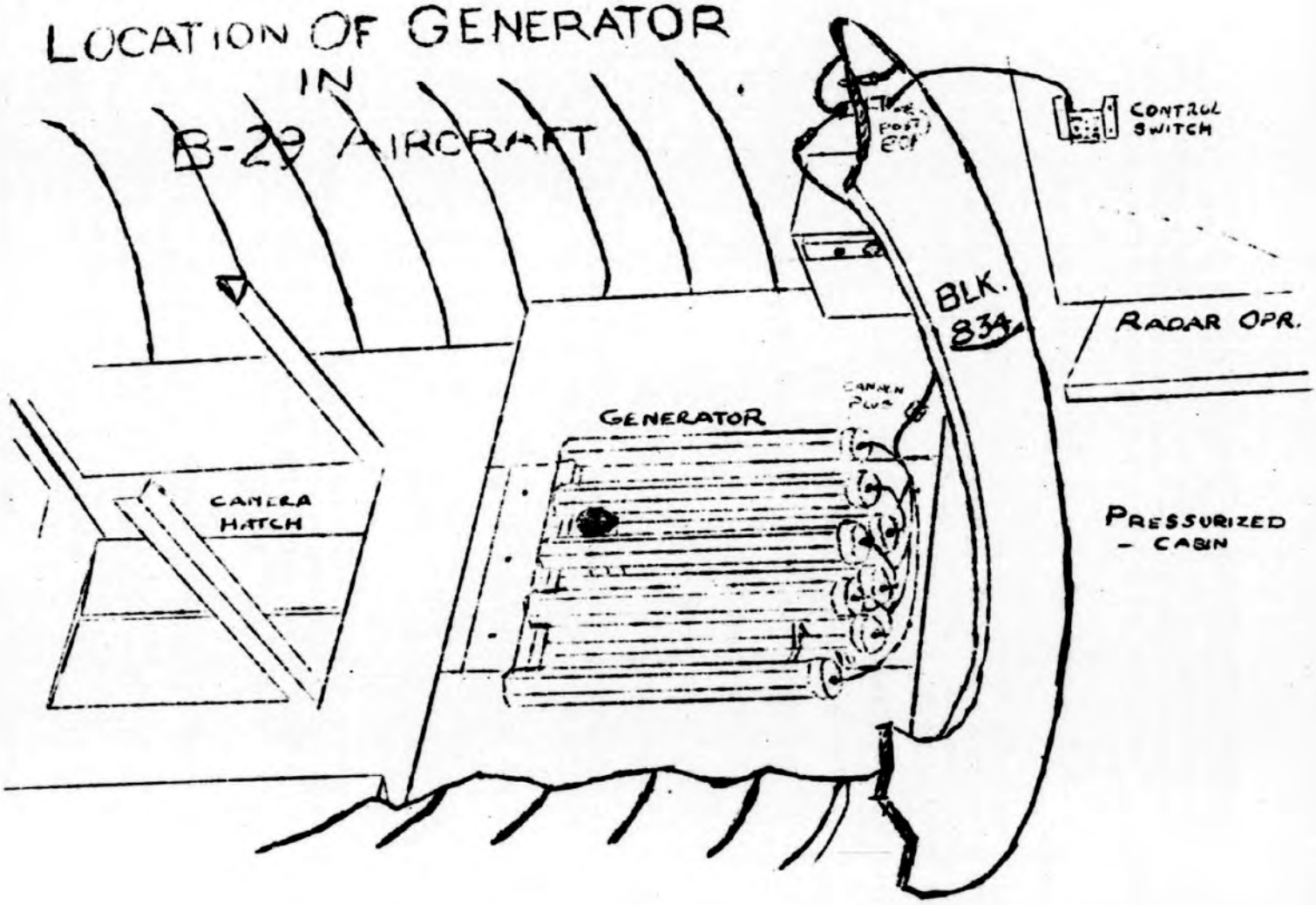
The lead aircraft smoke signaling equipment consists of eight chambers welded to a manifold such that a smoke mixture burned in each of the chambers leaves the apparatus thru a single exhaust. The chambers, manifold, and exhause, made from fired M-69 incendiary bomb casings, are fitted with steel screw plugs and a lead to permit the ignition of electric squibs from the aircraft power supply. Each chamber holds three modified M-18 colored smoke grenades, which, upon ignition by the squib, burn and produce smoke for approximately one minute. The electric circuit of the generator is such that two chambers are fired simultaneously permitting four separate releases from switches located on the Radar Operators panel.

