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REGULATIONS

FOR

ARMY ORDNANCE SERVICES

PART II

PAMPHLET No. 7

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INSTRUCTIONS FOR THE EXAMINATION, TESTING AND SENTENCING OF CORDITE, BALLISTITE AND NITRO-CELLULOSE POWDER

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INSTRUCTIONS FOR THE EXAMINATION, TESTING AND SENTENCING OF CORDITE, BALLISTITE AND NITRO-CELLULOSE POWDER

SECTION I

GENERAL

A. GENERAL INFORMATION

1. Cordite is issued in Lots for identification and ballistic purposes. Lots consist of varying quantities up to about 40,000 lb., the larger the quantity the better, provided effective blending is achieved.

2. Cordite, Mk. I M.D. or R.D.B., is designated by size, according to the nominal diameter of the die through which it is pressed, in hundredths of an inch. In the case of tubular cordite the nominal external and internal diameters of the die are given (*e.g.* M.D.T. 15–13). Cordite S.C. H.S.C.T., H.S.C.T./a, R.D.N./A. or W. is designated according to the mean diameter of the finished cord, in thousandths of an inch. When it is in tubular form, the mean external and internal diameters of the finished cord are given (*e.g.* W.T. 154–136).

The nominal length of cordite sticks or tubes, if cut to only one length, is shown in the detail portion of the nomenclature, but, where any particular size is made in more than one length, such lengths are shown in the primary designation.

3. Each Lot is given a Lot number, comprising the manufacturers' initials and a serial number (*see* also para. **13**). The Lot number is marked on all packages containing cordite.

4. Lots of cordite made up from cordite which has been re-worked are indicated by adding the letter " R " after the Lot number.

Such cordite is issued according to the acceptance tests, either without restriction or with an anticipated life, which will be shown on the history sheets (*see* para. **50**).

5. Cordite was formerly grouped according to ballistics obtained at proof of Lots and given identification group numbers. These group numbers indicate the velocities obtained with the nominal charge when the cordite Lots were fired at proof; thus, Lots in single-figure groups were below the normal velocity, those with double-figure group numbers being above. As the result of proof, the charge weights for each Lot are adjusted according to this variation from normal velocity, so that all cordite Lots will give the normal velocity when fired in a new gun. Different groups will not, however, give the same ballistics when fired from a worn gun. It follows that cordite Lots in groups 9 and 10 are those the charge weight of which varies least from the nominal.

A letter prefixed to the group number indicates the nature of propellant concerned, as follows :—

A	indicating	cordite	R.D.N./A.
C	indicating	cordite	R.D.B.
D	,,	,,	M.D. or M.C.
E	,,	,,	W
H	,,	,,	H.S.C.T. or H.S.C.T./a
J	,,	,,	Bofors
S	,,	,,	S.C.
B	,,	ballistite	

5A. Since grouping has been discontinued the code letters only, referred to above, are used to indicate the nature of propellant.

B. METHOD OF PACKING

6. Cordite when cut into lengths is packed in wood cases painted khaki colour outside, the amount varying according to the nominal size of the cordite. Waterproof (or non-absorbent) paper is used as a lining to the cases.

Cordite when wound on drums may be packed in " barrels, special, transporting cordite," or in " cases, cordite drum."

7. In tropical climates, cordite in bulk and filled cartridges will always be stored in hermetically sealed metal or metal-lined packages. Small quantities of cordite in bulk will be packed in " cylinders, cartridge " of convenient size, the cordite being wrapped in non-absorbent paper (supplied by R.A.O.C.) to prevent contact with the metal; suitable reels or drums of thin metal, on which the cordite is wound, are used for certain small sizes of cordite.

8. Cordite cases, *except those containing cordite wound on drums*, have the following particulars stencilled on them in yellow paint :—

(*a*) On both ends :—
- (i) Nature and size of cordite.
- (ii) Manufacturers' initials and Lot number of cordite.
- (iii) Number of the case in the Lot of cordite.

(*b*) On both sides :—
- (i) Nature and size of cordite.
- (ii) Month and year of manufacture.
- (iii) Net weight in lb. and oz. of the cordite in the case.
- (iv) Tare weight in lb. and oz. of the case, etc.

9. Cases and barrels containing cordite wound on drums have the following particulars stencilled on them :—

Cases, cordite drum :—

(*a*) On both ends (in yellow paint)—
- (i) " S.A.," or " Howr." (as applicable).
- (ii) Nature and size of cordite.
- (iii) Manufacturers' initials and Lot number of cordite.
- (iv) Number of the drum in the Lot of cordite.

(*b*) On both sides (in yellow paint)—
- (i) " S.A.," or " Howr." (as applicable).
- (ii) Nature and size of cordite.
- (iii) Month and year of manufacture.
- (iv) Net weight in lb. and oz. of the cordite in the case.
- (v) Tare weight in lb. and oz. of the case, drum and packing material.

Barrels.—On the head (in black paint)—
- (*a*) " S.A.," or " Howr." (as applicable).
- (*b*) Nature and size of cordite.
- (*c*) Manufacturers' initials and Lot number of cordite.
- (*d*) Month and year of manufacture.
- (*e*) Net weight in lb. and oz. of the cordite in the barrel.
- (*f*) Tare weight in lb. and oz. of the barrel, drum and packing material.
- (*g*) Number of the barrel in the Lot of cordite.

10. Whenever transfer of a portion of a Lot of cordite is made to another command, thereby involving the compilation of a history sheet, packages will, before despatch, have the station monogram placed under or over (*not* at the side of) the Lot number for identification.

When more than one portion of the same lot is transferred to the same place, the subsequent portions should have a serial number as well as the monogram. Thus :—

C.T.	**C.T. 2.**
W.A. 867.	**W.A. 867.**

SECTION II

INSPECTION OF CORDITE

A. PERIODICAL INSPECTION

11. The inspection of cordite, whether in bulk or in cartridges (*except in small arm, machine gun and aiming rifle cartridges*), will be carried out by the inspecting ordnance officer twice a year, about **31**st March and **30**th September, one of these inspections coinciding, if possible, with the annual inspection of explosives (*see* R.A.O.S., Part II, Pamphlet No. 11).

12. Lots will be heat tested and colour tested where applicable) and visually examined at these inspections in accordance with their previous history as recorded on the history sheets and with the sentences passed in accordance with para. **46** (Tables **I** to **VI**).

13.—(1) Any portions of Lots which are or have been stored under different temperature conditions or in mechanized vehicles, limbers, etc., will be tested separately, and, if they give different results, will be sentenced separately, and treated as different " parcels " (*see* below). Different results are defined as above 25 per cent. difference in the mean figures of the heat tests, and above 20 per cent. difference in the S.V. test, or a difference greater than 4 in the colour number.

(2) In order to keep these portions of Lots distinct, a distinguishing letter should be added after the Lot number (*e.g.* **Lot W.A. 100, W.A. 100A, W.A. 100B**), and always be shown thus on correspondence, inspection reports (A.F. G 900), and be marked on the packages and cartridges. Each portion of a Lot so marked will then be known as a " parcel."

(3) In the event of a " parcel " (*e.g.* **Lot W.A. 100A**) having to be split, a number will be added after the distinguishing letter, *thus :* **W.A. 100A1, W.A. 100A2.** Each " parcel " will be allotted a separate history sheet (A.F. G 935). This action will be in addition to and distinct from any that may have been taken under para. **10.**

14. On receipt of cordite at a station or in an area where the temperature of storage is so much higher than that at which the cordite was last tested and sentenced that a shorter period for re-test is entailed, the unexpired period for re-test on the current sentence, shown on the history sheet, will be revised by the inspecting ordnance officer in accordance with the tables (para. **46**). A sample of the cordite will then be re-

tested at the half-yearly inspection immediately prior to the expiry of the revised period.

15.—(1) If cordite is received at a station or in an area where the temperature of storage is lower than that at which the cordite was last tested and sentenced, revision of the period for re-test on the current sentence will not be necessary. On the expiry of the period, however, the cordite will be tested and sentenced in accordance with the new temperature of storage conditions, due regard being paid in all instances to the provisions of para. **47**, in the event of any previous lower tests being recorded in the history sheets.

(2) If other cordite of the same Lot is already held at the station or in the area, the newly received cordite will be treated separately, and dealt with, if necessary, as laid down in para. **13.**

(3) Cordite manufactured between August, 1914, and January, 1920, when received under these conditions, will invariably be " parcelled," even though the results of the separate heat tests are identical.

16. Any Lot whose previous history is unknown will be tested at the first periodical inspection after its receipt in a station or area.

17. Cordite of the same Lot number in bulk and in cartridges will not be grouped together for the purpose of test, but will always be tested and sentenced separately, and tests on cordite in specially cooled storage must not govern cordite (of the same Lot number) which is not so kept.

18. When the period for re-test on the last sentence of a Lot of cordite, as shown by the history sheet or other record, has nearly expired, the inspecting ordnance officer will take steps to select the necessary sample for test, or request the officer in charge of the cordite to forward a complete unopened package from which a sample can be taken. (For selection of sample, *see* **Appendix I.**)

B. SPECIAL INSPECTION

19. In the case of a Lot or " parcel " of cordite older than five years, which has been subjected in storage at any time to a temperature of or above 90° F. but under 100° F. for 56 consecutive days or more, or a Lot of cordite of any age subjected in storage to a temperature of 100° F. or above for 28 consecutive days or more, a sample of each such Lot will be taken by, or sent to, the inspecting ordnance officer for special examination and test. (For packing and marking the sample, *see* para. **51.**)

C. VISUAL EXAMINATION

20. The cordite in a package or cartridge from which a sample for testing is selected will be examined for general appearance, colour, smell and sweating.

20A. If cordite is found in an unserviceable condition, action will be taken as laid down in para. **57A.**

21.—(*a*) Cordite **Mk. I,** in good condition is smooth and tough ; the colour varies from light to dark brown and it has little smell.

(*b*) Cordite **M.D.** is of a horny nature and harder and more brittle than cordite, Mk. I ; it is somewhat darker in colour and smells slightly of acetone.

(*c*) Cordite **W.** resembles cordite M.D., but can be distinguished by its aromatic odour due to the carbamite content.

(*d*) Cordite **R.D.B.** resembles cordite M.D. in being of a horny nature, harder and more brittle than cordite, Mk. I. The larger sizes, however, are noticeably softer than cordite M.D. and usually show a more uneven surface. Cordite R.D.B. smells slightly of alcohol.

(*e*) Cordite **S.C.** in good condition is smooth and flexible. When new, it is light amber yellow in colour but darkens with age to a reddish-brown. It possesses an aromatic odour due to its carbamite content.

(*f*) Cordite **Bofors** is hard and greenish in colour. The colour darkens somewhat on keeping and may become rather brownish. As with cordite S.C., particles of foreign matter, such as wood and metal, may be present. Local deterioration is revealed by localized reddish-brown discoloration which may bleach to a light patch, sometimes accompanied by some exudation.

If any cordite is found to be so affected, a report should be made on the appropriate form and a sample of the propellant forwarded to the C.O.O., Royal Arsenal, Woolwich.

(*g*) Cordite R.D.N./A, unlike the preceding natures of cordite which are translucent, is white and opaque. It is hard, smooth and very brittle.

(*h*) Cordite H.S.C. is of similar composition to S.C. but has a higher nitro-glycerine content and lower carbamite content.

22. Deteriorated cordite, Mk. I M.D. and R.D.B., may be more brittle and is usually darker than new cordite. It has a sour smell, sometimes resembling that of ether. Bubbles in cordite must not be mistaken for the light-coloured patches caused by local deterioration. These light-coloured patches should be specially looked for in cordite, M.D. ; if found, a heat test should also be taken of the affected parts. For pictorial representations of cordite when new and at various stages of corrosion, *see* Coloured Plate A.

Pictorial Representations of Cordite.—Sheet 1.

1

2

3

4

5

1.
2.
3.
4. } NEWLY MADE CORDITE. MD. SHOWING RANGE IN COLOUR.

5. EARLY STAGE OF CORROSION OF CORDITE MD. SIZE 16.

Pictorial Representations of Cordite.—Sheet 2.

6

7

8

9

6. INTERMEDIATE STAGE OF CORROSION OF CORDITE MD. SIZE 19.
7. ADVANCED STAGE OF CORROSION OF CORDITE MD. SIZE 16.
8. ADVANCED STAGE OF CORROSION OF CORDITE MD. SIZE 8.
9. CORDITE CONTAINING AIR BUBBLES.

PLATE B

PICTORIAL REPRESENTATIONS OF CORDITE S.C.

1

NEW CORDITE S.C. 100.

2

NEW CORDITE S.C. 270.

3

AGED CORDITE S.C. 140.

4

AGED CORDITE S.C. 205.

5

CORDITE S.C. 115 SHOWING INCIPIENT CORROSION.

CORDITE S.C. 115 SHOWING DEVELOPMENT OF CORROSION.

7

CORDITE S.C. 115 SHOWING ADVANCED CORROSION.
(*NOTE POSTULATED SURFACE.*)

8

CORDITE S.C. 270 WITH WHITE SPOT OF UNGELATINISED NITRO-CELLULOSE.

9

CORDITE S.C. 280 SHOWING AIR INCLUSIONS.

10

CORDITE S.C. 280 ROUGH SURFACE.

NOTE.—Nos. 1—7 represent Cordite as seen when held up to daylight.

Wt. 20857/8778 1536 8/41 C. J. C. & S. 51-947

22A. Cordite S.C. cannot be filtered during manufacture and may therefore contain foreign matter such as particles of wood, aluminium, carbonaceous matter, etc. As this type of cordite is highly resistant to any ill effect from such contamination, these impurities need not be regarded with apprehension.

White or opaque spots or streaks may be found in many sticks ; these are due to air inclusions or particles of unevenly gelatinized carbamite or nitro-cellulose and may be disregarded, as they will not affect stability or ballistics.

Pictorial representations of new and corroded S.C. cordite are shown on the Coloured Plate B.

23. If a suspicious-looking patch is observed in cordite, M.D., it should be cut open and a piece of service blue litmus paper, carefully moistened with distilled water (*i.e.* neutral to litmus) should be applied ; if a distinctly acid reaction is obtained, local deterioration is indicated.

23A. Local deterioration due to the presence of impurities in S.C. Cordite is revealed by local discoloration (reddish brown to blue in colour) or, in more advanced stages, by a raising of the surface of the cordite at the affected portion forming a pustule which may be almost black in appearance. Any cordite that is found to be pustulated should be forwarded to the W.D. Chemist, Woolwich, and a notification sent to the Chief Inspector of Armaments.

