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NOTES
ON SIGNAL AND ILLUMINATING DEVICES AND THE APPARATUS FOR PROJECTING THEM

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WAR DEPARTMENT,

WASHINGTON, *May 23, 1917.*

The following notes on signal and illuminating devices and the apparatus for projecting them are published for the information of all concerned.

[2605615, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

TASKER H. BLISS,
Major General, Acting Chief of Staff.

OFFICIAL:

H. P. McCAIN,
The Adjutant General.

NOTES ON SIGNAL AND ILLUMINATING DEVICES AND APPARATUS FOR PROJECTING THEM.

The various devices for signal and illuminating purposes are classified as follows:[1]

I. SIGNAL DEVICES.

A. ROCKETS AND SIGNAL CARTRIDGES—

Rockets.	Cartridges for the—		
	V.-B. gun.	25-mm. pistol.	35-mm. pistol.
Large white stars	White parachute		
Large red stars	Red parachute	Red stars	
Large green stars	Green parachute	Green stars	
Do	1 star	Illuminating, without parachute.	1 star.
Do			2 stars.
Do	3 stars	3 stars	3 stars.
Do	6 stars	6 stars	6 stars.
"Chenile" (a caterpillar rocket).	Chenile	Chenile	Chenile.
Red smoke	Red smoke	Red smoke	Red smoke.
Yellow smoke	Yellow smoke	Yellow smoke	Yellow smoke.
"Drapeau" (flag)			

B. BENGAL LIGHTS.—White and red, 30 seconds.

[1] This list will be changed from time to time to keep pace with the development and manufacture of new devices. The devices and projecting apparatus now in use are the following:

1. SIGNAL DEVICES.

The signal rocket with large stars, white, red, and green; signal cartridge for the 25-mm. pistol, white, red, and green; signal cartridge for the 35-mm. pistol (1, 2, 3, and 6 stars), white, red, and green, for aviation use; Bengal lights (white, 3 minutes, 90 seconds, and 30 seconds; red, green, and yellow, 30 seconds).

II. ILLUMINATING DEVICES.

Illuminating rocket (flare) of 27 and 34 mm.; illuminating cartridge, with or without parachute, for a 25-mm. gun; and illuminating grenades, 1 minute.

III. PROJECTING APPARATUS.

Signal pistols of 25 and 35 mm.; signal rifle of of 25 mm. for illuminating cartridge; and stand for firing rockets.

II. ILLUMINATING DEVICES.

A. ROCKETS.—34-mm. rockets.

B. CARTRIDGES.—The cartridges classified as illuminating devices are the white parachute, V.-B.; the one star, V.-B.; and the illuminating cartridge, without parachute, for the 25-mm. pistol.

C. BENGAL LIGHTS.—White, 30 seconds.

The projecting apparatus for illuminating devices are the 25-mm. signal pistol; the 35-mm. signal pistol; the V.-B. grenade gun, and the rocket tube.

I. SIGNAL DEVICES.

A. SIGNAL ROCKETS—

DESCRIPTION.

A rocket is composed essentially of a cartridge and rocket head forming the rocket proper, and a rocket stick.

The cartridge and rocket head are in one piece and this piece is fastened to the rocket stick when required for firing.[1]

The cartridge consists of a cardboard packing case containing the necessary propelling charge to give the desired upward course through the air.

The following are the functions of the principal features of this rocket:

The lighting fuse at the lower end is protected by a brass hood; outside of this there is a metal cap covering the lower end (hence the lighting fuse), which is designed to insure the tamping of the device. To remove this cap and uncover the fuse, it is only necessary to pull the loop of string which is normally folded and secured alongside the cartridge. The socket for the rocket stick [2] is a sort of sectional steel tube, square at one end and rectangular at the other, designed to support the beveled end of the rocket stick. A spring-blade with clips prevents the rocket stick from falling out of the socket. A compartment [3] containing the smoke producing charge which is lighted at the same time as the propelling charge, and indicates by its train of smoke the course of the rocket, making it possible to locate the point of explosion.

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[1] It is always necessary, however, in spite of the fact that the rocket and stick may be very rapidly assembled, to keep a few of these devices assembled ready for firing.

