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ADMIRALTY FLEET ORDERS

GUNS AND AMMUNITION—MAINTENANCE.

GUNS, GUN MOUNTINGS, DIRECTOR FIRING GEAR UNDER LOW TEMPERATURE.

ADMIRALTY, S.W.1,
4th March, 1943.

The following Orders having been approved by My Lords Commissioners of the Admiralty are hereby promulgated for information and guidance and necessary action.

By Command of their Lordships,

H.V. Markham

To all Commanders-in-Chief, Flag Officers, Senior Naval Officers, Captains and Commanding Officers of H.M. Ships and Vessels including Minor War Vessels (1 Copy), and Superintendents or Officers in Charge of H.M. Naval Establishments concerned.

Note:—For scale of distribution see A.F.O. 998/43.

1024.—Guns and Ammunition—Maintenance

(D.N.O. (W.O.) 3/43.—4.3.1943.)

GUNS AND AMMUNITION—CONSOLIDATED ORDERS ON MAINTENANCE UP TO THE END OF 1942

The following order consolidates previous A.F.Os. up to the end of 1942 on the general maintenance of gun armament and ammunition, the use of muzzle covers, etc. Precautions to be taken in cold weather are described in A.F.O. 1025/43. The fitting of heating to various classes of guns is described in C.A.F.Os. 6305/42 and 6309/42.

Orders as regards individual kinds of guns and ammunition are not included and will be found in the appropriate orders and handbooks.

I.—LUBRICANTS

The following instructions are to be observed and the approved lubricants as shown in the table appended adopted by all H.M. ships :—

(1) The quantities shown as " estimated annual expenditure per gun " should be adhered to as far as possible. Where it is found, however, that the quantity actually required is considerably in excess of or less than that stipulated above the matter should be reported to Admiralty (Director of Armament Supply).

(2) The use of Cooper's grease No. 4 as a protective coating in bad weather is also approved for breech blocks of Q.F. semi-automatic guns, but should not be used as a lubricant for drills or firings.

(3) Quantities of the lubricants required should be demanded by ships as naval stores on the basis of the scales shown.

(4) The Sea Store Establishments and Lists of Particulars will be amended.

(5) In ships employed in low temperature conditions the attention of ships' officers is drawn to the special precautions given in A.F.O. 1025/43.

(6) Recent inspection of the bores and chambers of guns mounted in destroyers has shown that while those in the after mountings are generally in fairly good condition on return to harbour, those in the foremost mountings are invariably in extremely bad condition, particularly at No. 1 mounting, which in bad weather is almost continually under water.

(7) In the case of bores of guns, serious pitting by rust can be prevented by the use of the brush piasaba.

(8) No special brush is provided for the cleaning of chambers of guns and arrangements should, therefore, be made for their thorough scrubbing from time to time by an improvisation consisting of brushes, steel wire, file card type, Pattern 205, suitably attached to a wooden stave, with subsequent cleaning by the use of the bore brush piasaba wrapped with a rag or cotton waste.

(9) Further, when guns are kept loaded at sea, the loaded cartridge case should be lightly greased with Cooper's grease No. 4 for the full extent of its sides.

(10) This Order applies to all guns which are liable to heavy washing down.

(11) The possibility of supplying a larger piasaba as a chamber brush is under investigation.

	Nature of gun.	For (*a*) Breech screw or breech block (exterior rubbing surfaces). (*b*) Crank journals, lock platform and recoil plate guides.				For Remainder of mechanism.			
		Lubricant.		Estimated annual expenditure per gun.		Lubricant.		Estimated annual expenditure per gun.	
		(*c*) Normal weather.	(*d*) Below 20° F.	(*c*).	(*d*).	(*e*) Normal weather.	(*f*) Below 20° F.	(*e*).	(*f*)
I	O.B.L., 16 in., Mark I.	Colloidal graphited grease Z.E. or Z.P., or greasegraph No. 3 (*a*).	Colloidal graphited grease Z.E.	100 lb.	30 lb.	G.S. mineral oil.	Oil, D.T.D. 44D.	20 galls.	6 galls.
II	O.B.L., 14 in., Mark VII.	Colloidal graphited grease Z.E. or Z.P., or greasegraph No. 3 (*a*).	Colloidal graphited grease Z.E.	100 lb.	30 lb.	G.S. mineral oil.	Oil, D.T.D. 44D.	20 galls.	6 galls.
III	O.B.L., 6 in., Mark XXIII.	Colloidal graphited grease Z.E. or Z.P., or greasegraph No. 3 (*a*).	Colloidal graphited grease Z.E.	30 lb.	10 lb.	G.S. mineral oil.	Oil, D.T.D. 44D.	12 galls.	4 galls.
IV	O.B.L., other natures	G.S. mineral oil (*a*) ...	Oil, D.T.D. 44D.	20 galls.	6 galls.	G.S. mineral oil.	Oil, D.T.D. 44D.	20 galls.	6 galls.
V	O.Q.F., 5·25 in. to 4 in.	Colloidal graphited oil Z.A. (*a*) or Oil Graph (*see* note).	50/50 Colloidal graphited oil Z.A./Oil, mineral non-freezing, or Oil Graph.	14 lb.	5 lb.	G.S. mineral oil.	Oil, D.T.D. 44D.	12 galls.	4 galls.
VI	O.Q.F., 2-pdr., Mark VIII, II* and II* C.	Colloidal graphited oil Z.A. (*b*).	Colloidal graphited oil Z.A.	6 lb.	4 lb.	G.S. mineral oil.	Oil, D.T.D. 44D.	6 galls.	2 galls.
VII	O.Q.F. types other than V and VI.	G.S. mineral oil (*a*) ...	Oil, D.T.D. 44D.	12 galls.	4 galls.	G.S. mineral oil.	Oil, D.T.D. 44D.	12 galls.	4 galls.