24. The surface of cordite is sometimes moist ; this condition is called sweating. This is due to the exudation of nitro-glycerine, which is liable to take place in certain cordites after exposure to cold and subsequent warming. The exudation occurs most readily in cordite of high nitro-glycerine content. Thus cordite, Mk. I, may exude after storage at 45° F. or below, and cordite S.C. after storage at 40° F. or below, but exudation is rarely observed in cordite, M.D., unless the temperature has fallen to 32° F. or below. Cordite, R.D.B., is intermediate in composition and may be classed approximately with Mk. I. The sweating is due to freezing of the nitro-glycerine, which crystallizes on the surface and subsequently melts when the temperature rises.

25. Sweating does not injuriously affect cordite, and if it occurs in made-up cartridges no action need be taken ; but if it appears on cordite in bulk the cordite must not be removed from its packages for any purpose till it recovers its normal state, which it will do if its temperature is kept above 45° F., by the reabsorption of the nitro-glycerine ; when this has taken place the cordite is serviceable.

26. An oily appearance is also sometimes seen on cordite,

Mk. I M.D. or R.D.B. ; this is due to exudation of mineral jelly, and does not affect the cordite.

27. To distinguish the exudation of nitro-glycerine from that of mineral jelly, wipe a stick of the cordite with a strip of clean blotting-paper, about $\frac{1}{4}$ in. in width, so that the stain from the exudation appears about the centre of the strip. Then, in some comparatively dark place apart from the laboratory, etc., hold the strip in a horizontal position and light it at one end. If the exudation is nitro-glycerine, the flame will travel faster and become distinctly green on reaching the stain.

28.—(1) The results of the examination for general appearance, colour, smell and sweating, and a statement as to whether zinc chloride is found in the cylinder from which the cordite is taken, will be fully entered in the Report of Inspection.

The presence of zinc chloride may be inferred from a white deposit on the interior of the cylinder, which, when tested with a piece of moistened blue litmus paper, turns the paper red.

When zinc chloride is found, the contents of the affected cylinder will be re-packed in a fresh cylinder and the affected cylinder set aside for return to the C.O.O., Woolwich Arsenal, if otherwise serviceable. A further percentage should then be examined.

(2) All Q.F. cartridges in boxes that have been opened for the purpose of selecting a sample of the cordite for test will be examined for cracks, etc., as laid down in R.A.O.S., Part II, Pamphlet No. 2.

(3) In the case of fixed ammunition, the base of the shell from rounds broken down for selection of a sample of the propellant for testing will be examined to see that it is quite clean and free from any explosive use in the filling of the shell. If any contamination is found, full particulars as to its nature and extent will be reported.

28A. Cordites which contain carbamite as a stabilizer are liable to give rise to an emanation which softens paint. It is very important therefore that packages which contain S.C. or W. cordite in bulk or in the form of B.L. cartridges should be unpainted internally.

D. LOTS OF UNKNOWN IDENTITY

29. The following action is to be taken when there is doubt as to the Lot number of any cordite (whether in bulk or in cartridges) :—

(*a*) If by markings or otherwise the Lot number can be established with reasonable certainty, the cordite will be treated as being of such Lot, the packages, etc., containing it marked accordingly, and a separate A.F. G 935 made out.

(*b*) If the Lot number cannot be ascertained, the package containing the cordite will, as a rule, be marked "Lot unknown," "For practice—use early," and will be issued accordingly; but if the quantities are large or the circumstances exceptional, particulars will be reported.

Unknown lots will not be sent to stations abroad.

E. WET CORDITE

30.—(1) If cordite has become wet from any cause—

(*a*) It will, if wet with fresh water, be dried in a well-ventilated building, a sample then being subjected to heat test and colour test if applicable, and, if it passes the test, the consignment will be re-packed and retained as fit for service in all respects.

(*b*) If wet with salt water, it will first be washed thoroughly in fresh water, then the procedure will be as in (*a*).

(*c*) Cordite R.D.N./A will not be treated as above. A report must be made to C.I.A. and the cordite held pending instructions.

(2) In the case of tubular cordite it is necessary to ensure that the water enters and circulates through the tubes sufficiently to clear away any deposit. To effect this the tubes should not be thrown into the water and left to soak in a horizontal position, as there would then be some danger that the water would not fill the tubes, but a bundle of tubes should be dipped under the water, being kept vertical, and worked up and down a few times, then lifted out of the water and allowed to drain. This process should be repeated a number of times until the tubes are clean.

If facilities exist, it may be found more convenient to hold the cordite under a tap of running water, so as to allow the water to run through the tubes. In order to dry them they must be allowed to drain, and the drying can be assisted by whisking a bundle of the tubes through the air while held in the hand.

Care will be taken that during these operations the cordite is not exposed to direct sunlight and that the Lots are kept distinct.

The foregoing is the normal procedure, but if the quantities are large or the circumstances exceptional, the matter will be reported.

(3) For cordite in cartridges, with gunpowder igniters which have become wet from any cause, *see* paras. **32** and **33.**

31. Wetted cordite Mk. I, M.D., R.D.B. and S.C. sometimes become a dirty white colour due to absorbed water, and this

colour may vary considerably even in the same cartridge. Such light-coloured sticks must be specially looked for and will be tested separately.

F. SULPHUR-INFECTED CORDITE

32. Cordite will be considered " sulphur-infected " when it is in cartridges fitted with gunpowder igniters—

(*a*) which have become wet from any cause.
(*b*) with broken igniter bags.
(*c*) where gunpowder dust from the igniter is found on the cordite.

33. Cordite found to be sulphur-infected will be dealt with as follows :—

(*a*) Mk. I cordite, whether affected with wet or dry gunpowder, will be destroyed.
(*b*) M.D., R.D.B. S.C. or W. cordite affected as at (*a*) of para. **32** will be destroyed, but, if affected as at (*b*) or (*c*) of that para., a sample of the Lot concerned will be washed in distilled water, when possible, dried, and subjected to heat test as directed in **Appendix I** ; if the sample passes the test, the remainder of the contaminated cordite of that Lot will be wiped free of gunpowder with a clean, dry cloth, and will then be considered serviceable.
(*c*) R.D.N./A. cordite will be reported immediately to C.I.A. and held pending instructions.

G. RE-WORKED CORDITE

34. Lots of cordite made up from cordite which has been re-worked are indicated by adding the letter " R " after the Lot number.

One year from the date of manufacture re-worked Lots will be specially heat-tested. In addition the S.V. test will be applied in the case of Mk. I cordite and the colour test for S.C., W. and R.D.N./A. cordite. They will then be sentenced on the results of the tests and thereafter periodically tested and sentenced in accordance with the tables in para. **46.**

H. CORDITE CYLINDERS

35. Cordite cylinders in the service are either—

(i) Of *known* Lots—the maker's initials and Lot numbers of the cordite being marked on the label affixed to the lid of all Q.F. cartridges in which assembled, and stencilled on packages containing cylinders in bulk.
(ii) Of *unknown* Lots—in certain cartridges made up prior to October, 1909.

SECTION III

TESTING AND SENTENCING CORDITE

A. CORDITE (EXCEPT CORDITE CYLINDERS)

36. The normal stability test for all natures of cordite is the "heat test"; in addition, for Mk. I cordite (except cordite cylinders), the "silvered vessel test" and, for S.C., W. and R.D.N./A. cordite, the "colour test," as shown in para. **46** (Tables).

37. The heat test will be carried out by inspecting ordnance officers in accordance with the instructions in **Appendix I** and the colour test as laid down in **Appendix V,** but the silvered vessel test will normally be carried out only at Woolwich. Hence, when Mk. I cordite is sentenced "**S.V.T.**" in accordance with para. **46** (Table I), a sample of about 1 lb. of the Lot concerned (packed as directed in para. **51**) will be consigned to the C.O.O., Royal Arsenal, Woolwich, the requisite Army Forms G 900, in duplicate, completed as regards current heat tests, etc., being forwarded as laid down in R.A.O.S., Part II, Pamphlet No. 11.

37A. In all cases where S.C., W. and R.D.N./A. cordite is subjected to heat test, a colour test will also be taken. Instructions for carrying out the colour test are contained in **Appendix V** and for sentencing S.C. or W. cordite in para. **46** (Tables IV to VI).

38. When the duplicate results of the heat test (*see* **Appendix I,** para. 27) are not identical, the cordite will be sentenced on the mean figure.

39. In the case of cartridges made up of different Lots of cordite (*e.g.* certain howitzer cartridges), each Lot will be separately tested and sentenced. In cases where the date for test or re-test of the two Lots differs, the earlier date will be taken for both Lots.

40. Should a test reach the condemning limit, the cordite will be dealt with early as in para. **46** (Tables), except when the test is considerably at variance with the result to be expected from the history sheet, and/or the destruction of a large quantity of cordite cartridges in equipments is involved. In such cases the results of the heat test will immediately be reported to the Chief Inspector of Armaments, Royal Arsenal, Woolwich, and the cordite will be isolated, if practicable, pending receipt of authority for destruction.

B. CORDITE CYLINDERS

41. Cordite cylinders, whether of *known* or *unknown* Lots, will not be subjected to the silvered vessel test, but will otherwise be treated in all respects as Lots of Mk. I cordite :—

(*a*) *Known Lots.*—A single test will be sufficient to govern all cylinders of the same Lot number fitted to cartridges in a station or area within an inspecting ordnance officer's jurisdiction, irrespective of the Lot number of the cordite (sticks) in such cartridges, provided that the cylinders have not been separately " parcelled " (*see* para. **13**).

(*b*) In the case of Q.F. cartridges made up of a particular Lot of cordite which are fitted with cordite cylinders of *known* Lot number but which are not all of the same Lot number, the total number of cylinders of each Lot and the tests applicable will be recorded on the history sheet and shown in reports of inspection.

(*c*) *Unknown Lots.*—Cordite cylinders of *unknown* Lot associated with one particular Lot of cordite in cartridges at a station will (*except when portions of the Lot of cordite are separately parcelled as laid down in para.* **13**) be regarded as a single group for purposes of testing and sentencing.

42. When a Lot or group of cordite cylinders in cartridges become due for re-test, and the number of cylinders of that Lot or group does not exceed the following, they will be removed from the cartridges, destroyed *without testing*, and replaced by serviceable cylinders of *known* Lot number :—

Cylinders—

0·05-in. × 2½-in.	...	...	...	...	...	14
0·05 ,, × 4 ,,	...	...	...	...	...	10
0·15 ,, × 4 ,,	...	...	...	...	...	8
0·20 ,, × 4 ,,	...	...	...	...	...	6

Similarly, small quantities of cylinders in bulk on becoming due for re-test will (when the numbers on charge do not exceed the numbers indicated in **Appendix I,** para. 22) be destroyed without testing.

43. In Q.F. cartridges fitted with cordite cylinders of *unknown* Lot, both cordite sticks and cylinders will be heat tested whenever either is due for test.

44.—(1) When a heat test result below the condemning limit is given by cordite cylinders in cartridges the cordite (sticks) of which has given a serviceable result at test, all

cylinders of that particular Lot or group will be removed from all cartridges affected and replaced by serviceable cylinders of *known* Lot number.

(2) Cordite cylinders of *known* Lot removed from cartridges the cordite (sticks) of which has been sentenced unserviceable will (if not sulphur-infected and if the number is 20 or more) be specially heat tested. If found to be serviceable on the results of the test, they may be re-used, provided that the period for re-test is not shorter than that for the cordite (sticks) of the cartridges to which they are to be fitted. Less than 20 cylinders of *known* Lot, all sulphur-infected cylinders (*see* paras. **32** and **33**), and all cylinders of *unknown* Lot from such cartridges will be destroyed without testing.

(3) Cordite cylinders of *known* Lot removed from cartridges and retained for re-use may be stored and grouped with cylinders of the same Lot number in bulk, provided that the cylinders from cartridges do not give different results at heat test (as defined in para. **13**) from the bulk.

45. If the cordite cylinder in a cartridge is replaced by one of different Lot number, care will be taken to ensure that the label on the lid of the cartridge is amended accordingly. If necessary, a new label, which should always be of the latest pattern, will be affixed.

C. SENTENCING

46. Cordite will be sentenced on results of tests as in the following tables (*see also* para. **47**).

TABLE I.—Cordite Mk. I (except Cordite cylinders)

NOTE.—Mk. I Cordite sentenced to be silvered vessel tested as below, will be heat tested every three months until the result of the silvered vessel test is known.

Tests (1)	Sentences		
	Mean temperature of storage below 60° F. (2)	Mean temperature of storage 60° to 80° F. (3)	Mean temperature of storage over 80° F. (4)
*Heat test (mean) over 25′	Re-test after 3 years	Re-test after 3 years	Re-test after 1½ years
,, ,, 16′ to 25′ ...	,, ,, 3 ,,	,, ,, 2 ,,	,, ,, 1 year
,, ,, 12′ to 16′ ...	,, ,, 3 ,,	,, ,, 1½ ,,	,, ,, 9 months
,, ,, 8′ to 12′ ...	,, ,, 2 ,,	,, ,, 1 year	,, ,, 6 ,,
,, ,, 4′ to 8′ ...	S.V.T.	S.V.T.	S.V.T.
,, 4′ and under ...	Destroy	Destroy	Destroy
S.V. test over 300 hours	†Re-test after 2 years	†Re-test after 1 year	†Re-test after 6 months
,, ,, 250 to 300 hours ...	† ,, ,, 1 year	† ,, ,, 6 months	Destroy
,, ,, 200 to 250 hours ...	† ,, ,, 6 months	Destroy	Destroy
,, 200 hours and under ...	Destroy	Destroy	Destroy

* *See* **Appendix I,** para. **36,** as regards recording the time taken to complete the tests.

† *I.e.* heat and silvered vessel test. If, however, the heat test result is 4 minutes or under, the S.V. test will not be necessary, but the cordite will be sentenced " Destroy " and destruction carried out as provided for in para. **40.**

TABLE II.—Cordite Mark I (Cylinders only)

*Heat Tests (Mean) (1)	Sentences		
	Mean temperature of storage below 60° F. (2)	Mean temperature of storage 60° to 80° F. (3)	Mean temperature of storage over 80° F. (4)
Over 25′	Re-test after 3 years	Re-test after 3 years	Re-test after 1½ years
,, 16′ to 25′	,, ,, 3 ,,	,, ,, 2 ,,	,, ,, 1 year
,, 12′ to 16′	,, ,, 3 ,,	,, ,, 1½ ,,	,, ,, 9 months
,, 8′ to 12′	,, ,, 2 ,,	,, ,, 1 year	,, ,, 6 ,,
,, 5′ to 8′	,, ,, 1 ,,	,, ,, 6 months	,, ,, 3 ,,
5 minutes and under	Destroy	Destroy	Destroy

* *See* **Appendix I,** para. **36,** as regards recording the time taken to complete the tests.