[2] The old-style device did not have this socket.

[3] The old-style device did not have the smoke pot compartment.

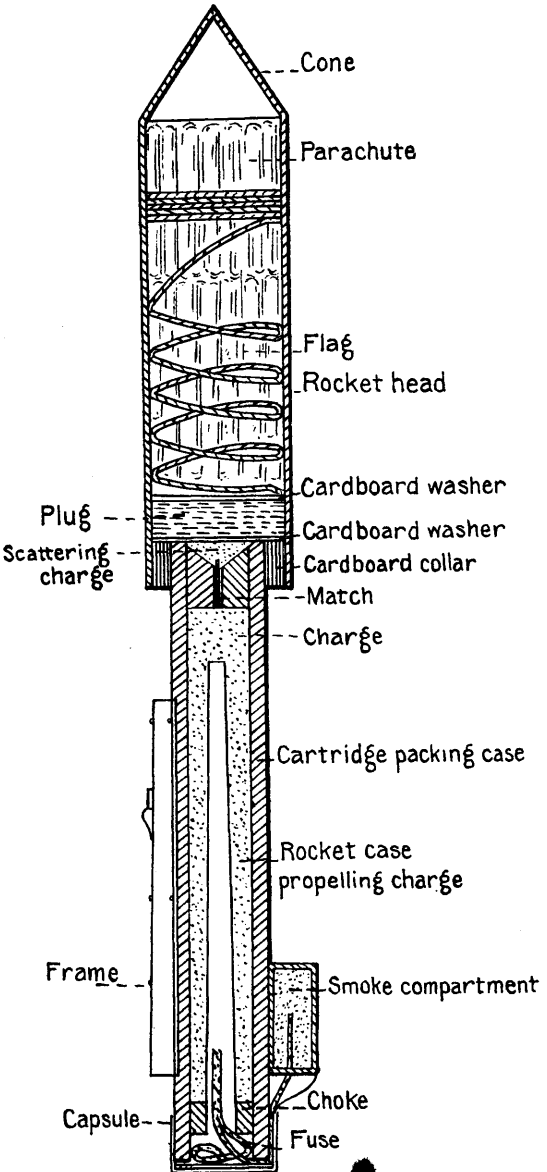


FIG. 1.—Cross section of flag rocket.

The **rocket head**, surmounting the cartridge and ending in a cone, incloses the signal (white or colored stars, "Chenille," smoke, "Drapeau," etc.). The **bursting charge** is placed between the propelling charge and the signal; this is a small powder charge designed to expel the signal from the head (i. e., discharge it) after lighting it, if necessary. The wooden **rocket stick** is designed to give the rocket its direction. It is beveled at one end in such a way as to permit its adjustment to the socket. Figure 1 shows a cut of a flag (drapeau) rocket.

TO FIRE THE ROCKET.

1°. **Attach the rocket stick.**—Insert the stick into the socket, beveled end first, as far as it will go, testing its firmness by pulling in the opposite direction.

2°. **Uncap the rocket.**—Hold the case firmly in the left hand and with two fingers of the right hand give a quick pull on the loop of string running the length of the rocket. This unfastens the metal cap and uncovers the fuse, which is still protected by the small brass hood.

3°. **Place the stick in the firing trough,**[1] which is set at an angle nearly vertical.

4°. **Light the fuse.**—Remove the small brass hood which protects the fuse; rub the fuse quickly but lightly with the friction brush [2] and retire a few paces to the rear or side immediately. The rocket is fired 5 to 6 seconds after the fuse is lighted. In case of failure to ignite, disengage the end of the fuse from the copper ring which surrounds it, cut it obliquely and light it with a match or tinder-box fuse. The fuse having ignited the propelling charge, the escape of the liberated gases to the rear causes the forward movement which is controlled in its flight by the stick of the rocket.

The burning of the cartridge composition ignites the bursting charge, which in turn releases the signal from the rocket head after having lighted it (as in the case of a light or smoke signal). In some devices the signal is held in air after having been released by means of a parachute.

Rocket head, cartridge and stick prolong their trajectory and fall farther on.