Each of the twenty-four M-18 colored smoke grenades is modified by removing the Bouchon fuze, being careful not to arm the fuze during the process. With certain grenades the threads are frozen fast but the fuze may easily be removed by shearing the whole flange from the grenade body. After the removal of the fuze, an electric squib is inserted well into the fuze cavity and its lead wires are taped securely to the grenade body. Three grenades prepared in this manner are placed in a wire cage and the unit is inserted into a chamber. One wire is attached to the cage and the other lead from each squib, is connected to the terminal on the cap which is then screwed in place. The squib leads will have a tendency to kink or loosen as the cap is turned and extreme care must be taken to assure ample slack in the wires to prevent them from breaking or shorting during the process. Squib circuits will not be tested with a continuity tester or the squibs may be fired during the test.

The apparatus is installed directly aft of bulkhead 834 (the compression door leading from the C.F.C. cabin to the camera hatch.) Installation is possible on all aircraft employing the camera Photo-electric cell hatch (BAC modification 739 M) by removing the cell cover plate and hatch cover below the floor-board. The generator is fitted so that the exhaust pipe passes thru the cell cover and hatch cover to a point about one foot below the skin of the aircraft. The generator is mounted on a sheet iron plate which should just cover the center floor panel, and at the same time the exhaust should be well centered in the hatch cover opening.

It is possible to install or remove the Lasse from the aircraft by means of the cannon plug connection. However, the leads from the switches and the cannon receptacle are soldered to the plugs on either side of bulkhead 834. Thus the electrical installation is permanent. Leads 1, 2, 3, and 4 from the switch are soldered to any four vacant terminals of Post 3L on the pressurized side of the bulkhead. Similarly leads from the cannon recepticle are soldered

to the corresponding terminals of Post 3L on the aft side of the bulkhead. After these connections have been made the plugs should be re-taped to insure an airtight seal. A ground connection should be made between the aircraft and the terminal provided on the generator. A connection between the free termina of the circuit breaker and any source of 28 volt power completes the electrica installation of the Lasse. Time required for the initial installation will run between one and two hours and subsequent installation should be completed in ten minutes.



8. Incendiary Bomb Inspection Teams. (Restricted) The 73rd Wing has established an incendiary bomb inspection team composed of Chemical Officers from Air Service Groups, Chemical Companies, Air Operations, and Wing Headquarters. The purpose of this team is to insure that incendiary bombs are properly prepared, fuzed, armed and are in good condition. The procedures observed are as follows:

a. Each member of the team is assigned two squadrons for his inspection.

b. Information concerning the bomb load, arming and fuzing is given to team member in sufficient time to allow a complete inspection from the time the bombs are readied on the hardstands until they are loaded and fuzed in the airplane.

c. Team members check the following:

(1) Condition of bombs.

(2) Difficulties experienced in readying bombs before loading.

(3) Arming employed

(4) Suspension.

(5) Fuzing.

d. Any irregularities that are found are brought to the attention of the responsible armament or ordnance officer for immediate corrective action.

e. All planes scheduled to fly the mission will be inspected.

f. A report is submitted to the Wing Chemical Officer within 12 hours after the scheduled takeoff time giving the details of any irregularities found. The report includes unit, plane number, type of bomb and the irregularity found.

The results of these procedures are quite naturally, improved bombing results. Competition between bomb squadrons to do a perfect job of incendiary bomb handling is encouraged. The accumulative result is bound to be more properly functioning bombs on the assigned targets in the Japanese Empire.

9. Handling AN-M47A2 Incendiary Bombs (Restricted) Because of the large numbers of AN-M47A2 incendiary bombs being used by this command the entire handling operation from bomb dump to airplane demands careful study by Chemical Officers. Further study is needed to evaluate standard operating procedures which are fully compatible with all existing situations. The following problems and suggested solutions are presented on the basis of operating experience to date:

a. Storage Procedures: To facilitate access and air circulation in bomb storage revetments an aisle must be left between every second row of

boxed M47A2 bombs. Boxes are stacked on dunnage in straight rows. Component parts are stored separately in the nearest fuze hutment or other covered storage revetment. Fuzes should be stored separately from bursters and igniters. T-19 cluster adapters should be stored under cover with definite numbers being made easily accessible to bombs prepared for missions.

b. Mission preparations. A minimum of one maximum strength mission of bombs should be ready for immediate issue at all times. Preparing bombs for missions consists of the following operations accomplished by Chemical Companies, Air Operations:

(1) Removing the lid from the bomb box.