TABLE III.—Cordite M.D., Cordite R.D.B., and Bofors

†Heat Tests (Mean) (at 160° F.)	Sentences		
	Mean temperature of storage below 60° F.	Mean temperature of storage between 60° and 70° F.	Mean temperature of storage over 70° to 80° F.
Over 15′	Re-test after 3 years	Re-test after 2 years	Re-test after 1½ years
,, 10′ to 15′	,, ,, 2 ,,	,, ,, 1½ ,,	,, ,, 1 year
,, 8′ to 10′	,, ,, 2 ,,	,, ,, 1 year	,, ,, 6 months*
,, 5′ to 8′	,, ,, 1 year	,, ,, 6 months*	,, ,, 6 ,,
5′ and under	Destroy	Destroy	Destroy

Mean Temperature of Storage over 80° *F.*

Heat Test	Sentence
Over 30′	Re-test after 1 year.
Over 6′ to 30′	,, ,, 6 months.*
6′ and under	Destroy.

* And examine visually the cordite in a few cartridges in each of 3 per cent. of packages.

† *See* **Appendix I,** para. **36,** as regards recording the time taken to complete the tests.

TABLE IV.—Cordite S.C.

Heat Test (at 150° F. mins.)	Colour number	Carbamite content	Sentences	
			Mean temperature of storage below 80° F.	Mean temperature of storage 80° F. or above
	20 or below		Re-test after 3 years	Re-test after 3 years
Over 4′	Over 20	Over 4	Re-test after 3 years	Re-test after 2 years
		4 or over 3	Re-test after 2 years	Re-test after 1 year
4′ or less		3 or less	Destroy	Destroy

Notes :—1. Carbamite content estimations are *not* required until a colour number over 20 is attained and thereafter cordite will be tested by carbamite content in lieu of the colour test.

When cordite is sentenced for carbamite estimation, a sample of about 1-lb. of the Lot concerned will be consigned to the C.O.O., Royal Arsenal, Woolwich (*see* paras. **37** and **51**).

2. **In the event of either heat test or carbamite test giving a result below the specified minimum, the cordite will be destroyed irrespective of other test results.**

TABLE V.—Cordite W

Heat tests (Mean) (at 150° F.)	Colour number	Carbamite content (%)	Sentences	
			Mean temperature of storage under 80° F.	Mean temperature of storage 80° F. or over
Over 4′	15 or under		Re-test after 3 years	Re-test after 3 years
	Over 15	Over 3	Re-test after 3 years	Re-test after 2 years
		3 or over 2	Re-test after 2 years	Re-test after 1 year
4′ or under		2 or under	Destroy	Destroy

Notes :—1. Carbamite content estimations are *not* required until a colour number over 15 is attained and thereafter cordite will be tested by carbamite content in lieu of the colour test.

When cordite is sentenced for carbamite estimation, a sample of about 1 lb. of the Lot concerned will be consigned to the C.O.O., Royal Arsenal, Woolwich (*see* paras. **37** and **51**).

2. In the event of either heat test or carbamite test giving a result below the specified minimum, the cordite will be destroyed irrespective of other test results.

TABLE VI—(PROVISIONAL) CORDITE R.D.N./A.

NOTE.—If two tests give different sentences when applied to the same sample, the test indicating the lower stability will be taken.

Heat Test (Mean) at 150° F.	Colour Number	Sentence.	
		Mean temperature of storage below 80° F.	Mean temperature of storage 80° F. or above.
Over 4′	Below 5	Re-test after 2 years.	Re-test after 1 year.
4′ or under	5 or over	The results of the tests will immediately be reported to the Chief Inspector of Armaments, and the cordite will be isolated, if practicable, pending the receipt of further instructions.	

TABLE VII—CORDITE H.S.C. (AND H.S.C.T.)

Heat Test at 150° F.	Colour number	Carbamite content (%)	Sentences	
			Mean temperature of storage below 80° F.	Mean temperature of storage 80° F. or above
Over 4′	10 or below		Re-test after 3 years	Re-test after 3 years
	Over 10	Over 2	Re-test after 3 years	Re-test after 2 years
		2 or over 1	Re-test after 2 years	Re-test after 1 year
4′ or less		1 or less	Destroy	Destroy

Notes :—1. Carbamite content estimations are *not* required until a colour number over 10 is attained, and thereafter cordite will be tested by carbamite content in lieu of the colour test.

When cordite is sentenced for carbamite estimation, a sample of about 1 lb. of the Lot concerned will be consigned to the C.O.O., Royal Arsenal, Woolwich (*see* paras. **37** and **51**).

2. In the event of either heat test or carbamite test giving a result below the specified minimum, the cordite will be destroyed irrespective of other test results.

47. If at periodical test a Lot or " parcel " gives a low result, and at a later periodical test a higher result is obtained, **sentence will be passed as if the Lot or " parcel " had again given the low result,** *i.e.* sentence will always be passed on the lowest test recorded.

48. Cordite Lots shown by their history sheets to be nearing the condemning limit on results of tests recorded will be sentenced at the discretion of the inspecting ordnance officer:—

" Use early—R.A.O.S., Part II, Pamphlet No. 7, 1933, para. 48," and packages will be so marked.

48A. Cordite M.D., M.C., R.D.B., or Mk. I, except that held in Q.F. cartridges, will, on the expiration of the life officially prescribed, be subjected to the 100 per cent. surveillance test, in addition to the heat test, in accordance with the instructions laid down in **Appendix VI.**

D. ARMY FORMS

49. The results of all examinations, whether " periodical " or " special," will be reported on A.F. G 900. The forms rendered at the annual inspection of all explosives will show every Lot on charge, but those rendered at intermediate inspections of cordite will show only the Lots due for testing, except that, when a test of cordite cylinders in cartridges is due and a test of the cordite sticks is not due, the Lot numbers of the cordite in the cartridges with which the cylinders are associated will also be reported.

E. HISTORY SHEETS

50.—(1) Inspecting ordnance officers will keep up separate history sheets (A.F. G 935) for each Lot of cordite in their jurisdiction as shown in the following specimens, except in the case of cordite in :—

(*a*) M.L. mortar charges ;

(*b*) small arm and aiming rifle ammunition ;

(*c*) gun and howitzer ammunition issued from the R.A.O.C. Depots, to practice camps at home stations for immediate expenditure. If, however, any ammunition so issued remains unexpended when the practice camps close at the end of each season, a report, showing the nature and number of cartridges and the propellant Lot numbers, will be sent by the inspecting ordnance officer of the area to the Chief Inspector of Armaments, Royal Arsenal, Woolwich, when extract history sheets will be forwarded to the inspecting ordnance officers concerned.

(2) Should any part of a Lot be transferred from one station (or inspecting ordnance officer's area) to another, an extract of its history sheet will be sent to the inspecting ordnance officer concerned and a copy of the extract to the Chief Inspector of Armaments. If the station to which the Lot of cordite is sent has already some of the same Lot on charge and it is not separately parcelled as defined in para. **13,** the quantity of cordite in bulk or number of cartridges received and the tests shown on the extract will be entered on the station sheet when they differ from the tests, etc., already recorded thereon.

(3) When a Lot is expended or destroyed, the history sheet will be completed and returned to the Chief Inspector of Armaments.

(4) Inspecting ordnance officers will not enter movements of cordite from one place to another within their jurisdiction, *e.g.* from one R.A. sub-district to another, except when the temperatures of the magazines or explosives stores differ widely.

(5) The history sheet should bear the same identification marks as the Lot or " parcel " of a Lot, as laid down in paras. **10** and **13.** The history of a " group " or Lot of cordite cylinders in cartridges will be entered on the history sheet of the Lot of cordite with which it is associated. Only one history sheet will be required in the case of howitzer or composite cartridges, the tests of each Lot of cordite being separately recorded thereon.

Specimen sheet "A"

HISTORY SHEET OF CORDITE (OR OTHER PROPELLANT) IN CARTRIDGES

Full designation of Cartridge ... ... Q.F. 18-pr. shrapnel.
Station ... ... Dover — Mean annual temperature of storage } 53° F.
Lot No. W.A. 11270 D.9.
Size 8 M.D.
Date of Manufacture, 1/1925.

No. of cartridges	Received from	Date	No. of cartridges	Issued to or expended	Total No. of cartridges on charge	Remarks and initials
800 ...	C.O.O., Bramley ...	31.10.25	—	—	800	A.B.
		5.4.26	60	Expended at practice	740	A.B.
		6.4.26	140	,, ,,	600	A.B.
		10.5.26	400	O.O., Warley	200	H.S. to Warley and Woolwich 9.5.26 C.D.
		21.6.26	100	Expended at practice ...	100	C.D.
		10.9.26	48	,, ,,	52	C.D.
		11.12.28	52	,, ,,	Nil	H.S. to Woolwich 11.12.28

Explanation.—On 9.5.26, 400 cartridges are sent to Warley. An extract of this form (*see* Specimen Sheet "B") is sent with them, and one is also sent to C.I.A.
The remaining cartridges have been expended at practice by 11.12.28, and this sheet is then returned to C.I.A.

ALL PARTICULARS BELOW TO BE FILLED IN WHEN A TEST IS TAKEN

Station	Mean annual temperature storage	Date	Heat test	S.V. test	Sentence	Station	Mean annual temperature storage	Date	Heat test	S.V. test	Sentence
Woolwich	58° ...	9.2.25	33′ 34′, 33′ 34′, 34′ 33′ (at 180° F.)		↑ (3)						
Dover ...	54° ...	2.28	Over 30′ over 30′		↑ (3)						

Specimen sheet " B "

HISTORY SHEET OF CORDITE (OR OTHER PROPELLANT) IN CARTRIDGES

Full designation of Cartridge ... ... Q.F. 18-pr. shrapnel.

Station ... ... Warley

Mean annual temperature of storage } 53° F.

Lot No. W.A. 11270 D.9.
Size 8 M.D.
Date of Manufacture, 1/1925.

No. of cartridges	Received from	Date	No. of cartridges	Issued to or expended	Total No. of cartridges on charge	Remarks and initials
400 ...	O.O., Dover ...	10.5.26			400	C.D.

Explanation.—400 cartridges sent from Dover to Warley. I.O.O., Dover, fills in extract from History Sheet (Specimen " A ") as shown, entering the new station (in this case Warley) and where received from (in this case Dover). One extract is sent to Warley and one to C.I.A. All known tests should be shown on the extract.

ALL PARTICULARS BELOW TO BE FILLED IN WHEN A TEST IS TAKEN

Station	Mean annual temperature storage	Date	Heat test	S.V. test	Sentence	Station	Mean annual temperature storage	Date	Heat test	S.V test	Sentence
Woolwich	58° ...	9.2.25	33′ 34′, 33′ 34′, 34′ 33′		↑ (3)						

Specimen sheet "C"

HISTORY SHEET OF CORDITE (OR OTHER PROPELLANT) IN CARTRIDGES

Full designation of Cartridge ... ... Q.F. 18-pr. shrapnel.
Station ... ... Warley — Mean annual temperature of storage 55° F.
Lot No. W.A. 11270 D.9.
Size 8 M.D.
Date of Manufacture, 1/1925.

No. of cartridges	Received from	Date	No. of cartridges	Issued to or expended	Total No. of cartridges on charge	Remarks and initials
250 ...	C.O.O., Bramley ...	4.11.25	—	—	250	E.F.
		5.4.26	70	Expended at practice ...	180	E.F.
400 ...	O.O., Dover ...	10.5.26	—	—	580	E.F.
		14.6.26	200	Expended at practice ...	380	E.F.
		15.6.26	180	,, ,,	200	E.F.
		5.4.28	200	,, ,,	Nil	H.S. to Woolwich 5.4.28

Explanation.—400 cartridges are received from Dover on 5.4.26, accompanied by an extract from the Dover History Sheet (*see* Specimen Sheet "B"), which on receipt is attached to this sheet.
The whole of the cartridges on charge have been expended at practice by 5.4.28, and this sheet is then returned to C.I.A.

ALL PARTICULARS BELOW TO BE FILLED IN WHEN A TEST IS TAKEN

Station	Mean annual temperature storage	Date	Heat test	S.V. test	Sentence	Station	Mean annual temperature storage	Date	Heat test	S.V. test	Sentence
Woolwich	58° ...	9.2.25	33′ 34′, 33′ 34′, 34′ 33′ (at 180° F.)		↑ (3)						
Warley	55° ...	2.28	over 30′ over 30′ (at 160° F.)		↑ (3)						

SECTION IV

DISPOSAL AND DESTRUCTION OF CORDITE

A. PACKING SAMPLES AND MARKING PACKAGES

51.—(1) Each sample of cordite selected for testing is immediately to be wrapped in non-absorbent paper (supplied by R.A.O.C.), care being taken that it is clean and dry, and then placed in a tinned-plate cylinder, provided locally. Each cylinder will be distinctly labelled to show the nature and Lot number of the contents, the lid being secured with a tape band shellacked on.

(2) The cylinders will be packed in a wooden box or case just large enough to hold them, and the lid secured with brass screws. " Station monogram " and " Government Explosives," etc., labels will be affixed in the usual way, and a label giving the following particulars will also be affixed to the package, both inside and out :—

Station.
Fort or unit.
Manufacturers' initials and Lot numbers of the cordite samples.
Date on which test is due, or the letter " T " if for special examination and test under para. **19.**

(3) Until the samples can be forwarded, and during transport, the packages (clearly directed) containing them should be stowed in a selected place, which should be as cool and dry as possible.

B. DISPOSAL OF CARTRIDGES FROM WHICH SAMPLES HAVE BEEN TAKEN FOR TEST

52.—(1) When facilities exist, cordite selected from cartridges for test, *except* 3·7-*in. and* 4·5-*in.*, will, if sentenced serviceable on the results of test, be replaced by the same weight of cordite of the same nature and size held on charge in bulk for that purpose. If, however, suitable cordite in bulk is not available locally, one of the cartridges, from which a sample has been taken for current test, may be broken down and the quantity of cordite required used for replacement. Any cordite remaining over will be held on charge in bulk and used for replacement as and when required.