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[1] The firing trough, which has replaced the rocket stand, consists of a metal tube, pointed at one end to facilitate driving it into the ground (a wedge will help fix it more firmly). A small hinged door allows the stick to be inserted laterally into the tube.

[2] A number of friction brushes are packed in each case of rockets.

TYPES OF SIGNAL ROCKETS.

The various types have already been enumerated on page 1.

These rockets are visible by day or night excepting the red smoke, yellow smoke, and flag rockets, which are visible only by day. All, except star rockets, have parachute attachments.

B. SIGNAL CARTRIDGES FOR THE VIVEN-BESSIERES (V.-B.) TRENCH GUN.

DESCRIPTION.

The signal cartridge for the V.-B. trench gun consists of a steel case [1] containing the signal device and its igniting arrangements.

Figure 2 shows a cut of a white, red, or green signal cartridge, with parachute.

The principal features are as follows:

The swaging at the base, resulting in a slightly greater diameter than the body of the cartridge; the firing pin; the primer, containing the cap and a delay-action fuse with a burning time of 4 seconds; the wooden disk supporting the primer; the bag of black powder designed to propel the device itself after having ignited it by means of a quick match (yarn dripped in alcohol and mealed powder); the signal device itself with the parachute. Figure 2 shows a parachute cartridge, but the parachute is not included in all types of V.-B. signal cartridges; a blank cartridge for firing the signal cartridge from the V.-B. gun is attached to the signal cartridge by means of a metal hook.

FIRING THE CARTRIDGE.

1°. **Separate the blank cartridge** from the signal cartridge by hook which connects them and throw the hook away.

2°. Insert the signal cartridge into the discharger, **large end first,** the discharger having been previously placed on the muzzle of the rifle.

3°. **Load the rifle** with the blank cartridge. **Never use a ball cartridge.**

4°. Fire, with the rifle held almost vertical. The immediate effect is to project the signal cartridge about 100 meters into the air and simultaneously to start the fuse. In reality the shock of the gases generated by the blank cartridge against the base of the signal cartridge caused the firing pin to strike the cap, which is thereby exploded and in turn ignites the slow match. It is so devised that the slow match ignites the bursting charge at about the same instant

[1] Painted yellow to prevent rust.

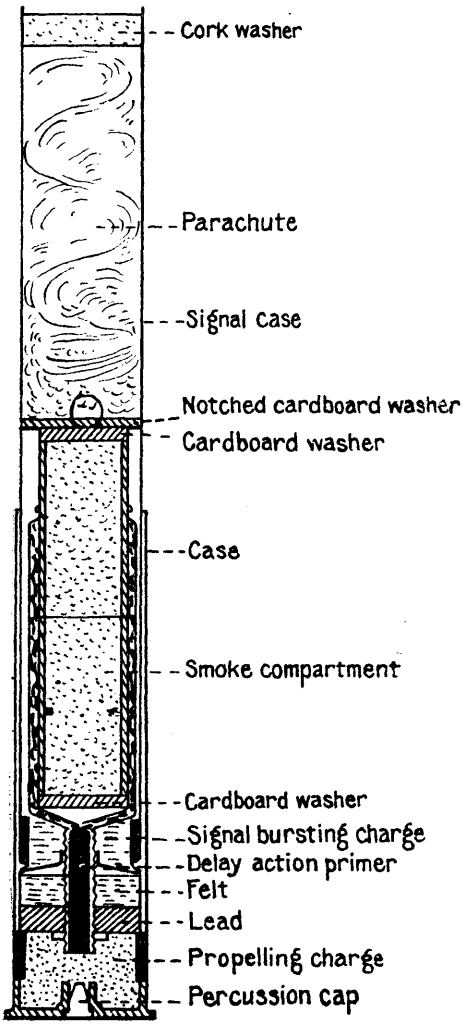


FIG. 2.—Cross section of signal cartridge for 25-mm. pistol (with red or yellow smoke).

as the signal cartridge reaches the highest point in its trajectory. The bursting charge in exploding releases the signal, which then appears while the empty case continues its course.

TYPES OF SIGNAL CARTRIDGES FOR THE V.-B. TRENCH GUN.