(2) Removing nose closure plug and adapter sleeve (if present).

(3) Inspecting bomb case, burster well, suspension lugs, and tail fin for defects.

(4) Performing any necessary surveillance.

(5) Inserting AN-M12 burster in burster well. (Or if the M-13 burster is used inserting first the AN-M9 igniter then the burster spring pushing the latter into the tail end of the igniter with the M-13 burster).

(6) Replacing nose closure plug.

(7) Replacing bomb in the packing box. (For deviations from this procedure see below.)

c. Storage of Prepared Bombs: Prepared bombs which are stored in packing boxes are stacked in neat rows so as to facilitate loading on bomb service trucks and trailers. It is a debatable question as to whether bombs will stand storage better in packing boxes or completely out of the boxes. In either circumstance the shipping bands must be left on the bombs so as to prevent damage to tail fins.

d. Transportation to Airplane: M47 bombs may be transported from the bomb dump to the airplane either in or out of packing boxes on bomb service trucks and trailers. When transporting bombs in packing boxes flat bed trucks and trailers may be used to advantage. During recent operations involving very large numbers of M47 bombs AAF C-2 wrecking trailers have been used to transport bombs to the line. If bombs are removed from packing boxes prior to transportation to the line great care must be taken to prevent damage to tail fins.

e. Loading of Airplane: In B-29 airplanes without bomb bay fuel cells the T-19 (M-24) cluster adapter is used to load 6 bombs on stations 2, 5, and 8 of each outside rack and 5 bombs on station 8 for a total of 184 bombs. In some aircraft a radio compass installation under the tunnel in the forward bay permits the loading of only 4 bombs on station 8. In airplanes containing one bomb bay fuel cell 92 bombs may be loaded in one bay as above while in the bay containing the fuel cell 6 bombs are loaded on station 2, and 3 bombs on station 5 for a total of 128 bombs. In all cases the center stub racks are removed. B-7 shackles must be used in all cases. Care must be taken to shim M-126A1 fuzes so that a straight pull is obtained on each arming wire thus eliminating hang-ups or broken arming wires.

II. AIR CHEMICAL TRAINING

10. Training Lessons Learned from "Blitz" Incendiary Operations. (Restricted) Maximum effort incendiary operations with several missions being staged in rapid succession are real proving grounds for the adequacy of offensive Chemical Warfare Training. Every individual concerned in these missions, whether he be a private in a chemical company, air operations or a lead crew bombardier, requires a certain amount of Chemical Warfare Training in order to efficiently perform his part of the job. During recent operations the following points on incendiary bomb training have been observed:

a. Thru experience in handling thousands of incendiaries, Chemical Companies, Air Operations have learned many lessons on procedures for unboxing and preparing incendiaries clusters, assembling component parts for bombs, loading bomb trailers, etc. These lessons must be passed on to all company members. If a man is doing the job the hard way he must be trained to do it the easy way. After correct methods have been determined these must be translated in terms of training lessons to all personnel concerned.

b. With a small amount of training, crews can easily load AN-M47A2 bomb with the T-19 cluster adapter. However, it has been observed that unless some preliminary instruction is received that loading crews not only experience difficulty in loading, but are also apt to make time consuming mistakes in the operation.

c. Personnel require training in the proper methods of hooking arming wires to shackles and fuzes. The proper shimming of fuzes and methods of computing settings and adjusting mechancial time fuzes needs to be emphasized. Arming malfunctions may be reduced to a minimum by proper training.

d. The removal of incendiary clusters from waterproof containers is apparently just so much hard work. However, there is a right way and a wrong way to perform this task. Clusters may be damaged and excess time may be spent on this job unless correct procedures are employed. Officers in charge of this operation should determine the most efficient methods to use and then carefully train their personnel in these methods.