Note 1.—In very hot weather, one of the colloidal graphited greases in Section I may be used.

Note 2.—When oil, anti-freezing, D.T.D. 44D, is not available, oil mineral, non-freezing, should be used.

II.—Cleaning Oil

Oil, gun cleaning, Type " A " has proved by trials to be a satisfactory substitute for the boiling water method of removing chemical fouling and rust from the bores and working parts of small arms and machine guns. This oil will therefore be introduced for the purposes stated above for use with all small arms and machine guns in the Naval Service (including Naval Aircraft Guns).

2. It should be noted that this oil is purely a cleaning oil and is *not* to be used for lubrication or preservation, for which purpose existing authorised oils and greases are to continue to be used.

3. The oil, gun cleaning, Type " A " should be used in the following manner :—

(*a*) *Chemical corrosion and powder fouling.*—To remove this from the bore, 30 to 40 strands of No. 26 s.w.g. hard brass wire are to be placed in the cleaning rod. The wire is to be well soaked in the cleaning oil and used until chemical corrosion and fouling have disappeared, The bore is then to be cleaned with flannelette soaked in the oil, dried out and lightly oiled with the lubricant approved for the bore.

(*b*) *Metallic fouling.*—The cleaning oil will not remove metallic fouling, which should be removed by the normal methods, after which the bore should be cleaned with flannelette soaked in cleaning oil, dried out and lightly oiled with the lubricant approved for the bore.

(*c*) *Rust.*—(i) Rust is to be removed from the bore as described at (*a*) above or by using wire gauze soaked in cleaning oil in the double pull-through to be followed by cleaning with flannelette soaked in cleaning oil, drying out and lightly oiling with the lubricant approved for the bore.

(ii) Rust is to be removed from the other parts of the mechanism, etc., by steeping them in cleaning oil for ten minutes, after which they should be dried and examined. If the rust has not been completely removed, No. 00 emery cloth or a file card is to be used and the parts again steeped in the cleaning oil for ten minutes. With badly rusted parts it may be necessary to repeat this procedure two or three times. After the treatment the parts are to be dried thoroughly and lightly oiled with the lubricant already approved for use with them. It should be noted that the oil can be used repeatedly for cleaning by immersion, provided that it is carefully strained.

(*d*) *Cleaning of mechanism parts at periodical stripping.*—Whenever periodical stripping is carried out any part of the mechanism, inside body of the gun or other parts which are fouled are to be coated lightly with the cleaning oil, left for ten minutes, dried and cleaned, if necessary with a file card or wire brush. The parts are then to be wiped clean and lightly oiled with the lubricant already approved for use with them.

III.—Machine Guns

From time to time instances have occurred of 0·5-in., 0·303-in. and 0·30-in. machine gun barrels expanding at the muzzle. Investigation indicates that these failures were caused by water in the bore or the use of grease as a measure of protection against heavy weather.

2. Additional protection against weather conditions on all types of machine guns of 0·5-in. and below should be afforded by the provision of painted canvas covers to fit over the flash eliminators or compensators if fitted, otherwise, over the muzzles. These covers are to be made by ship's staff and may be fired through with all types of ammunition.

3. The holes at the rear end of the 0·5-in. V.M.G., Mark III, flash eliminator, are not to be covered or filled up with grease, but when muzzle covers are fitted, the guns are to be raised slowly to full elevation twice every day to allow any water which has collected at the base of the flash eliminator to drain out through these holes, but not to enter the muzzle.