The various types of signal cartridges for the V.-B. trench gun are enumerated in the table on page 5. All these devices are visible by day and night, excepting the red and yellow smoke cartridges, which are visible only by day. All are provided with parachutes, except the one, three, and six star cartridges. Among these cartridges, which are primarily intended for signaling, there are two which may also be used for illuminating purposes, viz, the white parachute and the one-star cartridges.

Those signal cartridges suitable for night use have distinguishing marks on the upper part. (See table: Characteristics of devices and projecting apparatus.)

C. SIGNAL CARTRIDGES FOR THE 25-MM. PISTOL.

DESCRIPTION.

Signal cartridges consist of a cardboard or metal case containing a fulminate capsule and a charge designed to propel the signal case.

A signal case consisting of:

(*a*) A cardboard cylinder containing the (red or green) star for the red or green cartridges. A quick fuse in contact with the bursting charge which fires the signal.

(*b*) For the cartridge without parachutes, which may be used for illuminating purposes the signals are multiple lights and smoke composition contained in a metal cylinder which also carries the retarding primer, the bursting charge and the signal. On firing, the cylinder is forced forward and the retarding primer is ignited, followed about three seconds later by the ignition of the bursting charge which produces the explosion and lights the signal.

Figure 3 shows the cut of a (red or yellow) smoke cartridges.

FIRING THE CARTRIDGE.

With the 25-mm. bronze, breech-loading pistol the arm is pointed almost vertically.

TYPES OF SIGNAL CARTRIDGES FOR THE 25-MM. PISTOL.

Various types of signal cartridges for the 25-mm. pistol are shown in the table on page 5.

All these devices are visible by day or night, except the yellow and red smoke cartridges, which are only visible by day. These last two are provided with parachutes.

The illuminating cartridge without parachute, although classified with the signalling devices is chiefly used as for illuminating pur-

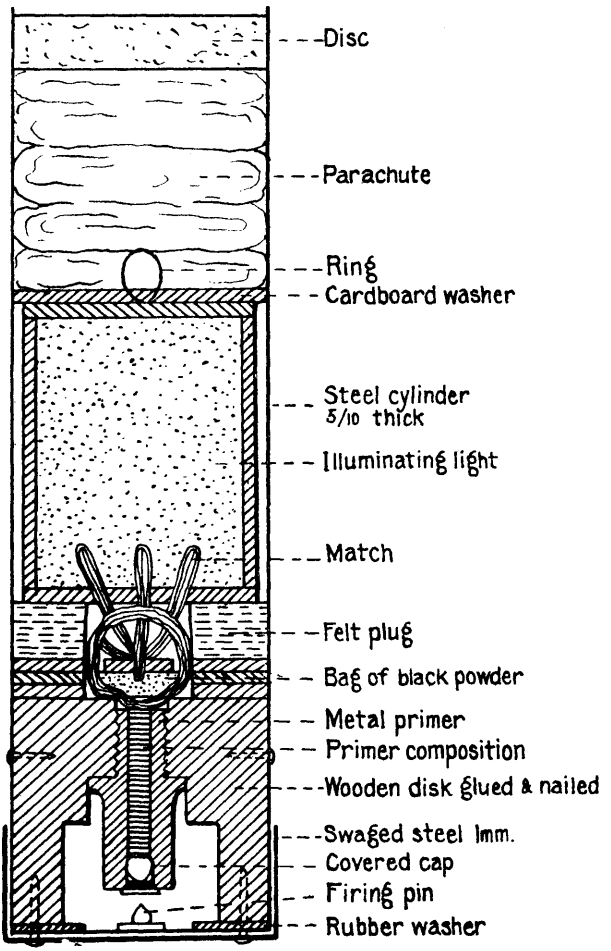


FIG. 3.—Cross section of signal cartridge for V B. discharger (white, red, and green with parachute).

poses. The star is lighted about 50 meters from the firing point and burns over its entire trajectory (about 6 seconds). Its fall is

retarded by a peculiar twisting motion which is caused by a special arrangement.

Those signal cartridges suitable for night use have distinguishing marks on the upper part. (See table: Characteristics of devices and projecting apparatus.)