e. Upon arriving in this command most Armament crews were expertly trained in loading GP bombs, but were almost totally unfamiliar with aimable incendiary clusters. These crews have now learned this job the hard way. Mistakes have been made and men have been injured and killed in loading operations. We must now make certain that all personnel are trained in proper loading methods for all incendiary clusters and bombs.

f. Pilots and bombardiers should be thoroughly familiar with the operating characteristics of incendiary bombs and clusters. For example, pilots must understand the importance of flying at briefed altitude to allow clusters to open at the proper altitude above the target. They also need to understand formation requirements for dropping AN-M47A2 bombs. Bombardiers should thoroughly understand the fuzing and arming of all incendiary munitions, ballastics, patterns obtained from clusters and the functioning of all types. Offensive Chemical Warfare Training is the answer to these problems and is bound to result in better bombing.

Chemical Officers must be thoroughly trained in all phases of incendiary warfare. They must thoroughly understand all technical details of handling, storing maintaining, preparing, transporting, loading, arming, fusing, and employing incendiary bombs and clusters. In addition they should be entirely familiar with the bomb bay of a B-29 with special emphasis on the use of various rack and station combinations in the loading of incendiary bombs and clusters. Again the answer is training.

11. Bombardiers CWS Training Check List (Restricted) The Bombardier is the bombing leader of each combat crew. Once a bomber takes off on a mission it is the bombardier who must be depended upon to handle all situations that may arise pertaining to bombs and bombing. The following is a check list which may be used as a guide in the planning of Offensive Chemical Warfare Training for Bombardiers:

a. Bombs - description, use, and functioning of:

(1) M69, M69X, M74, M50 series, M47A2, M76 and 55 gallon oil drum incendiary bombs.
(2) M77 (HC filled) and M47A2 WP filled smoke bombs.
(3) M70, M47A2, M78 and M79 Chemical bombs.

b. Grenades - description, use and functioning of:

(1) M-3 Red grenades
(2) M-8 White grenades
(3) M-15 WP grenades
(4) M-18 Colored grenades

c. Clusters - description, use and functioning of:

(1) E28, E36, E46, and E48 incendiary clusters
(2) T-19 (M-24) Cluster adaptor
(3) E69 smoke cluster

d. Fuzes - description, use and functioning of:

(1) M101 and M103 series fuzes used on M76 incendiary bombs.
(2) M-1 and M3 fuzes used on M69 and M74 bombs.
(3) M126A1 fuzes used on M47A2 bombs.
(4) All mechanical time fuzes used on incendiary clusters and on air burst M47A2 WP filled bombs.

e. Flight preparations

(1) How to check arming wire installations and fuze settings.
(2) How to pull car seal wires and safety pins.

f. Use of smoke:

(1) Use of smoke grenades in air-sea rescue activities.
(2) Use of B-29 smoke generator.
(3) Employment of M47A2 WP bombs in laying smoke screens.

12. C&S Training for Advanced Bases. (Restricted) As the war draws closer to Japan the Air Forces can expect to occupy bases which are within range of Nipponese aircraft operating from the homeland. There is the ever present possibility that these aircraft may be used to lanch gas attacks upon forward bases. A large measure of our defense against these attacks must be in the form of personnel properly trained in what to do, how to do it, when to take action and why the action is necessary. Personnel going to forward bases should be given a brief training review in gas defense. Recent exercises of this kind conducted at Bomber Command headquarters indicate that individual protective equipment may be checked and a gas defense drill may be conducted at the same time. The following points should be stressed:

a. Fit of mask and ability to adjust is tested in gas chamber.

b. Use of protective cover, shoe impregnite, ointment, and eye shields is demonstrated.

c. Individual protective equipment is checked including:

(1) Mask

(2) Carrier

(3) Two protecitve covers

(4) One can shoe impregnite M-1

(5) One tube M-5 ointment

(6) Two Eye shields

III. AIR CHEMICAL SUPPLY

13. Supply and Conservation of Napalm. (Restricted) Chemical Companies, Air Operations are now storing and handling large quantities of Napalm. As the supply of Napalm is still critical it is essential that handling and storage operations be carefully supervised. The Air Chemical Officer has recently emphasized the following points on the conservation of Napalm.