Cordite used for replacement of samples taken from cartridges for test must have given a heat test result of :—

(*a*) over 30 minutes at last test ; *or*

(*b*) a result during the last 12 months equal to or better than the cordite in the cartridges to be re-made, and there must not have been any previous lower tests.

Cartridges so re-made will have the word " TESTED," the date of re-making and the monogram of the station or depôt marked on them, and will be issued without restriction. Packages containing such (*i.e.* tested cartridges) will be marked " Tested " with the station monogram and date.

Tested cartridges must never be subsequently re-tested, and should, therefore, when possible, be expended before any others of the same Lot number.

Cartridges Q.F. 3·7-in., or 4·5-in. howitzer, will not be re-made.

(2) If facilities for re-making are not available, the marking on the boxes from which cartridges have been taken for test will be amended to show the number of cartridges remaining in them, and the components (*except charges*) of the cartridges broken down will be returned to the C.O.O., Royal Arsenal, Woolwich, when opportunity occurs. Any portions of charges not expended in testing will be destroyed.

53. Boxes not filled to capacity with cartridges will form first issues for expenditure at practice.

C. DISPOSAL OF UNSERVICEABLE AND DOUBTFUL CORDITE

54. Cordite sentenced for destruction will (*except during hostilities or as provided for in paras.* **40** *and* **55**) be disposed of as soon as practicable ; destruction will not be delayed for confirmation of the sentence. Unserviceable cordite awaiting destruction (*except as in para.* **55**), and doubtful cordite awaiting silvered vessel test must be isolated in some safe, cool place, but not in a magazine or explosives store with other explosives. Extemporized magazine or explosives store accommodation will be provided if necessary, in which case magazine or explosives store conditions, as applicable, will, as far as possible, be observed. For instructions as to unserviceable cordite during hostilities, *see* **Appendix II.**

55. Unserviceable cordite in Q.F. cartridges, 6-pr. and under, will not be destroyed if the cartridges can be expended within three months from the date of heat test. Such cartridges

need not be isolated, but should be stored apart from other Lots. If the ammunition cannot be used up in three months it will be broken down and the cordite destroyed.

56. Spare sections of B.L. or Q.F. cartridges returned from annual practice which contain war-manufactured cordite will be destroyed.

57. Whenever practicable, cordite ordered to be destroyed should be visually examined for light-coloured portions or other signs of deterioration; if these are found, samples will be saved, the infected parts tested for acid, and particulars reported.

57A. In the event of cordite being found in an unserviceable condition, particulars of the lot number, quantity or number of charges held and quantity or number of charges found unserviceable will be reported at once, *by telegram*, to the Chief Inspector of Armaments, Woolwich, S.E.18, and the lot concerned will be isolated pending instructions.

D. DESTRUCTION OF UNSERVICEABLE CORDITE

58. The cordite will be conveyed to the ground selected in its original packages or in barrels and cases, the usual precautions for transport of explosives being observed.

59. The ground on which the cordite is to be burnt and its neighbourhood must be free from dry grass or other inflammable material.

60. Cordite for burning will be laid out in a train about 100 ft. long to every 500 lb. of cordite, and a second burning will not be carried out on the same ground, or in the vicinity, until the operations detailed in para. **63** have been performed.

61. The cordite will be burnt under the personal superintendence of the inspecting ordnance officer.

The following stores are required :—

Cells, inert " A " as required.
Suitable firing-key or switch.
Cable, electric, E.1, Mk II.
Fuze, electric, No. 14.
Two water-buckets.
Two watering-cans.
Two shovels.
Tools as necessary for opening packages.

62. After having ascertained that the ground and vicinity is clear and that the wires are disconnected from the battery,

the operator will connect up the fuze and place it in the train of cordite so that the direction of burning may be, as far as possible, against that of the wind. (This should be taken into consideration when the train is laid out.) He will then proceed to the battery, and, when ordered to do so by the inspecting ordnance officer, will connect the leads to the battery and fire.

All persons must be at a safe distance (not less than 20 yds.) from the cordite before the firing-key of the battery is actuated.

63. Immediately after the cordite has burnt out, the ground will be well watered, for which purpose the two watering-cans and two buckets will be ready filled. The ground will then be carefully examined to see that no fire remains. Any unconsumed cordite found will be carefully collected and burnt.

E. DESTRUCTION OF PAPER LININGS FROM CORDITE BOXES

64. After cordite boxes are emptied, the paper linings will be removed from them and carefully searched for loose pieces of cordite that may have become enclosed in the folds. The paper will then be destroyed by burning in small quantities, under precautions, in a suitable place.

F. TRANSPORT OF DOUBTFUL OR UNSERVICEABLE CORDITE

65. Doubtful or unserviceable cordite will not be shipped on private vessels. Should such cordite be ordered home from stations abroad, transport will be arranged by the naval authorities. This does not apply to samples of cordite for silvered vessel test, which will be sent to Woolwich (*see* para. **37**).

APPARATUS HEAT TEST, CORDITE.

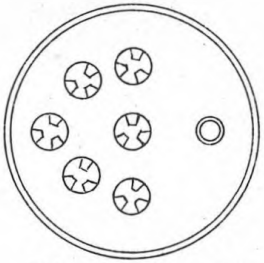

FIG.2.

PLAN OF LID.

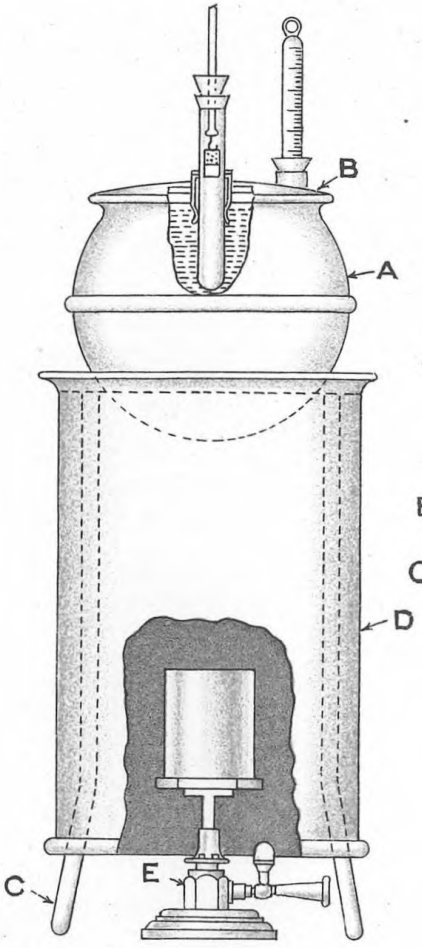

FIG.1.

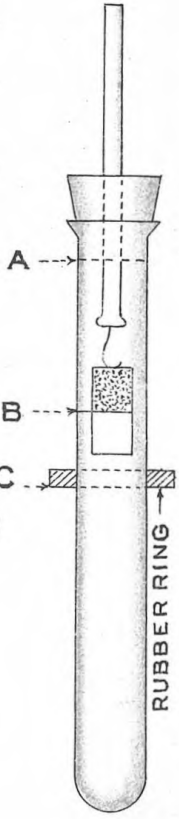

FIG.3.

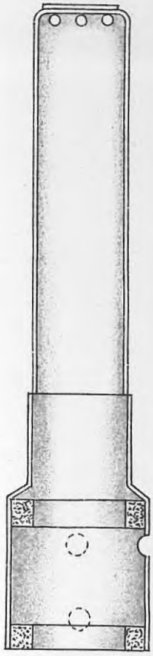

FIG.4.

L.855,20857,8778,1500,7/41.

Malby & Sons, Lith

APPENDIX I

HEAT TEST, CORDITE

(Referred to in para. **37.**)

A. Apparatus and Materials required

1.

Balance	1
Bath	1
Blade, cutter, cordite	1
Bottle, dropping, Mk. III (for glycerine and water mixture)	1
,, ,, ,, (for glycerine and water mixture) (spare)	1
Box, cordite cuttings	1
Brushes (for cleaning test tubes)	4
Brush, sash tool, No. 2 (for cleaning cordite mill and nest of sieves)	1
*Burner, Argand, gas	1
Caps, black paper (for test tubes)	6 for each bath
Cutter, cordite	1
Discs, lead	6 for each bath
Forceps (for lifting heat test papers)	1
†Gauge, heat test paper (for measuring wetted portion of test paper)	1
Glycerine and water mixture (pure glycerine diluted with an equal volume of water)	4-oz. bottle
‡Lamp, spirit, Berzelius	1
‡Lamp wicks	12
Mill	1
Needles (for piercing heat test papers)	a supply
Papers (standard tint)	,,
,, (test)	,,
Plate, glass, perforated (for supporting test papers when piercing)	1
Rings, test tube	12
Rods, glass, bottle dropping, Mk. I	4
,, ,, Mk. I (with platinum wire hook) ...	12
Scoops (for use in weighing ground cordite) ...	2

* Only required at stations where gas is available.

† Supplied by Chief Chemical Inspector, Royal Arsenal, Woolwich, on application.

‡ Only required at stations where gas is not available.

Screen, copper, with mica window	1
Sieves (nest of two)	1
Spatula, Mk. I	1
*Spirit, methylated, industrial, bottle of	1
Stand, tripod	1
Stands, test-tubes, with holes (to hold test tubes when preparing cordite for testing)	2
Stands, test tubes, with pegs (for draining test tubes after cleaning)	2
Stoppers, rubber, bottle dropping, Mk. I	2
,, ,, glass rod, platinum hook, Mk. I	12
,, ,, thermometer, Mk. I	4
Test tubes	12
Thermometers	2
Thermometer, chemical, standard	1
†Tubing, rubber, $\frac{1}{4}$-in. (for burner, Argand, gas), yds.	6
Watch, stop, Mk. II	1
Weights, grain, and forceps in box	set 1

B. Description of Apparatus

2. The nest of sieves is constructed of copper. It consists of two sieves with perforations of specified size, a lid and a pan.

3. The water-bath consists of the spherical copper vessel " A " (**Fig. 1**), fitted with the loose lid of sheet copper " B," and resting on the tripod stand " C."

Under the tripod stand will be placed, either the Argand burner " E " which is provided with a copper chimney, or the Berzelius spirit lamp (*see* para. **4** below). Round the stand will be placed the screen of sheet copper " D." The lid " B " has seven holes, arranged as seen in **Fig. 2,** Nos. 1 to 6 for holding the test tubes containing the cordite which is being tested, and No. 7 for holding the thermometer. Brass clips or wire cages are soldered round holes 1 to 6, on the under surface of the lid, to hold the test tubes in position.

4. When gas is available the Argand burner will be used. When gas is not available, the Berzelius spirit lamp, of which the size of the flame can be regulated, will be used.

5. The thermometer (100–212° F.) will be fitted into the hole in the lid of the water-bath by means of the perforated rubber stopper.

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* Only required at stations where gas is not available.
† Only required at stations where gas is available.

6. The glass rod, terminating in a platinum wire hook, will be used for suspending the test paper in the test tube (Fig. **3**), and will be fitted into the test tube by means of the perforated rubber stopper.

7. The rubber ring "**C**" (Fig. **3**) will be placed round the test tube to check the escape of water vapour from the bath, and from condensing in the upper portion of the tube.

8. The ventilated light-tight cap (Fig. **4**) will be used to shield from light the portion of the test tube which is above the lid of the bath.

9. The lead disc or adjustable cover will be used to cover any hole in the lid of the water-bath which is unoccupied by a test tube.

10. The stop-watch will be used for timing the duration of the test.

10A. The chemical standard thermometer will be used only for standardizing the thermometers used for the test. A tag is affixed to each standard thermometer showing the correction to be applied to its readings. Standardization will be carried out at frequent intervals, at least every three months, and the corrections, if any, will be recorded on tabs affixed to the thermometers. In carrying out the test, the temperature recorded by the thermometer in the bath, when corrected, will be that specified for the test.

In carrying out the standardization, the standard thermometer and the Mk. II thermometer are tied together with their bulbs adjacent and are supported in one of the holes of the bath in such a position that they are immersed in the water to the depth indicated in para. **12.** The other holes are covered with the lead discs and the temperature of the bath raised to 5 degrees above the highest required temperature. The flame is then removed and the readings of the thermometers are compared as the bath slowly cools.

If the reading of a thermometer is found to differ by more than one degree from the true temperature indicated by the standard thermometer, suitably corrected, it must be returned to the C.O.O., Royal Arsenal, Woolwich, for examination by the C.I.A.

Every two years a demand should be submitted for a chemical standard thermometer. On receipt of this, the standard thermometer in use will be returned to the C.O.O., Royal Arsenal, Woolwich, for re-testing by the C.I.A.

C. Preparation of Apparatus

11. The heat test bath will be placed on a bench which is at right angles to a window facing north, or away from direct

sunlight. The background to the heat test bath must be free from yellow tint.

The tint line on the test paper is most easily read by using a dead-white card, placed immediately behind the test tube. Near the sea, the very bright light which is sometimes experienced may be subdued with advantage by placing tissue paper over the window panes which are adjacent to the bath.

12. The water-bath will be filled to within $\frac{1}{4}$ in. of the edge, the lid placed in position, and the thermometer inserted so as to be immersed in the water to a depth of $2\frac{3}{4}$ in. The water will then be heated and maintained at a constant temperature of 160° F., the holes in the lid being covered by the lead discs.

13. When the Berzelius spirit lamp is used, it is preferable to heat the water in a kettle or other vessel before pouring it into the bath, the lamp being used only to maintain the temperature.

Care must be taken in lighting and re-lighting the lamp. It will first be removed from the room and then lit by means of a taper attached to a stick at least 2 ft. long ; it must never be filled or lit when warm.

14. The test tubes will be washed thoroughly with tap water, the fibrous test tube brush being used, and will be allowed to drain. They will then be rinsed with distilled water, if this is available, and dried in a water-oven. If distilled water is not available, the test tubes will be dried thoroughly with a clean cloth. It is most important that the test tubes should be thoroughly cleansed and that the cloth should be clean and dry.

The stoppers, rubber (glass rod), and the glass rod will be cleaned frequently with tap water, pumice being used for the stoppers where necessary. They will then be dried with a clean cloth before use.

15. The mill, before being taken into use, will be carefully cleaned and adjusted. The spindle cutter will be removed and both cutters thoroughly cleaned, using " Brush, No. 2," before commencing to grind cordite for test, and again after the grinding of each sample is completed.