D. SIGNAL CARTRIDGES FOR THE 35-MM. PISTOL (AVIATION).—These cartridges are similar to those used for the 25-mm. pistol.

E. BENGAL LIGHTS.

Bengal lights are made in white and red. They consist of cardboard cylinders,[1] covered with black varnish and parafined, containing the illuminating composition.

Ignition is caused by a Bickford fuse, one end of which is set in a small leather tube filled with a special igniting charge, which is fired by a friction brush, or, if this method fails, by an ordinary match or tinder box.

II. ILLUMINATING DEVICES.

A. ILLUMINATING ROCKETS.

The illuminating rocket is similar to the signal rocket. It has not, however, the smoke compartment, by which its course is marked. The method of firing is the same as for signal rockets except that the firing trough should be pointed toward the area to be illuminated and driven into the ground at the proper angle so as to send the rocket in the desired direction. An angle of 45° to 50° is found to be the best for securing the proper trajectory and point of explosion of the rocket to give the best illumination of the terrain.

B. ILLUMINATING CARTRIDGES.

The cartridges noted under the heading "Devices for Signaling," which may be used for illuminating purposes are the white parachutes (30 seconds) and the one star (10 seconds) for the V.-B. trench gun and the illuminator cartridge, without parachute (6 seconds), for the 25-mm. pistol.

C. BENGAL LIGHTS.

The white Bengal light (30 seconds) noted under heading "Devices for Signaling" is to be used in place of the old-fashioned illuminating grenade.

[1] The manufacture of Bengal lights in spherical form (like the old-fashioned illuminating grenade) is now the subject of experiment.

III.—CHARACTERISTICS OF DEVICES AND PROJECTING APPARATUS.

Devices and apparatus.	Length.	Weight.	Height of explosion or range.[1]	Duration of visibility or illumination.[1]	Distinguishing marks.	Remarks.
Rockets.						
	Mm.	*Grams.*	*Meters.*	*Seconds.*		
Large star rockets (white, green, or red)	413	625	300 to 400	15	Band of color.	
		Kg.				
"Chenile" (caterpillar) rocket	600	1,180	300 to 400	20 to 25	Inscription on tag wrapped around rocket head.	
Red smoke rocket	600	1,100	300 to 400	20		
Yellow smoke rocket	600	1,125	300 to 400	20		
Flag rocket	650	1,145	300 to 400			
34-mm. illuminating rocket	630	1,150	400 to 500	30		
Cartridges, V.-B.						
		Grams.				
White parachute	165	380	[2] 100	25 to 30	O.	Marked in relief.
Red parachute	165	360	100	25 to 30	R.	
Green parachute	165	325	100	25 to 30	V.	
One star	110	250	100	10	*	
Three stars	110	255	100	5 to 6	* * *	
Six stars	110	230	100	5 to 6	* * * * * *	
"Chenile" (caterpillar)	165	325	100	20 to 25	* * * * * * *	
Red smoke	165	310	100	10 to 20	Inscription on the red paper seal pasted over stopper.	
Yellow smoke	165	330	100	10 to 20	Inscription on the yellow paper seal pasted over stopper.	

25-mm. cartridges.						
Red	100	60	60	5 to 6	R.	Marked in relief.[3]
Green	100	60	60	5 to 6	V.	
Illuminating, without parachute	100	68	60	6	*	
Three stars	175	158	60	5 to 6	* / * *	
Six stars	175	155	60	5 to 6	* / * * / * *	
Red smoke	195	185	60	10 to 15	Head varnished and marked in red.	
Yellow smoke	195	195	60	10 to 15	Head varnished and marked in yellow.	
35-mm. cartridges.						
One star	130	225	50	10	*	Marked in relief.
Two stars	130	210	50	9	* *	
Three stars	165	260	50	8	* / * *	
Six stars	165	280	50	5	* / * * / * *	
"Chenile" (caterpillar)	165	160	50	20 to 25	* / * * / * * * * * * *	
Red smoke	165	145	50	10 to 15	Tag at the base. Plug painted red.	
Yellow smoke	165	155	50	10 to 15	Tag at the base. Plug painted yellow.	
Bengal lights.						
White	60	170	.....	30		Band of color.
Red	60	130	.....	30		

[1] Approximate figures which may vary with the same device according to circumstances. Height of explosion if aimed vertically (signals). Range, if fired at an angle of 45 degrees (for illuminating devices).