a. Napalm is a mixture of aluminum hydroxy soaps of complex organic acids obtained from petroleum, vegetable, and animal fat sources. Fats and similar products are in short supply, and every effort should be made toward the conservation, both of the fats, and of their derivatives. Napalm should not be wasted.

b. Naphthenic acids comprise a complex mixture of organic acids, generally unknown in composition, which occur in the crude oils pre-

dominating in naphthenic hydrocarbons. Naphthonic acids are the source of one of the principal components of Napapm aluminum soaps, and, since the acids themselves vary widely in composition and physical properties, the soaps made from them will likewise vary in properties. This is even more true for the soaps made from vegetable and animal sources of organic acids, which are also subject to the additional effects of oxidation and decided variations in the unsaponifiable matter.

c. The information disclosed in the above two paragraphs accounts for the wide variations in physical properties of Napalm shipments. Acids from some sources make light colored Napalm, while others make darker Napalm. There will always be different shades, varying from creamy white, thru khaki and brown; some are quite dark in color due to impurities and unsaponifiable matter. Some Napalms will be sticky, so that they will ball when squeezed in the hand, even when dry. In general, these will be more dense and will occupy less volume in the container after transporting than the dry Napalms which are less dense and less sticky. The fluffy Napalms may occupy the full container volume even after considerable agitation during transportation. These differences in color, texture, etc., are not included in the specifications since they do not affect operational use; but, the setting rates in gasoline do vary with the Napalm characteristics. Once gelled, however, it is to be expected that the fuel would be completely satisfactory.

d. Reference is made to mimeographed letter from this office, file 470.6 (Napalm) dated December 1944, subject: "The Effect of Water on Napalm Thickened Fuels," paragraph 4 of which is quoted below:

"In addition to the effect of moisture on Napalm, various grades and sources of gasoline will also affect the Napalm mixture and mixing time, as well as the various sources of Napalm manufacture. With all these factors affecting the consistency of the finished gel and without available information upon which a decision could be based, it is necessary that a simple test be made to forecast whether or not a satisfactory gel will be made. The best test available is actually to mix several drums under the conditions of operation and observe the gel after 24 hours storage. Using 6.1% Napalm in gasoline, by stirring 15.75 pounds of Napalm into 40 gallons of gasoline, the gel should not be pourable out of the closure opening of an "American" (5 gallon "Blitz can" with a 2 inch screw-type drum closure) after 24 hours of storage. This test should be made with each lot of Powdered Napalm, and source of gasoline, as well as with each material change of the weather. No Xylenol should be used in the test because its use gives erratic results. A 6.1% gel is the optimum. Increased percentages of Napalm usually result in stiffer gels. Very stiff gels with concentrations of Napalm over 8% are to be avoided if possible. However, if the conditions of operation and materials supplied fail to make a 6.1% gel which will not be pourable from an "American" after 24 hours, then increased amounts of Napalm should be used up to the point where gels which meet the test are made."

e. Since all wet or damp Napalm will be sticky, so that it will ball when squeezed in the hand, and, yet many dry Napalms behave the same way, it is difficult to determine whether or not a Napalm is sticky because of its specification and natural characteristics, or, because of an excessive water content. Hence, the "Blitz can" test of paragraph 4 should always

be made when a doubt exists. The corrective measures should be practiced prior to any salvage decision or recommendation for its discard.

f. If a Napalm is too wet for fire-bomb use, it can be completely recovered by drying for four hours at 160 degrees Fahrenheit, and then repackaged in moisture proof metal containers.

g. The disposition of surplus Napalm should be handled in accordance with the provisions of War Department Circular No 379 dated 19 September 1944.

14. Supply of Smoke Grenades.(Restricted) In normal operations in this theatre smoke grenades are considered an item of ground ammunition and are supplied thru the Island Command ground ammunition depots. However, because of the large numbers of smoke grenades now being used in B-29 operations these items will now be supplied in the same manner as other air ammunition. Chemical Companies, Air Operations will receive, store and issue M-3, M-8, M-15, and M-18 smoke grenades. Bomber Command headquarters has established necessary requirements and shipping schedules.

15. Packing of T-19 (M-24) Cluster Adapter (Restricted) The Air Ordnance Office has indicated that two types of packaging are being used for T-19 (M-24) cluster adapter. Sixteen adapters are packed in a wooden box. Total weight of this type of box is 50 pounds and volume is 2.2 cubic feet. In order to save weight on air shipment a second type of packaging consisting of a cardboard box with metal strapping will also be used.