Mills, Mks. III**, IV***, V** and VII.**—The fly-nut will be unscrewed and the handle removed. The metal cap at the bottom of the hopper extension will be released by giving it a quarter turn and the spindle with cutter withdrawn. After cleaning, the spindle, cutter, metal cap, handle and fly-nut will be replaced. The lower bush will be lightly screwed up into the crosshead. The knurled nut on top of the crosshead will be adjusted so that it reads " O " against the index,

when the zero (upper) line on the lower end of the spindle agrees with the lower edge of the cap. In this position the teeth of the two cutters should just clear ; this will give the finest grinding. The lower bush should be screwed down by means of the tommy until its face bears on the shoulder of the spindle, so that the spindle revolves freely without end movement.

Mills, Mks. III* or IV.—These will only be used until a mill of later mark is available.

The fly-nut will be unscrewed and the handle removed. The gunmetal collar, at the bottom of the hopper extension, will be released by giving it a quarter turn, and the spindle cutter will be withdrawn. When replacing the cutter, the fixing screw in the boss of the crosshead will be loosened, the spindle cutter placed in position and the collar fitted on the hopper extension. The spindle cutter will then be raised until the teeth come into contact with those on the shell cutter, and the bearing collar will be adjusted with the spanner until it bears on the lower shoulder of the spindle. One of the key-slots in the bearing collar will be brought into line with the fixing screw, and the screw tightened. The handle and fly-nut will be replaced. The spindle cutter will then be lowered as found necessary by means of the adjusting collar above the crosshead.

When the mill has been lying unused for any length of time, an ounce or so of cordite will be ground through the mill, and will be discarded, before grinding for heat testing is begun.

16. The sieves will be cleaned before each operation with the " Brush, No. 2," and again on completion of sieving for the day.

17. When the glycerine and water mixture in the dropping bottle becomes turbid, it will be discarded. The bottle will be rinsed and dried and replenished with a suitable quantity of fresh mixture. Only the glycerine and water mixture supplied for the purpose will be used.

18.—(1) The heat test is a very delicate test, and the presence of the slightest trace of acid from any extraneous source may render the test useless and misleading. The greatest care will therefore be taken that there is no trace of acid or other chemical impurity on any of the articles used, or on the operators' hands, and that the Heat Test Room is free from fumes. The test will be carried out, if possible, in a separate room where no chemical testing is done.

(2) A receptacle, having a small quantity of water in the bottom, should be kept in a convenient place in the test room, for the retention of waste cordite cuttings pending destruction as laid down in paras. **58** *et seq.*

D. Test Papers and Standard Tint Papers

19. Test papers and standard tint papers will be obtained by direct application to the Chief Chemical Inspector, Royal Arsenal, Woolwich. The test papers are supplied in amber glass tubes, each containing 100 test papers. Test papers withdrawn from the tube and not required for use will be returned at once to the tube and the cork inserted. The tube when not in use will be kept tightly corked and stored in a place which is, as far as possible, dark, cool and dry. The test papers will not be touched with the fingers. Test papers, if unduly exposed to light, become discoloured and unserviceable.

The stock of test papers held for testing will be renewed every twelve months.

20. The test papers when stored under unsuitable conditions are liable to deterioration. In the event of the quality of the papers being suspected, a detailed report thereof, together with the tube of test papers suitably packed, will be forwarded to the Chief Chemical Inspector, Royal Arsenal, Woolwich. The report will be accompanied by a copy of the Army Form G 900, showing the current tests of cordite in which the test papers under suspicion were used.

21. The standard tint paper is supplied in a glass tube enclosed in a cardboard case. It will be stored in the case when not in use. A new standard tint paper will be obtained every twelve months.

E. Selection and Preparation of the Sample of Cordite to be Tested

22. A sample taken from a cartridge for testing will be representative of all portions of the cartridge, or if taken from bulk, will be representative of the contents of a complete box or of the quantity held on charge if less than a complete box.

The sample will include sticks showing the greatest differences in appearance, and will consist of, approximately, $\frac{1}{4}$ lb. for sizes up to and including M.D.11, W. 093 or S.C.100, and for larger sizes at least ten sticks. In the case of Mk. I cordite for silvered vessel test, about 1 lb. will be selected. A sample must not be selected from a cartridge marked "Tested." In the case of cordite wound on drums, a sample will be selected from the loose ends of the cords.

In the case of cordite cylinders, the following numbers will be selected :—

0·05 in. × 2½ in.	12	But *see* para. **42.**
0·05 ,, × 4 ,, ...	8	
0·15 ,, × 4 ,, ...	6	
0·20 ,, × 4 ,, ...	4	

23. The selection of the sample will be carried out in a dim light, and on removal from the cartridge or box, the sample will immediately be wrapped in non-absorbent paper and placed in a clean tinned-plate cylinder (*see* para. **51**), so that any possible effect of light or aeration may be guarded against.

24. When sulphur-infected cordite is to be tested, the sample will first be thoroughly washed in distilled water so that all traces of grains of gunpowder may be removed from the surface of the sticks. The sample will be dried carefully with clean blotting-paper before being ground.

25. The mill will be adjusted so as to give the finest grinding, *i.e.*, the maximum yield of heat test size (*see* para. **15**). This will be achieved when the crosshead is reading " 0." About 2 oz. of the sample, consisting of, approximately, equal portions from the middle and ends of each stick or cylinder, will be taken, cut into small pieces about $\frac{1}{8}$ in. long, and introduced into the hopper of the mill for grinding. The first portion which passes through the mill will be discarded on account of the possible presence of foreign matter from the mill. The cordite will be passed only once through the mill.

Before sticks taken from Q.F. cartridges are prepared, about $\frac{1}{8}$ in. will be cut off from each end and discarded.

26. The ground material will be placed on the top sieve of the nest of sieves and sieved. The portion which passes through the top sieve and is retained by the second sieve will be used for the test, and sieving of this portion will be continued until practically all of the dust has been removed. When this has been attained the cordite will be placed in a well-stoppered test tube pending the carrying out of the test (*see* para. **29** below). No delay must take place between grinding the cordite and carrying out the test, and samples not tested within 40 minutes after grinding will be discarded. Special care will be taken at the same time to subject the ground cordite to as little aeration or exposure to light as possible.

No direct sunlight will be allowed to reach the cordite before or during the test. Handling the cordite will be avoided as far as possible.

F. Application of the Test

27. The test will be applied in duplicate, *i.e.* two results will be obtained for each sample of ground and sieved cordite.

28. The temperature of the bath will be maintained at 160° F. $\pm$0·5° (150° F. $\pm$0·5° for S.C., W. and R.D.N./A. cordite)

during the test, by careful regulation of the heating flame. The level of the water in the bath during the test must be not more than half an inch from the edge.

29. When the temperature of the bath is constant, two portions, each of 25 grains, of the ground and sieved cordite will be accurately weighed on the scoop, placed in two of the test tubes and collected at the bottom by gentle tapping.

The following procedure (paras. **30** *to* **36***) will be carried out for each of the two test tubes :—*

30. Immediately after the cordite has been weighed out, a test paper is removed, by means of the forceps, from the amber glass tube in which the papers are issued and stored, then placed on the perforated glass plate and pierced with a clean needle in the centre, near the upper edge.

The test paper is then held in a horizontal position at the lower end by means of the forceps, and a suitable amount of glycerine and water mixture, correctly judged by experience and conveniently regulated by the quantity contained in the dropping bottle, is withdrawn on the surface of the glass rod.

The rod is held so as to be parallel with the upper edge of the test paper and is inclined so that the excess of liquid is caused to flow away from the extremity of the rod. A portion of the rod, a little distance from the extremity, is then applied to the upper edge of the test paper and drawn, rapidly and evenly, down the surface of the paper to a distance of about 0·4 centimetre from the top edge (the distance depending slightly upon the amount of liquid attached to the rod). The glycerine and water mixture is so applied that the lower edge of the tint line (or the margin between the wetted and dry portions of the paper), at the conclusion of the test, is even, parallel with the top edge of the paper and at a distance from the top edge of 0·9 to 1·2 centimetres when measured with the gauge provided.

31. The platinum wire hook of the glass rod, after being cleaned by passing through a flame, will then be passed through the perforation in the test paper so that, when inserted into the tube, the test paper will hang vertically.

The rubber stopper, carrying the rod and test paper, will be pressed firmly into the test tube and so adjusted that the bottom of the stopper coincides, approximately, with the etched line " A " on the test tube and the centre of the test paper coincides exactly with the etched line " **B** " (Fig. **3**).

The test tube will then be fitted with the rubber ring and inserted into the bath so that the line " **C** " on the test tube coincides with the upper surface of the lid, and the rubber ring rests on the lid.

32. The portion of the test tube above the lid of the bath will be shielded at once from the light by being covered with the black paper cap. The cap will be raised from time to time for observation of the test paper, and will be removed towards the conclusion of the test.

33. Special precautions will be taken to prevent unnecessary exposure of the test paper to light, especially after it has been wetted. A test in which the test tube is not inserted into the bath within three minutes of the wetting of the test paper will be discarded.

34. The test will be read by reflected light. The test is completed when the faint brown line, appearing at the margin between the wet and dry portions of the test paper, equals in colour the brown line on the standard tint paper.

The coloured lines produced in the test differ slightly as regards width, regularity and definition of outline, and, occasionally, uniformity of colour. The general impression given to the eye is affected ordinarily by all these factors, but special care must be taken to disregard their effect and to judge the line by its actual colour, the test being taken as completed when the shade and intensity of a small area in the darkest portion of the coloured band are considered to be equal to those of the colour of the coloured band of the standard tint paper.

35. At the completion of the test, the distance of the tint line (or of the margin between the dry and wetted portions of the test paper, when no tint line has been obtained) from the top edge of the paper will be measured by means of the gauge. A test in which the test paper has been so wetted that the distance is not within the required limits of 0·9 to 1·2 centimetres will be discarded and another test taken.

36. The time which elapses between the insertion of the test tubes into the bath and the completion of the test (up to 30 minutes) will be entered in the report and history sheet, " over 30 minutes " being entered if the test is not completed by that time. Both results will be recorded for each sample tested, sentence being passed on the mean figure when the two results are not identical.

APPENDIX II

INSTRUCTIONS FOR DEALING WITH LOW TEST CORDITE IN TIME OF WAR EMERGENCY

(Referred to in para. **54.**)

NOTE.—These instructions remain in abeyance until the issue of War Office Authority.

1. Cordite sentenced "**Destroy**" (*see* Tables **I** to **III**, para. **46**) will be dealt with as under :—

(*a*) **At Tropical Stations, as defined in Magazine Regulations.**

(i) The cordite will be kept isolated.

(ii) Destruction will be carried out after nine months, or on replacement.

(iii) Heat tests need not be taken during isolation, but before final destruction a test will be taken, and reported on Army Form G 900, to the Chief Inspector of Armaments, Royal Arsenal, Woolwich.

(iv) The report, as at (iii), does not affect the question of destruction of the cordite, which will take place automatically, provided cordite has been received to replace.

(v) If cordite to replace has not been received when nine months have elapsed as at (ii), and it is considered at the station that destruction would too far deplete equipments, telegraphic reference will be made to the War Office.

(*b*) **At other Stations abroad (not tropical), including the Channel Islands :—**

(i) The cordite will be kept isolated.

(ii) Destruction will be carried out after 12 months, or on replacement.

(iii) Action will be taken as at (iii)–(v) above.

(*c*) **At Home Stations, not including the Channel Islands :—**

(i) Full particulars of the cordite, together with the results of the tests obtained, will be reported to the Chief Inspector of Armaments, Royal Arsenal, Woolwich, by telegram, when instructions will be issued.

2. Isolation.—The cordite will be isolated in some safe, cool place, so that it will cause no damage in case of spontaneous ignition.

3. Where possible, arrangements should be made for the effective isolation of low heat test cordite in cartridges in close proximity to the guns, in order that it may be used up, as far as possible, before any other cordite. (No material alteration of ballistics or danger to the gun is to be expected from the use of such cordite fired in a gun.)

4. If practicable, where other structures are not available, temporary underground " dug-outs " should be formed, in which the cordite can be kept cool and protected from the sun by being well earthed over. By appropriate spacing and sub-dividing of the contents of these temporary structures, the effect of spontaneous ignition should be almost negligible. The amount of cordite to be placed in any one " dug-out " should be governed by local conditions.

5. Should no other more suitable accommodation exist, or be possible, the storage employed should take the form of a temporary building (not of corrugated iron), designed to keep the contents as cool as possible.

6. The use of a tent for the purpose of isolation is, however, undesirable, and should not be resorted to, owing to the rise of temperature through exposure to the sun.

7. In the case of buildings selected for the storage of low test cordite which are exposed to the sun's rays, preference should be given, where possible, to those having walls protected by pent roofs.

8. Low test (condemned) cordite once isolated will never subsequently be replaced in a magazine with other explosives.

9. Replacement. Stations abroad, as defined in para. 1 (*a*) **and** (*b*).—When issue from Woolwich is necessary, particulars of the cordite which has reached the condemning limit, and of the extent to which replacement is required, will be reported to the War Office by telegram.

CORDITE CYLINDERS

10. At Stations abroad, as defined in para. 1 (*a*) **and** (*b*) **:—**

(*a*) *Known Lots in Q.F. Cartridges.*—Unless immediate replacement is practicable, the cartridges will be isolated (paras. **2** to **7**), and the cylinders dealt with as in para. **1** (*a*) and (*b*) above, a heat test being taken prior to destruction, and reported as in para. **1** (*a*) (iii).

The cylinders will not be removed from the cartridges until others to replace have been received. When re-fitted with fresh cylinders the cartridges will be returned to the magazine or explosive store.

If, however, the number of cylinders affected is such that their immediate removal from the cartridges would not too far deplete equipments, they should be so removed and destroyed, in which case isolation of the cartridges will not be necessary. A report of the tests (A.F. G 900) will be forwarded as in para. **1** (*a*) (iii).

(*b*) *Unknown lots in Q.F. Cartridges.*—Action will be taken as for " Known Lots," except that a final heat test will not be required.

(*c*) *Cylinders in Bulk* will be destroyed, the Report of Inspection (Army Form G 900) being forwarded as in para. **1** (*a*) (iii).

(*d*) *Replacement.*—Action will be taken as in para. **9.**

11. At Home Stations, as defined in para. 1 (*c*) :—

Cylinders in Cartridges and in Bulk.—Action will be taken as for cordite in para. **1** (*c*).