4. In the case of shoulder shooting machine guns fitted with compensators the muzzle cover will blank the compensating holes and prevent the compensator overcoming the tendency for the gun to climb in automatic fire. Provided the users are warned no difficulty will be experienced in holding the gun.

5. All 0·30-in. and 0·303-in. machine guns mounted on board ship are to be protected from the weather by the application of a light coat of Grease D.T.D. 143C to the exterior of the gun. The working parts of these guns are to be lightly lubricated with G.S. mineral oil if the air temperature is above 20°F. Below 20°F. oil, D.T.D. 44D, or if this is not available, oil, mineral, non-freezing, is to be used. Before changing from normal lubricants to non-freezing lubricants the gun must be stripped and all traces of the normal lubricant removed from the working parts. This is best done by thorough cleaning with oil, gun-cleaning, Type " A ", as laid down in current instructions for the use of this oil.

6. Ammunition for the guns mentioned in this Order loaded in magazines, metallic belts, links or strips and the interior and exterior of the magazines, belts, links or strips are to be *very lightly* coated with Grease D.T.D. 143C by ship's staff, as far as possible without unbelting or unlinking the ammunition, where the latter is supplied belted or linked. Particular attention is drawn to the fact that the Grease is to be *very lightly* applied. If it is thickly applied, not only will stoppages occur, but no extra protection is afforded to the ammunition.

7. On no account is the ammunition to be oiled, as all types of oil have been found to penetrate into the propellant and/or the percussion cap. This is known to result in hangfires and missfires and is suspected to cause burst cases.

IV.—Muzzle Covers

Tampions may not be carried on board ship for any gun below 4·5-in. calibre

2. Canvas or other covers should be used over the muzzles of guns as described later in this Order. They should be removed before firing except as mentioned below.

3. Trials indicate that no damage is likely to be caused if a practice shot, or a shell fuzed with a base fuze, is fired through a muzzle cover. This enables guns whose muzzles are not readily accessible to be loaded with shell fuzed with a base fuze and fired with an unpainted muzzle cover on.

4. The firing of fuzed shell through gun muzzle covers should not normally be permitted, and is only to be done on occasions when it is essential for the muzzle cover to be kept in place. The only occasions when the muzzle cover should be kept in place are when the weather conditions are such that ice would form in the bore or constant accumulations of water cause danger of firing with a quantity of water in the bore if the muzzle cover were not in place.

5. Small trials have shown that the liability to premature of shell fitted with fuzes when fired through muzzle covers coated with 3 ins. of pitch to simulate ice is as follows :—

Base Fuzes. Are unlikely to premature and will probably be in a fit condition to function correctly on impact and the risk can be taken.

Nose, Percussion. Nos. 44 and 45P, 131, 240, 241, 243 and 246 are all liable to premature and should not be fired through muzzle covers. Nos. 230, 118, 360 are not very likely to premature.

Time, Mechanical. Nos. 206 and 207 may premature with heavy ice formation and entail moderate risk.

Time Combustion Fuze. Nos. 124, 125, 192, 198, 400, 401 are unlikely to premature.

Time and Percussion Fuze. Nos. 65A, 92 and 93 are liable to premature.

6. Nose fuzes, if fired through a muzzle cover, will probably be blind even if they do not premature.

7. Every endeavour should be made to keep the muzzle covers free from ice formations and the liberal application of Cooper's grease to both sides of the cover will be found a very considerable help in this direction.

8. Cases have occurred of Army guns in North Africa developing a bulge in the bore. This has been ascribed to sand collecting in the bore when guns have been left with the muzzle covers off and the gun being fired in this condition.

When collection of sand in the bore is possible, *e.g.* alongside, muzzle covers should be kept in place.

9. Rubber muzzle covers to design N.O.D. 2190/18 have been supplied for guns 40-mm. calibre and below.

10. Details of these covers are as follows, viz. :—

Type No.	*Guns for which suitable.*
1	Browning, 0·303-in., machine gun. Bren, 0·303-in., machine gun. Oerlikon, 20-mm., Mark I and II, machine guns.
2	Q.F., 2-pdr., Mark II* and II*C. Q.F., 40-mm., Mark I and II (Bofors).
3	Q.F., 2-pdr., Mark VIII. Q.F., 2-pdr., Mark XIV.
4	Colt-Browning, 0·5-in., aircraft type (air-cooled), machine gun. Vickers, 0·5-in., machine gun. Hispano, 20-mm., machine gun (with muzzle thread protector).
5	Vickers, 0·303-in., gas-operated machine gun. Hotchkiss, 0·303-in., machine gun.
6	Marlin, 0·30-in., machine gun. Savage Lewis, 0·30-in., machine gun, without muzzle brake. Farquhar, 0·303-in., machine gun.
7	Vickers, 0·303-in., machine gun.
8	Maxim, 0·303-in., machine gun.
9	Hispano, 20-mm., machine gun (without muzzle thread protector or recoil reducer).
10	Colt-Browning, 0·5-in., M.2, water-cooled machine gun (with flash eliminator).
11	Hispano, 20-mm., machine gun (with recoil reducer).