16. Storage of FS Smoke Mixture. (Restricted) FS smoke mixture Chlorsulfonic Acid) is being shipped to each Air Chemical Ammunition Depot as a filling for T-8 Skymarker bombs. FS is shipped in standard 55 gallon drums equipped with venting and filling plugs. Chemical Companies, Air Operations should observe the following factors in handling and storage of this chemical agent:

a. Chlorsulfonic Acid produces painful burns on the skin. Skin burns should be washed with water and then with sodium bicarbonate solution. Later treatment should be employed for other burns. If any of the acid gets into the eye large amounts of water should be used.

b. Chlorsulfonic Acid is not a fire hazar , but may cause fires by coming in contact with combustible materials. In contact with water, chlorsulfonic acid decomposes with explosive violence forming sulfuric and hydrochloric acids. Water should never be allowed to get into containers which contain chlorsulfonic acid.

c. A shaded area is desirable, whenever possible, for storage. The most practical method of storage is to place one layer of drums on rails raised above the ground to a height equal to that of the bed of a 2½ ton truck.

d. FS will build up pressure in storage, therefore periodic venting of drums is necessary. The following procedure will be observed in venting FS filled drums:

(1) Personnel engaged in the operation will be protected with a gas mask, rubber gloves and rubber apron.

(2) Drums should be inspected monthly. Pressure may be detected by placing a straight edge approximately 30 inches long on the drum and inspect the head for bulging.

(3) A bulging head indicates a building up of pressure. If the head of the drum at its center is closer than 1/16 inch to the straight edge the pressure must be released.

(4) In relieving pressure, first stand the drum on end with the plugs up. Relieve the pressure in the drum by loosening slowly one of the plugs on the head with a plug tightening wrench. Loosen the plug sufficiently to allow all internal pressure to be released. The plug may be protected while loosening by covering the wrench head and the plug with a large tin can or a cloth. In addition the operator should stand as far away from the plug as possible.

DISTRIBUTION:

30 Chemical Section XXI Bomber Command
1 Chemical Officer 73rd Wing
1 Chemical Officer 313th Wing
1 Chemical Officer 314th Wing
1 Chemical Officer 315th Wing
1 Chemical Officer 58th Wing
4 870th Chemical Company AO
4 887th Chemical Company AO
4 813th Chemical Company AO
4 891st Chemical Company AO
4 802nd Chemical Company AO
4 890th Chemical Company AO
1 792nd Chemical Depot Company Avn
2 Air Base Chemical Officer 73rd Wing
2 Air Base Chemical Officer 313th Wing
2 Air Base Chemical Officer 314th Wing
2 Air Base Chemical Officer 315th Wing
2 Air Base Chemical Officer 58th Wing
2 Air Base Chemical Officer XXI Bomber Command Combat Staging Center(Prov)
1 Air Base Chemical Supply Officer XXI BC Combat Staging Center (Prov) APO 86
1 Air Base Chemical Supply Officer 73rd Wing
1 Air Base Chemical Supply Officer 313th Wing
1 Air Base Chemical Supply Officer 314th Wing
1 Air Base Chemical Supply Officer 315th Wing
1 Air Base Chemical Supply Officer 58th Wing
1 Chemical Officer, AAFPOA APO 234
1 Chemical Officer, AAFPOA (Admin)
1 Air Chemical Officer, Washington, D.C.
1 Headquarters 20th Air Force
1 Chemical Officer 7th Air Force
1 Chemical Officer Air Depot APO 246
1 Chemical Officer, 20th Bomber Command
1 Chemical Officer CBI Air Service Command

1 Chemical Officer, Far Eastern Air Force
1 Chemical Officer, HUSAFPOA
1 Chemical Officer, CPBC
1 Chemical Officer, WPBC
1 Chemical Officer, AGF APO 244
1 Chemical Officer, AGF APO 246
1 Chemical Officer, AGF APO 247
1 Chemical Officer, 7th Fighter Command, APO 86
2 Chemical Officer, 2nd Air Force
2 Chief, Chemical Warfare Service
1 Chemical Officer, AGF APO 86