[2] Range: If fired as illuminators at an angle of 45 degrees, increase to 150 to 200 meters.

[3] The following exceptions may be found in supplies of 25-mm. cartridges: Red cartridges, red paper disk pasted on. Green cartridges, green paper disk pasted on. Illuminating cartrigdes without parachute, white paper disk pasted on. Three-star cartridge, one tack head projecting from the circular plug or disk. Mark "Signal 3." Six-star cartridge, two tack heads projecting from the circular plug or disk. Mark "Signal 6."

III.—CHARACTERISTICS OF DEVICES AND PROJECTING APPARATUS—Continued.

Devices and apparatus.	Length.	Weight.	Height of explosion or range.	Duration of visibility or illumination.	Distinguishing marks.	Remarks.
Projecting apparatus.	*Mm.*	*Grams.*	*Meters.*	*Seconds.*		
25-mm. pistol [1]	195	940				
		Kg.				
35-mm. pistol	227	1,150				
Rocket firing trough	1	2,500				
		Grams.				
Rocket stick	1	160				

[1] The caliber of the 25-mm. pistol is actually a trifle more than 25-mm. (26.6 to 26.7 mm.).

IV. METHODS OF PACKING AND PRECAUTIONS TO BE OBSERVED IN HANDLING SIGNAL AND ILLUMINATING DEVICES.

A. ROCKETS.

Rockets are shipped in cases of 30 [1] (100 white, red, or green large star rockets). Each case also contains a package of friction brushes for igniting fuses, or 0.5 m. of time fuse (slow match) and one package of quick fuses.

The packing case is made of wood, with handles, and has an inner case of tinplate fitted with a sliding lid and painted with a waterproof coating. The case is marked on both sides with the number and type of rockets contained therein, the manufacturer's mark, and the lot number and date of manufacture.

	Case of 30 rockets (100 large star rockets).		
	Weight empty.	Weight packed.	Dimension (meters).
	Kilograms.	*Kilograms.*	
Flag rocket	18	53	0.75 by 0.47 by 0.45
Illuminating rocket [1]	.....	52	
"Chenile" rocket	17	53	0.70 by 0.38 by 0.45
Red or yellow smoke rocket	.....	50	
Large star rocket	25	90	0.63 by 0.42 by 0.55

[1] Illuminating rockets are occasionally packed in cases of 50.

PRECAUTIONS TO BE OBSERVED IN HANDLING ROCKETS.

Store the cases flat, right side up, and keep as dry as possible. In handling avoid shocks which might effect the charge and cause explosion.

Rockets which are prepared for firing in advance of their use should be protected by being covered with well-made sand bags. At storehouses and depots cases should be stacked and distributed as far as possible according to lots, using the oldest first. Rockets are manufactured in lots of 3,000.

B. SIGNAL CARTRIDGES FOR V.-B. TRENCH GUNS.

These cartridges are shipped in cases of 30. Each case also contains two extra blank cartridges for use in case of misfire. The packing case is of wood, with handles, but not lined. It is marked in

[1] Each case of rockets is accompanied by a bundle of rocket sticks.

black paint on two sides with the number and type of cartridges contained therein, the manufacturer's mark, and the lot number and date of manufacture.

	Cases for 30 V.-B. cartridges.		
	Weight, empty.	Weight, packed.	Dimensions (meters).
	Kg.	*Kg.*	
One, three or six light cartridges without parachute...	6.5	13.5 to 14.2	0.61 by 0.22 by 0.16
White, red, green, Chenile or smoke cartridges with parachute.....	7.5	16.9 to 19.0	0.61 by 0.22 by 0.22

PRECAUTIONS TO BE OBSERVED IN HANDLING V.-B. CARTRIDGES.

Store the cases flat, right side up, and keep dry as far as possible. As the V.-B. signal cartridges operate by percussion, the case should be handled with care and not be allowed to drop.

At the storehouses and depots the cases should be stacked and distributed as far as possible according to lots, using the oldest first. These cartridges are manufactured in lots of 3,000 (30 full cases).