APPENDIX III

INSTRUCTIONS FOR THE EXAMINATION AND TESTING OF NITRO-CELLULOSE POWDER, IN BULK OR IN CARTRIDGES

1. Sampling.—Packages containing nitro-cellulose powder in bulk or in cartridges are airtight, and after opening for inspection and removal of a sample (about ½ lb.), for test, should be tightly closed again as soon as possible.

It is most important that packages should not be left open in a damp atmosphere.

The cartridge from which a sample is first taken for test should be re-packed and specially labelled to show that powder has been extracted for test. This cartridge will be retained and the powder used for re-making other cartridges containing N.C. powder of the same Lot number, from which samples may subsequently be taken for test. This procedure will be repeated with a fresh cartridge when the quantity in the first is used up. Samples for test must always be taken from a fresh cartridge, and tested cartridges which are re-made will be marked in accordance with the instructions contained in para. **52** (1). In selecting the sample for test the same care will be taken as laid down for cordite (*see* **Appendix I.** para. 22).

2. Odour.—Immediately on opening the package or cartridge the odour of the contents should be noted. The odour will be ethereal if the powder is in good condition, but pungent, acid and characteristically nitrous if the powder is unsound and decomposing.

If the decomposition has reached an advanced stage, the cartridge bag and case will have been attacked by the acid fumes liberated.

3. Colour.—The grains of sound powder differ very considerably in colour : they may be buff, linen-brown, greenish, dark green-blue or nearly black, and progressive change through this range of colours will take place on storage.

This change of colour is due to slight change in the stabilizer present in the powder, and does not indicate marked deterioration of the nitro-cellulose.

When seriously deteriorated, the very dark grains become light again in colour, patches of orange-yellow may develop, and the whole of the grains ultimately become orange-yellow (*see* para. **5** below).

4. Consistency.—The grains of sound powder have a rough surface and are very hard and tough. As deterioration pro-

ceeds, the grains become brittle. The development of small cracks round the edges of the grains is another sign of decided deterioration.

5. Reaction to Litmus.—The grains of sound powder are neutral in reaction, but the orange-yellow deteriorated grains in a state of advanced decomposition are decidedly acid to Service blue litmus paper.

6. Abel Heat Test.—This heat test will be carried out at **180° F.**, with the usual precautions, on the sample ground to cordite heat test size (*see* **Appendix I**). The test must, however, be taken as complete on the development of a definite brown line of whatever character.

7. Sentencing.—Nitro-cellulose powder, after a period of three years from date of acceptance, will be heat tested as indicated above (para. **6**), and sentenced on the results of tests as follows :—

*Heat Test (mean) (at 180°).	Sentence—Applicable to all Temperatures of Storage.
Over 20 minutes	Re-test after one year ↑ (1).
Over 8 minutes to 20 minutes	A 1-lb. sample, selected from the same package from which the heat test sample was taken, will be sent to the C.O.O., Woolwich Arsenal, for special test, the procedure laid down in paras. **37** and **51** being followed.
8 minutes and under	Destroy.

Nitro-cellulose powder which on visual examination appears to have reached the degree of deterioration mentioned in paras. **2, 3, 4** and **5** above will be sentenced unserviceable, and destroyed on receipt of confirmation of sentence.

8. Reports.—The results of examination—odour, colour, consistency, reaction to litmus and heat test—will be entered fully in the Report of Inspection (A.F. G 900).

9. History Sheets.—History Sheets (*see* para. **50**) will be kept for nitro-cellulose powders in bulk and in cartridges.

10. Wet powder.—If nitro-cellulose powder, in bulk, or in made-up charges, has become wet, report should be made, and a 1-lb. sample sent to Woolwich as directed in para. **7**.

11. Destruction.—Nitro-cellulose powder sentenced for destruction must be destroyed in small quantities at a time, as laid down for the destruction of unserviceable cordite (paras. **58** to **63**).

* *See* **Appendix I,** para. **36,** as regards recording the time to complete the test.

APPENDIX IIIA

INSTRUCTIONS FOR THE EXAMINATION AND TESTING OF N.C.Y. POWDER IN BULK AND OF CARTRIDGES M.L. 3-IN. MORTAR AUGMENTING

A. N.C.Y. powder in bulk.

1. Sampling.—Packages containing N.C.Y. powder in bulk are airtight. Each package that is opened for inspection should be tightly closed as soon as possible. The packages must not be left open in a damp atmosphere. Each sample taken should be representative of a complete package and should consist of about $\frac{1}{4}$ lb.

2. Appearance and odour.—The N.C.Y. powder should be in the form of small, free-running, rounded grains coloured with an orange dye and having an odour of camphor. The presence of an occasional undyed or deeply dyed grain may be disregarded. A slight fading of the dye occurs on prolonged storage.

3. Reaction to Congo red.—The N.C.Y. powder should not show an acid reaction when tested with Congo red paper. The portion taken for the test is placed between two moistened pieces of the Congo red paper and the whole is pressed between two clean glass surfaces for about half a minute. The Congo red paper should show no blueing due to acidity.

4. Heat test.—The heat test will be carried out at 170° F. in the manner as for cordite (*see* **Appendix I**), except that the material for test is not to be ground or sieved.

5. Sentencing.—N.C.Y. powder after a period of three years from date of acceptance will be heat tested as indicated above (para. **4**) and sentenced on the results of test as follows:—

Heat test (mean) at 170° F.	Temperature of storage below 80° F.	Temperature of storage 80° F. and above
Over 15 minutes ...	Re-test after two years	Re-test after one year.
Over 8 minutes to 15 mins.	Re-test after one year.	Re-test after six months.
8 minutes and under	Destroy.	Destroy.

6. Damp or wetted powder.—N.C.Y. powder which is damp or has been wetted tends to become caked. If it is suspected that the powder has been affected by moisture, a report should be made and a 1-lb. sample sent to C.O.O., Woolwich, for special examination.

B. Cartridges M.L. 3-in. mortar augmenting.

1. These will be broken down and the N.C.Y. powder examined in accordance with the directions in (A) above. At the same time the celluloid containers should be examined. They should be transparent and practically colourless. Celluloid on deterioration becomes brittle, yellow in colour and opaque ; it also develops acidity. If any doubt is felt as to the condition of a container, it should be tested with Congo red paper.

2. The moistened Congo red paper should be pressed on the surface of the container for about half a minute and should show no blueing due to acidity.

3. If a container is found to be acid, it must be destroyed together with its contents. A report should then be made and 10 further containers from the same lot, selected as being the most deeply coloured, should be forwarded to C.O.O., Woolwich, for special examination.

APPENDIX IV

SECTION 1

INSTRUCTIONS FOR TESTING AND SENTENCING BALLISTITE IN BULK OR IN CARTRIDGES EXCEPT IN SMALL-ARM AMMUNITION

1. The inspection, selection of samples and testing of ballistite in bulk, or in cartridges, including 95-grs. mortar cartridges (*but excepting that in small-arm ammunition cartridges*), will be carried out on similar general lines to those laid down for cordite M.D. and cordite R.D.B.

2. Lots will be sentenced on the results of heat test in accordance with the following table :—

*Heat Test (Mean) (at 160° F.)	Temperature of storage below 80° F.	Temperature of storage 80° F. and above
Over 10 minutes ...	Re-test after 1 year.	Re-test after 6 months.
Over 6 to 10 minutes	Re-test after 6 months.	Re-test after 6 months.
6 minutes and under	Destroy.	Destroy.

3. When the stock sentenced for destruction on the results of heat test is large, or circumstances unusual, the results of test and amounts involved should be reported by telegram to the War Office, the ballistite in the meantime being isolated.

4. History Sheets (*see* para. **50**) will be kept for ballistite in bulk and cartridges, *except* small-arm cartridges.

SECTION 2

INSTRUCTIONS FOR TESTING AND SENTENCING BALLISTITE IN CARTRIDGES, S.A., RIFLE GRENADE, ·303-IN., BALLISTITE, H., AT TROPICAL STATIONS

1. At tropical stations, as indicated in Magazine Regulations, Part I, the ballistite in cartridges of the above description will be subjected to a violet paper surveillance test in accordance with the following instructions.

* *See* **Appendix I,** para. **36,** as regards recording the time taken to complete the test.

2. Apparatus required :—

(*a*) Bottles—Clear glass, with tightly fitting glass stoppers, 4 oz. Only bottles specially tested and supplied for the test will be used and special demands for these will be submitted.

(*b*) Papers—Paper, methyl violet, and paper, standard tint (surveillance test), will be obtained from the Chief Chemical Inspector, Royal Arsenal, Woolwich. Stocks of both papers will be renewed annually and the discarded stocks will be returned to the Chief Chemical Inspector.

Papers, methyl violet, are supplied in amber glass tubes, each containing 50 papers, and must be stored as received. (The wrapping paper should not be taken from the tubes when the papers are stored.) When not in use, the tube will be kept closed and stored in a place which is as far as possible dark, cool and dry. Papers, methyl violet, must not be exposed unnecessarily to light.

Paper, standard tint (surveillance test), is supplied in a glass tube enclosed in a cardboard case. It will be stored in the case when not in use, and must not be exposed unnecessarily to light.

3. Selection of samples.—The quantity of ballistite required for one test is 2 oz. and one such sample will be selected from cartridge of each make and date held on charge at the station.

4. Application of the test :—

(*a*) Before use the bottles must be thoroughly washed with distilled water (or the purest water available) and dried by the application of gentle heat and not by wiping with a cloth. Each 2-oz. sample will be placed in a bottle labelled with the Lot No. (i.e., make and date) and other distinguishing marks of the sample, including the date of selection.

(*b*) A strip of dry test paper, bearing the date in black lead pencil, will be placed on top of the ballistite in the bottle and the stopper tightly inserted. In carrying out this operation, the paper should be handled with the same care as in handling heat test papers. The test bottle thus prepared will be stored in the same store or magazine (preferably in the hottest position) as the ammunition from which that particular sample was drawn. The test samples must be stored in a dark place or dark container. The test paper should be examined at monthly intervals and any colour changes noted. The changes in colour to be expected are through pale violet, pink and yellow to white. The test will be considered complete when the paper has changed to a shell pink colour, corresponding to that of the standard tint paper.

The monthly examination can be made without removing the stopper from the bottle, except when a change of paper is necessary.

(*c*) Papers will be withdrawn at three-monthly intervals, whether colour change has taken place or not, and a fresh paper inserted. At no time should the bottle containing the sample be left open longer than is absolutely necessary for the rapid withdrawal or insertion of test paper.

(*d*) Whenever a paper is found to have attained the standard tint, it should be replaced by a fresh paper. If the time of test falls to two months or under, a fresh sample of ballistite from the same lot of cartridges will be taken, a new test started and the old sample disposed of.

When the time of test is one month or less with a fresh sample, all cartridges of the particular lot affected will be isolated and the result of the test reported to the C.I.A., Royal Arsenal, Woolwich, for instructions as to their disposal.

(*e*) No sample should continue under test for more than 12 months. At the end of this period a fresh sample will be selected from the same lot of cartridges, a new test started and the old sample disposed of.

APPENDIX V

(*Referred to in para.* **37A**)

THE COLOUR TEST OF S.C. AND W. CORDITE

1. Principle of the Test.—The colour test is a measure of the amount of stabilizer which has been used up during the life of the cordite in combining with the acid products of decomposition. The bodies so formed produce a coloured solution when the cordite is dissolved in acetone and the intensity of the colour of this solution is compared with those of various standard colour solutions of graded intensity.

2. Selection of Samples.—The sample must be selected and prepared as directed for the heat test (*see* **Appendix I,** paras. **22–26**), except that the sieved material used for the test is the finely divided cordite deposited in the pan of the nest of sieves.

3. Preparation of the Cordite Solution.—1 gramme (15·432 grains) of the prepared material is placed in a 100 ml. conical flask to which has been previously transferred exactly 50 ml. of acetone from the measuring cylinder. The acetone used must be that specially supplied for the purpose. The flask is closed with a cork covered with tinfoil and the contents are agitated from time to time until solution is complete. The solution of S.C. Cordite is then allowed to stand overnight for settling, but the acetone solution of cordite W. requires a longer period of standing (5 days) owing to its turbidity and relatively high viscosity. Exposure to bright light must be avoided throughout these operations and, except when being handled, the flask containing the solution is placed in the dark.

4. Application of the Test.—The test will be divided into two methods, A and B :—

Method A, for cordite S.C. or W. of which the colour number does not exceed **5**, and which will be carried out locally.

Method B, for cordite of which the colour number exceeds 5. The following stations abroad will be regarded as central stations for the purpose of carrying out Method B of the colour test :—

Hong Kong
Singapore
Ceylon
Egypt
Gibraltar
Jamaica
Sierra Leone

Stations not regarded as central stations will forward samples for testing by Method B when such test is necessary as follows :—

Samples from		*Central Station*
Tientsin, Peking	to	Hong Kong
Penang	to	Singapore
Mauritius	to	Ceylon
Aden, Haifa	to	Egypt
Malta	to	Gibraltar
Bermuda	to	Jamaica

For home stations samples will be consigned to the C.O.O., Royal Arsenal, Woolwich, for testing by Chief Chemical Inspector; the requisite A.F. G 900 in duplicate completed as regards test results, etc., being forwarded as laid down in R.A.O.S., Part II, Pamphlet No. 11.

5. Method A (for Colour Numbers 1 to 5)

(1) Apparatus and Materials required.

V.A.O.S. *Section*		*Store*	*No.*
U		Acetone, special, 1 gallon or 1 quart sealed cans	1
U		Apparatus, heat test, cordite—	
		Test tubes	12
N.I.V.	Chief	Cylinders, measuring, glass, 50 ml.	2
N.I.V.	Chemical	Flasks, conical, 100 ml.	12
N.I.V.	Inspector	,, ,, corks	36
N.I.V.	Supply	Tinfoil	4-*oz.*
			No.
N.I.V. (Chief Chemical Inspector supply)		Standard colour solution, No. 1, 4-oz. bottle	1
		,, ,, ,, No. 2 ,,	1
		,, ,, ,, No. 3 ,,	1
		,, ,, ,, No. 4 ,,	1
		,, ,, ,, No. 5 ,,	1

(2) **The Test.**—The cordite solution, prepared as in para. **3** above, is decanted into a test tube (apparatus, heat test, cordite) disturbance of the sediment being avoided. The tube is filled to the lowest etched mark. Other tubes are

filled to the same mark with water (Colour No. 0) and with Standard Colour Solutions 1, 2, 3 4 and 5 respectively, as required. The tubes are held parallel to the line of a window facing north and the colour of the cordite solution is matched against those of water and the standard colour solutions by viewing down the columns of liquid towards a sheet of white paper, spread on the bench. The tubes are slightly raised from the bench and inclined towards the operator during the matching. The colour number of the cordite is taken as that of water (No. 0) or of the standard colour solution to which it most closely approximates in intensity of colour.

At the conclusion of testing, the colour standard solutions contained in the test tubes are discarded and the test tubes are cleaned with tap water and finally with distilled water. The flask and the test tube containing the cordite solution are cleaned with acetone.

6. Method B (for Colour Numbers above 5)

(1) **Apparatus and Materials required.** — In addition to the items shown in para. **5** (1) the following are also required.

V.A.O.S. *Section*	*Store*	*No.*
N.I.V.	Colorimeter, colour test, cordite	1
H 2	Skins, chamois leather	1
N.I.V. (Chief Chemical Inspector supply)	Standard colour solution, No. 25, 4-oz. bottle ...	1

(2) **Preliminary Adjustment of the Colorimeter.**—A dead-black wooden screen (3 feet square) is erected in front of a window facing north. The screen is provided with side wings and a top piece about 1-foot wide extending away from the window. A small aperture (about 3 inches square) is cut centrally in the screen at such a height that, when the Colorimeter is placed behind the screen with the mirror adjacent to the aperture, the aparatus is at a convenient height for use. The positions of the instrument and the mirror are so adjusted that the whole field is equally illuminated. When this position has been ascertained, it is convenient to fix a shelf with wooden stops, on which the instrument can be placed and held rigidly in position.

(3) **Determination of Colour Number.**—The cordite solution, prepared as in para. **3** above, is decanted, disturbance of sediment being avoided, into the right-hand cell of the instrument so as to fill it to a height of about 4 cm. In the left-hand cell of the instrument is placed a similar quantity of Colour Standard No. 25. The left-hand plunger, or cup,

according to the type of instrument, is then adjusted so that the column of standard colour solution viewed is 8 mm. in height, after which the right-hand plunger, or cup, is adjusted until the two fields viewed in the eye-piece are matched. The height of the columns of cordite solution being viewed is then read. Three further repeat determinations are made, the matching point being approached from both directions, and the mean of the readings is taken.

The colour of the cordite solution is calculated as follows :—

$$\text{Colour number} = 25 \times \frac{\text{viewed height of column of Colour Standard Solution.}}{\text{mean viewed height of column of Cordite Solution.}}$$

For colour numbers over 10 the same procedure is used, except that the height of the column of standard solution which is viewed is 16 mm.

At the conclusion of testing, the standard colour solution in the left-hand cell is discarded.and the cell and left-hand plunger or cup are cleaned with water and a clean cloth. The right-hand cell and right-hand plunger or cup are cleaned with acetone.

(4) **Care of the Colorimeter.**

(*a*) The reflecting mirror must be kept clean and bright so that it affords uniform illumination.

(*b*) The circle of colour viewed in the eye-piece must be accurately bisected so that equal areas of field from the two cells are viewed and the line between the fields is sharply defined.

(*c*) The cells must not be so filled that liquid overflows on the instrument during the adjustments.

(*d*) The instrument must be kept covered when not in use, to prevent access of dust.

(*e*) When necessary, the lens and mirror must be cleaned with a clean chamois leather.

APPENDIX VI

(*Referred to in para.* **48A**)

100 PER CENT. SURVEILLANCE TEST FOR CORDITE

SECTION I.—GENERAL INSTRUCTIONS FOR APPLICATION OF TEST

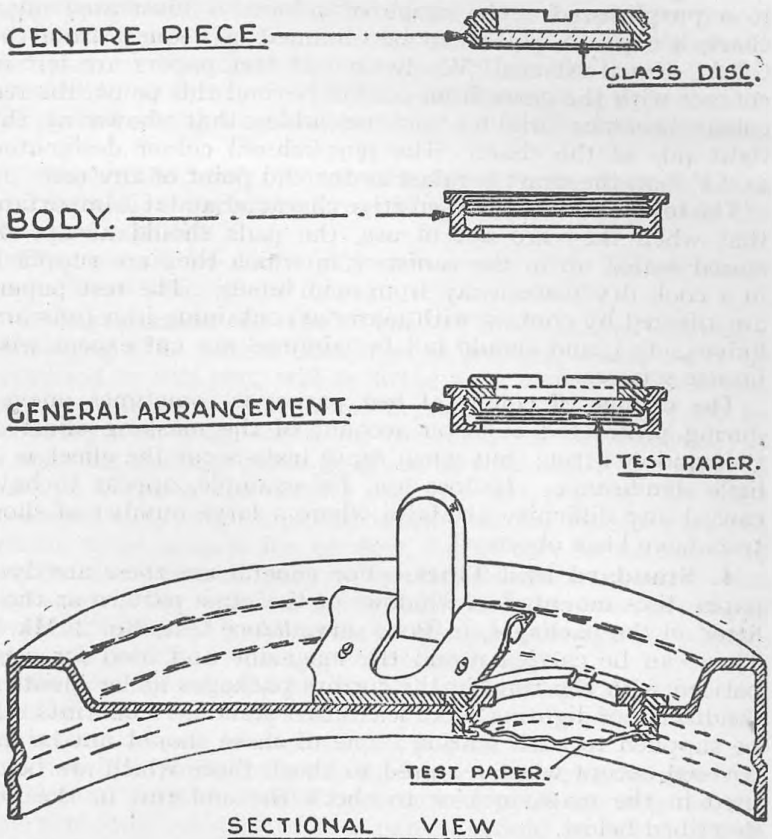
1. The 100 per cent. surveillance test is designed to indicate whether the cordite in any package is approaching a dangerous condition. Each package is provided with a glass window through which can be seen a coloured test paper which is exposed to the air inside the package. The test paper is affected by the gases given off by the cordite during storage and gradually changes colour. With new cordite, the change in colour takes place in the course of several months, the duration of the test depending on the temperature of storage. As the cordite ages, the test tends to become shorter. When the cordite is reaching a dangerous condition, it takes place in a few days. Individual packages containing cordite which for any reason has deteriorated more rapidly than that in similar packages containing the same lot, will be indicated by the papers changing in colour markedly more rapidly.

It is essential to ensure for the gases as free a path as practicable between the cordite and the test paper. This point is dealt with in the detailed instructions in Section II.

2. Inspection windows.—The glass window mentioned in para. **1** is fitted to the outside of the package in a convenient position. For packages containing B.L. charges, it consists of a screwed brass socket into which a brass plug with a central glass disc fits (*see* Fig. 1), the test paper being held between these two pieces in the manner of a washer. To eliminate the possibility of yellow reflections on the glass disc, any bright sockets or recesses are painted a dull black before issue. For boxes containing cordite stored in bulk, the inspection window consists of a glass disc held by a brass spring against a step on the inner end of a hole bored in one end of the box ; the test paper is held close to, but not in contact with, the inner surface of the window by a circular brass clip.

3. Test papers C.B.T.—The test papers for use with packages containing B.L. charges consist of discs of chemically treated paper, which are bound together in pads of 50 and are

FIG. 1. (REFERRED TO IN PARA. 2.)



SECTIONAL VIEW
SHOWING WINDOW IN LID.

INSPECTION WINDOW FOR CYLINDERS, CARTRIDGE.

issued in hermetically sealed canisters, each containing a dozen pads. For boxes containing cordite stored in bulk, papers of a similar nature are supplied already clipped to glass discs; these are issued in hermetically sealed canisters each containing 8 packages of 25.

The original colour of the test papers is blue and on exposure to the gases emanating from the cordite, it changes gradually to a purplish-red. The range of colours is illustrated on a chart, a copy of which can be obtained on request from the C.I.A., Royal Arsenal, Woolwich. If test papers are left in contact with the gases from cordite beyond this point, the red colour becomes brighter and resembles that shown at the right side of the chart. The purplish-red colour designated as " F " on the chart is taken as the end point of any test.

The test papers are of a sensitive character and it is important that when they are not in use, the pads should always be stored sealed up in the canisters in which they are supplied, in a cool, dry place away from acid fumes. The test papers are affected by contact with material containing iron (scissors, knives, etc.), and should not be trimmed nor cut except with bronze scissors.

The change of colour of test papers is sometimes uneven during protracted tests on account of the masking effect of the window fitting, but when rapid tests occur the effect is of little significance. It does not, for example, appear to have caused any difficulty at Malta where a large number of short tests have been observed.

4. Standard End Tints.—For general use these are dyed paper discs mounted in windows of the same pattern as those fitted in the packages, in Box, surveillance test, No. 2, Mk. I. They can be carried round the magazine and used for comparison with the tints in the cordite packages under identical conditions of lighting. At least two standard end tints will be supplied to each station; one of these should not be uncovered except when required to check those which are being used in the magazines or to check the end tint in the box described below.

In addition boxes of tints known as Boxes, surveillance test, No. 1, Mk. I, will be supplied to I.Os. for use in supervising the test. These are small flat metal boxes which contain four pieces of dyed paper, mounted under glass with a black surround, and are convenient for carrying about. Each box contains tints D, E, F (the end tint), and O.E.P. (over exposed paper), the last being normally kept covered by a separate flap; this tint box enables the operator to judge when the end tint is approaching and to confirm when it has been passed.

To prevent the tints from fading, the boxes containing them should be kept shut when not in use and stored with the same care and precautions as are observed with the test papers. Fresh standard end tints in boxes will be issued every two years to prevent the use of any which may have become faded or damaged.

5. Personnel for conduct of the Test.—Men who have had experience of carrying out heat tests for cordite should be suitable for this duty. Strict attention to cleanliness on the part of the operators is essential to the test. Before proceeding to insert test papers, the hands should invariably be washed, using soap and water only, well rinsed, and dried on a clean towel. Scouring powders and soda ash should on no account be used. Operators should have normal vision and should be capable of matching the test paper with the standard end tint.

They should be thoroughly conversant with the approved instructions hung in the magazines (*see* para. **35**).

6. Installation of the Test.—The packages normally containing B.L. cordite cartridges or charges, which are to be subjected to this test, will be fitted with inspection windows. Cases containing cordite stored in bulk or Q.F. charges will be provided with holes bored for the reception of windows. It is essential that the gases be given as wide and free a path as possible between the cordite and the test papers. In order to ensure this, care should be taken that the cordite does not remain tilted against the window, and it may be necessary to modify the internal packing arrangements in some service packages. The detailed information necessary to do this is given in Section II and can be found under the class of ammunition for which the package is normally used.

The packages should be stacked in the magazine in such a manner that the " inspection " windows are easily accessible for inspection and renewal of test papers.

When B.L. packages are in position, the screwed plug of the inspection window should be removed with the help of the key provided. A pad of test papers should be taken out of the canister (*see* under " Test papers " and " Personnel " for precautions in handling), and the current date written clearly with a soft black-lead pencil on each test paper, before insertion into the window. The pencil should on no account be wetted. Indelible or copying ink pencils must not be used, since the dye contained in them is bleached by the cordite gases. The test paper is then removed from the pad with the forceps provided, and inserted in the bottom of the socket with the date showing outermost. The centre plug is then screwed home firmly.

In the application of the surveillance test to cordite in bulk after the cases are in position, a unit, consisting of a test paper clipped to a window, is removed from the canister (with precautions in handling as mentioned above) and the current date written clearly on the test paper (again with precautions as described for B.L. packages).

The unit is then inserted glass outwards in the hole in the end of the box, and a brass spring is placed in the hole so as to press the unit against the step.

Copies of instructions for the use of operators will be hung in magazines (*see* para. **35**).

7. Inspection.—The test papers are to be examined at intervals to ascertain whether they have reached the end tint. The intervals are indicated in the following schedule for stations in which the test is at present in operation. Intervals for other stations will be prescribed when necessary.

Station	Frequency of inspection (B.L. and BULK)	
	Average temperature	Inspection period
Aden	85° F.	Every two days.
Bermuda	70°–75° F.	Twice weekly.
British Isles	60° F.	Weekly.
Colombo	80° F.	Every two days.
Gibraltar	60°–70° F.	Weekly.
Jamaica	80° F.	Every two days.
Malta	60°–70° F.	Weekly.
Mauritius	70°–80° F.	Twice weekly.
Malaya :—		
R.A. Magazine ...	80° F.	Every two days.
Army Magazine ...	60°–70° F.	Weekly.
Connaught Magazine	70°–80° F.	Twice weekly.
Hong Kong	70°–75° F.	Twice weekly.
Sudan	85° F.	Every two days.

It sometimes happens that the test paper is more affected in the centre than at the margins. The effective tint is to be taken as the most advanced tint perceptible on the paper. To facilitate decisions on this point appliances known as " eye-pieces, surveillance test " are supplied. These are ebonite or bakelite fittings which can be slipped into the recess of the test window and enable the centre zone of the paper to be viewed free from disturbing reflections. These fittings are only intended for use in doubtful cases and are not to be inserted in windows at every inspection.

On reaching the end tint, the test papers should be changed, the new paper bearing the date of change. In any case they should not remain in the cordite packages longer than six

months. It will be found convenient to make such six-monthly changes at the same period. If the test papers in some of the packages, *i.e.* new issues and transfers, have been inserted on dates differing from the general six-monthly date of renewal, they can be changed simultaneously with those in the other packages, thus arriving at a common changing date, throughout the magazine.

It is not necessary to adhere rigidly to the six-monthly changing date. As a particular " lot " of cordite deteriorates, it may be found that the bulk of the packages containing this " lot " reach the " end tint " in less than six months ; this " lot " can then be given a " general change " period of five months and so on, gradually reducing the time till the bulk of the " lot " is under suspicion as defined below.

Simple records kept on a card in the magazine will enable this to be done with a saving of labour.

The only exception to changing the papers at a common date will be that, when particular packages are under suspicion, as defined below, the test paper shall not be removed at the general changing date, but shall be allowed to continue to the standard end tint.

Whenever strong daylight falls upon test papers, the windows of the store are to be whitened. Where this is impracticable, a cover (sheet, tarpaulin or a plank, laid over a row of cylinders) should be used.

8. Sentencing.—(*a*) Packages in which the test papers reach the end tint in less than eight weeks are to be regarded as under suspicion ; they should be placed in an easily accessible position in the magazine and specially watched.

(*b*) When the test time falls to four weeks or less, the procedure is to be as follows :—

(i) *Where the test has been installed for not more than* 12 *months* :—The packages are to be removed from the magazine and segregated. The contents are to be broken down, inspected visually and tested by such tests as are applicable to the type of cordite concerned. A report should be cabled to the Chief Inspector of Armaments, Royal Arsenal, Woolwich, giving the Lot number of the cordite, the number of cases which have failed the test, with the times required to reach the end tint, the results of the examination, the total number of cases on test for four weeks or more, and the number which have given the end tint in four to eight weeks. Instructions as to disposal of the cordite will be sent by the War Office.