C. SIGNAL CARTRIDGES FOR 25-MM. PISTOLS.

The case is of wood with handles and an inner lining of tin-plate fitted with a sliding cover and painted with a waterproof coating. The case is marked in black paint on both sides with the number and type of cartridges contained therein, the manufacturer's mark and the lot number and date of manufacture.

	Number.			Cases for 25-mm. cartridges, signals.		
	Cartridges.	Boxes.	Packages.	Weight, empty.	Weight, packed.	Dimensions.
				Kg.	*Kg.*	*Meters.*
Illuminating cartridges (red or green).....	[1] 300	30	.....	14.40	32.9 to 35.3	0.66 by 0.38 by 0.19
Three and six light cartridges.....	150	25	.....	13.20	36.8 to 37.3	0.56 by 0.39 by 0.25
Red or yellow smoke cartridges.	150	.....	15	10.90	38.7 to 40.3	0.72 by 0.32 by 0.19

[1] Red and green cartridges are sometimes packed in cases of 500 and illuminating cartridges in cases of 200.

PRECAUTIONS TO BE OBSERVED IN HANDLING 25-MM. CARTRIDGES.

Store the cases flat, right side up and keep them dry as far as possible. These are percussion cartridges and care should be taken when handling not to let the cases drop.

At storehouses and depots the cases should be stacked and distributed according to lot, using the oldest first. These cartridges are manufactured in lots of 5,100.

D. SIGNAL CARTRIDGES FOR 35-MM. PISTOL.

The case is of wood, without lining and contains six boxes of 24 cartridges each. The case is marked in black paint on both sides with the number and type of cartridges contained therein, the manufacturer's mark and the lot number and date of manufacture.

	Cases for 144 cartridges (6 boxes of 24 each).		
	Weight, empty.	Weight, packed.	Dimensions.
	Kg.	*Kg.*	*Meters.*
1 or 2 light cartridge	16.10	46.4 to 48.5	0.68 by 0.37 by 0.32
2 or 6 lights, chenille, red, or yellow smoke cartridges	21.50	42.4 to 61.9	0.68 by 0.44 by 0.32

PRECAUTIONS TO BE OBSERVED IN HANDLING 35-MM. CARTRIDGES.

Store the cases flat, right side up, and keep dry as far as possible. These are percussion cartridges, and care should be taken in handling the cases not to let them drop.

At storehouses and depots the cases should be stacked and distributed according to lot as far as possible, using the oldest first. These cartridges are manufactured in lots of 4,320 (30 full cases).

E. BENGAL LIGHTS.

Bengal lights are packed in cases holding 200. Each case also contains 200 friction brushes put up in several small packages.

The cases are of wood, with handles and an inner lining of tin-plate, fitted with a sliding cover and painted with a waterproof coating. The cases are marked on both sides with the number and type of Bengal lights, the manufacturer's mark, and the lot number and date of manufacture.

CASES FOR 200 BENGAL LIGHTS.

Dimensions, meters: 0.56 by 0.44 by 0.28.
Weight, empty, 13.3 kg.
Weight, packed, 39.3 to 47.4 kg.

PRECAUTIONS TO BE OBSERVED IN HANDLING BENGAL LIGHTS.

Store the cases flat, right side up, and keep as dry as possible. At storehouses and depots stack and distribute the lights by lot if possible, using the oldest first. Bengal lights are manufactured in lots of 5,000.

PARTLY FILLED CASES.

If necessary to ship cases only partly filled, great care should be taken to pack them solidly with hay, vegetable fiber, or other packing material. Avoid transporting Bengal lights with uncovered fuses. Do not pack friction brushes loosely in the case, but have them tied in small packages.

GENERAL PRECAUTIONS TO BE OBSERVED IN HANDLING SIGNAL AND ILLUMINATING DEVICES.

These devices should never be stored with other munitions or devices. Colored devices (red or green) being charged with a chlorated compound, which under certain conditions is subject to deterioration, should be stored apart from other signals whenever possible.

Similar precautions should be taken in regard to red-smoke fireworks.

PONT,
Major General.

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