(ii) *Where the test has been installed for more than twelve months:*—The cordite will be examined and sentenced unserviceable, and samples will be selected as described below. The remainder of the cordite concerned will be destroyed.

The following particulars of cordite destroyed under the 100 per cent. Surveillance test are to be reported in writing to C.I.A.—

Lot No.	*Nature of cartridge*	*No. of cartridges or quantity of bulk*	*Date received at station*

together with the results of visual examination and other tests.

Reference should also be made to the cordite destroyed on the next A.F. G 900 or G 898 forwarded to Woolwich.

(*c*) Before destruction, the contents of the packages are to be broken down, examined visually for signs of deterioration, and tested by such tests as are applicable to the type of cordite concerned. A 2 lb. sample should be set aside for further examination if required. This should be representative of the worst material from the most deteriorated charge. If more than one lot is involved simultaneously, 2 lb. samples of the two worst lots should be set aside, that is, not more than 4 lb. in all.

If visual examination discloses the presence of " corroded " sticks of cordite, this should be confirmed by reaction with litmus paper as described in this pamphlet and a full description should be reported including the number of sticks affected, the size of the corrosion spots and their approximate position. Samples of the corroded sticks should be set aside pending further instructions. A suitable container for such corroded sticks is a well-corked heat-test tube.

9. Transport of Packages fitted with Inspection Windows.—The inspection windows are reasonably proof against breakage during transport, but care should be taken to avoid damage of the glass disc by projecting parts of neighbouring packages. Packages should be protected from rain and sunlight during transport by the use of tarpaulins or other sufficient means.

10. Protection against Direct Sunlight.—The test papers are not affected by diffused daylight, but should not be exposed to direct sunlight. Packages stowed in magazines in such positions that direct sunlight may play upon them through open doors, etc., should be protected by a screen (tarpaulin or other fairly opaque cover).

11. Daylight Lamps.—Artificial daylight lamps are supplied for use in dark magazines. The colour filters of these lamps have been carefully worked out and no other filters should be used. The filter system consists of a circle of bluish glass together with a cellophane disc of a very pale magenta tint. The front of the lamp should be kept covered when out of doors or in strong daylight to prevent fading of the magenta disc.

The instructions for charging (*see* paras. **23** to **34**), a copy of which is issued with each lamp, should be carefully followed. The lamps are fitted with lead rivet seals to prevent illicit use of the battery. These seals should always be renewed when the battery is recharged. The bulbs should be inspected occasionally and renewed when they show appreciable darkening.

In emergency, torches, electric, hand, of approved pattern, fitted with colour filters can be used. The light from lamps using dry batteries is variable in colour on account of polarization and no package of cordite should be sentenced thereby, but should first be examined in daylight. It is desirable that the batteries in such torches should be renewed when only about one-third of their total life is expended. Whenever artificial light shows apparent failure of the cordite in a cartridge, verification in *normal* daylight must *invariably* be obtained before sentencing the cordite.

12. List of Equipment to be supplied to each Station when required.

(1) Keys for opening and closing windows Nos. 1 and 4.

(2) Test papers C.B.T. (*see* para. **3**).

(3) Forceps, surveillance test.

(4) Standard end tints in circular window fittings and Box, surveillance test, No. 2, Mk. I.

(5) Standard tints in rectangular boxes (Boxes, surveillance tests, No. 1, Mk. I).

(6) Viewing cones (Eyepiece, surveillance test, Mk. I).

(7) Daylight lamp with spare bulbs, battery and spare electrolyte, and filter discs.

(8) Torch, electric, hand, with spare bulbs, batteries (including spare) and filter discs.

(9) Lids fitted with inspection windows Nos. 1 or 4 (*see* paras. **13** to **19**).

(10) Windows, No. 5, Mk. I, and brass springs to hold window units in position in cases (*see* paras. **20** to **22**).

(11) Scissors, magazine, Mk. II.

(12) Pliers, window, surveillance test.

SECTION II.—SPECIAL INSTRUCTIONS

B.L. Cartridges packed in Cylinders

13. Cylinder lids will normally be issued to stations with inspection windows already fitted (*see* para. **12** (9) above). Should it be necessary to fit windows to cylinder lids, the windows will be fitted into position as shown on Fig. 1. In any case care must be taken to see that the lids are perfectly clean and if necessary they should be wiped over with a clean cloth ; luting or foreign matter must not be allowed to collect in the window sockets.

14. Care must be taken to see that the loose millboard discs between the cartridge and the lid do not press against the window, as this prevents easy access of gases to the test paper. The cylinders are to be stored without their skeleton cases. Where millboard discs have already been removed they need not be replaced except for transport when required.

15. Cylinders containing cartridges in which the surveillance test has been installed should be subjected only to the minimum of handling and transport. Should the necessity arise at any time for the transport from one station to another of cylinders containing cartridges under test the cylinders must first be replaced in their skeleton cases.

Cordite charges packed in Cases, powder, metal lined, whole, C.118, Mk. IV Cases, powder, metal lined, half, C.119, Mk. IV

16. The inspection windows are fitted to the circular metal lid in the same manner as cartridge cylinder lids. Before fitting the new lids, they should be carefully inspected to see that they are clean, and if necessary they should be wiped over with a clean cloth. Care should be taken to prevent any luting or foreign matter from collecting in the window sockets.

17. Any packing on the top of the cordite charges, such as paper, should be removed, and the metal lid then securely pressed into position, using luting in the usual manner.

18. The wooden lids of the cases should be left open so that the windows are easily accessible for inspection and renewal of the test papers.

19. Item (9) in the list of equipment in para. **12** is required for this application of the test. (Lids.)

Cordite in bulk or Q.F. Charges packed in Cases Cordite

20. Any loose wood must be removed from the hole in the box to ensure that the window unit will fit snugly against the step, and any paper or other packing between the hole and the cordite must be removed to ensure easy access of gases to the test-paper.

21. Item (10) in the list of equipment in para. **12** is required for this application of the test.

22. Tinfoil strip, if included in the charges of cordite, need not be removed when subjected to the test.

Instructions for the care and maintenance of the "ceag" Inspection Lamp fitted with Alkaline Battery.

To open the lamp:

23. This lamp is locked by a lead rivet lock on the lamp top. To open, remove the rivet or seal, raise the knurled head of the lock and unscrew the lamp top.

The battery can then be removed for charging.

When replacing the battery make sure that the insulating bottom is in position and that the battery case is also insulated by the cylindrical red ebonite insulation, which should be replaced when damaged. This is necessary to avoid short circuiting between the case and the lamp.

Lamps should never be opened in *clean* areas, as defined in Magazine Regulations, Part I.

To remove the bulb:

24. The bezel ring is also locked by a lead rivet lock on the underside of the bezel ring. Remove the lead rivet, swing the locking lever clear and unscrew the bezel ring. The bulb can then be removed.

To focus the bulb:

25. Hold the reflector tightly against the reflector holder, switch on the lamp by rotating the lamp top, and screw the bulb in or out until a beam is obtained free from shadows or black spots. Replace the bezel ring.

Battery:

26. The battery is a 2-cell 2·5 volt all steel nickel cadmium battery, each cell having an average voltage over the shift of 1·25 volts.

Charging:

27. Before switching on, care should be taken to see that the batteries are connected properly and are not touching each other.

As the metal battery cases are " alive " when the battery is on charge, if the maker's stand is not used, care should be taken to insulate the lamp cases and to ensure that the batteries are not touching each other, otherwise the cells will not be properly charged.

28. The normal charging rate is two amps for eight hours.

The amount of charge should be determined by the amount of time the battery has been on charge, and not by voltmeter readings, which do not give a definite indication. It is better to overcharge than undercharge the alkaline battery.

After charging, the batteries must be allowed to stand, in order to reduce the high initial voltage. If this is not done the bulb consumption will increase.

Stoppers:

29. It is necessary to remove the stoppers whilst charging as these are of the solid type : when doing this care should be taken to prevent spraying by alkali due to slight gas pressure. After charging, batteries should stand for 24 hours before replacing stoppers.

Electrolyte:

30. The specific gravity of the electrolyte in the battery should be as near 1·19 as possible—it is important that this should not fall below 1·17 or rise above 1·19.

The plates must always be kept covered by the electrolyte.

Filling:

31. For foreign stations the batteries are supplied empty and should be filled at the station.

The electrolyte is supplied in tins each containing the exact quantity to make 20 fluid ounces (one pint) of solution. The solution should be made up by dissolving the electrolyte in distilled water. Considerable heat is evolved in this operation and the solution should be allowed to cool before being poured into the cells.

If it is desired to keep a stock of this solution it should be stored in a rubber-stoppered bottle.

For home stations the batteries are sent out filled and fully charged and there is no need to renew the electrolyte for 18 months, except in the case of spilling.

Refilling:

32. The procedure is as follows :—

Discharge the battery down to 1·0 volt, empty the electrolyte. Fill the battery with ordinary tap water and give a thorough shaking. If the water comes out dirty in any way, repeat the washing out until the water comes away clear.

Fill the battery with alkaline electrolyte, specific gravity 1·19, until the plates are covered.

Put the battery on charge for 16 hours at 2·0 amp.

Topping up:

33. Should be done weekly. Use distilled water. If the density of the electrolyte becomes too low (*i.e.* towards 1·17) top up once or twice with full strength solution.

Important:

34. Do not use a hydrometer or any other instrument that has been used in acid. All equipment and instruments should be used for alkaline electrolyte exclusively.

On no account must acid be used on or near the alkaline battery. The slightest trace of acid will seriously damage the battery, and a large amount will completely ruin it.

Instructions to be hung in Magazines

35.

(1) PAPERS MUST NOT BE TOUCHED BY HAND, FORCEPS MUST ALWAYS BE USED. (NOTE I.)

(2) EVERY PAPER MUST BE DATED AT THE TIME OF ITS INSERTION. (NOTE II.)

(3) BLACK LEAD PENCIL MUST ALWAYS BE USED : NEVER " INDELIBLE " OR " COPYING INK."

(4) THE DATE MUST BE WRITTEN AS CONCISELY AND NEATLY AS POSSIBLE WITHOUT UNNECESSARY STROKES. IT MUST INCLUDE THE DAY OF THE MONTH THUS—1.9.39.

(5) WINDOWS MUST BE KEPT FREE FROM DUST AND FINGERMARKS.

(6) TEST PAPERS SHOULD NOT BE EXPOSED TO DIRECT SUNLIGHT.

(7) WHEN A PAPER SHOWS SEVERAL DIFFERENT TINTS THE MOST ADVANCED SHOULD BE RECORDED. (NOTE III.)

(8) PROPER VENTILATION IS ESSENTIAL FOR THE CORRECT FUNCTIONING OF THE SURVEILLANCE TEST. THIS WILL, HOWEVER, BE ENSURED BY CORRECT OBSERVANCE OF THE INSTRUCTIONS LAID DOWN IN MAGAZINE REGULATIONS FOR THE VENTILATION OF MAGAZINES.

(9) ONLY DAYLIGHT LAMPS OR TORCHES SPECIALLY PROVIDED FOR USE IN THIS WORK SHOULD BE USED FOR READING TINTS. IN THE EVENT OF THE FAILURE OF ALL AVAILABLE TORCHES, READINGS SHOULD BE DONE IN FULL DAYLIGHT.

Notes

I. Forceps provided for use in this test should not be used for any other purpose. In the event of contamination they should be washed clean in distilled water.

II. It is not sufficient to date one paper in ten or twelve.

III. The usual example of varied coloration is when the centre of the paper shows a more or less circular patch of a more advanced tint than that of the edge. The tint to be recorded in this case is that which is visible in the aperture of the eyepiece supplied.

When a paper shows a white zone or even a more advanced tint round the edge, it can be taken as evidence of contamination of the window socket by acid or soldering flux. The lid of the cylinder should be replaced by a new one with a fresh paper. The old lid should be returned to Woolwich as contaminated.

When the test paper shows a patchy distribution of small blue areas on a reddish background the tint of the background should be recorded. This effect is due to the occasional presence of insensitive fibres in the test paper.

IV. Particular attention to ventilation is necessary, as excessive dampness in magazines may lead to unduly early fading of papers. It is of the utmost importance that the wet and dry bulb thermometer be maintained in good condition, as laid down in Magazine Regulations, Part I.

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Notified in A.C.Is. 24th December, 1941

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26 Regulations 2106

REGULATIONS FOR ARMY ORDNANCE SERVICES, PART II

PAMPHLET No. 7, 1933

AMENDMENTS (No. 1A)

Para. 21 (as promulgated by Amendments (No. 40) notified in A.C.I. 72 of 1940 and amended by Amendments (No. 43) notified in A.C.I. **732** of 1941). *Below* sub-para. (*g*) *insert* :—

26 Regulations 2106

(*h*) Cordite H.S.C. is of similar composition to S.C., but has a higher nitro-glycerine content and lower carbamite content. Amdt. 1A Dec., 1941

Para. 46.

Table VI (as promulgated by Amendments (No. 43) notified in A.C.I. **732** of 1940). Col. 1. *For* "4-ft." *substitute* "4′" in two cases.

Below Table VI *insert* :—

26 Regulations 2106

TABLE VII—CORDITE H.S.C. (AND H.S.C.T.)

Amdt. 1A Dec., 1941

Heat test at 150° F.	Colour number	Carbamite content	Sentences	
			Mean temperature of storage below 80° F.	Mean temperature of storage 80° F. or above
Over 4′	10 or below		Re-test after 3 years	Re-test after 3 years
	Over 10	Over 2	Re-test after 3-years	Re-test after 2 years
		2 or over 1	Re-test after 2 years	Re-test after 1 year
4′ or less		1 or less	Destroy	Destroy

Notes.—1. Carbamite content estimations are *not* required until a colour number over 10 is attained, and thereafter cordite will be tested by carbamite content in lieu of the colour test.

When cordite is sentenced for carbamite estimation, a sample of about 1 lb. of the lot concerned will be consigned to the C.O.O. Royal Arsenal, Woolwich (*see* paras. 37 and 51).

2. In the event of either heat test or carbamite test giving a result below the specified minimum, the cordite will be destroyed irrespective of other test results.

By Command of the Army Council,

THE WAR OFFICE,
24th December, 1941.

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