11. The allowance of covers for ships' guns and for guns used for ground defences (i.e. *excluding* guns mounted in aircraft) will be 10 per gun, of the appropriate type. Demands should be forwarded to the nearest R.N. armament depot or officer-in-charge of armament supply.

The covers will be issued in transparent paper envelopes containing ten. In view of the very large quantities necessary to equip all guns of the natures shewn in paragraph 2, expenditure of covers should be kept to a minimum and care should be taken that they are protected against deterioration by keeping them as far as may be possible in a cool and dark place when not in use. If operational circumstances permit, covers should be removed rather than fired through.

12. Proportion Book of Naval Armament Stores will be amplified accordingly.

13. The types and allowances of rubber muzzle covers for guns mounted in Naval aircraft are being promulgated separately.

14. No further supplies of rubber muzzle covers referred to above are being ordered, but a new type cover made of Bexoid is under manufacture and will be issued when available. Existing stocks of rubber covers are to be used up.

15. The description of the Bexoid covers is as follows :—

Type.	*Guns for which suitable.*
1.	Q.F., 2-pdr., Marks II* and II*c.
2.	Q.F., 2-pdr., Marks VIII and XIV.
3.	Q.F., 40 mm., Mark IV.
4.	20-mm. Oerlikon.
5.	0·5-in. Vickers, Mark III.
6.	0·303-in. Browning, with flash eliminator.
7.	0·303-in. Vickers G.O., Type A.
8.	0·303-in., Lewis, and 0·303-in. Savage Lewis with barrel mouthpiece.
9.	0·303-in. Hefah.
10.	0·30-in. Marlin.

Covers will be an easier fit over the muzzle of the gun if they are slightly warmed, e.g., in the pocket.

16. The allowance of the Bexoid covers for ships' guns and for guns used for ground defence will be the same as for rubber muzzle covers.

17. No Bexoid covers are being manufactured for 0·30-in. Savage Lewis, 0·303-in. Bren, Hotchkiss, Vickers, Maxim, Lewis (shoulder shooting), and 20-mm. Hispano machine-guns mounted for ship or ground defences. When present stocks of rubber covers for these guns are exhausted, no further covers will be supplied.

18. In the case of Oerlikon guns the outside diameter of the barrel at the muzzle has until recently varied widely. Bexoid covers may be made to fit all barrels by adoption of one or the other of the following expedients :—

(*a*) If the barrel is too small, resulting in the cover being a slack fit, insulating tape may be wrapped round the muzzle until the cover fits tightly over it.

(*b*) If the barrel is too large, preventing the cover from going on, the barrel may be carefully filed on its outside diameter until the cover can be made to fit. This work should only be undertaken by an Ordnance Artificer or R.N. Armament Depot.

19. Two-pdr. and 20-mm. nose fuzed high explosive or nose fuzed incendiary ammunition is not to be fired through muzzle covers. To avoid risk of this occurring the following precaution is to be taken with 20-mm. or 2-pdr. guns when the use of muzzle covers is necessary or likely to become necessary :—

If time permits the muzzle cover should be removed before firing but in any case the charger, magazine or belt is to be loaded so that the first two rounds to be fired are of the following types :—

20-mm. Oerlikon or Hispano—Practice or Practice tracer.

2-pdr. Mark II* gun—Practice projectile (including weighted shell) Tracer Projectile.

Mark II*C and VIII L.V. guns—Practice projectile. Tracer projectile.

Mark VIII and XIV H.V. guns—Practice projectile (including weighted shell) Practice Tracer (weighted shell with plug representing fuze and fitter tracer).

Note—When barrel heaters are in use, the first round in the 2-pdr. Mark VIII belt is to be of the special reduced charge practice ammunition, *vide* B.R. 258 (41), paragraph 164.

20. There is no danger attached to firing machine gun ammunition (0·5-in. and below) of any type through muzzle covers of approved types but, for the sake of economy, muzzle covers should if possible be removed before opening fire.

V.—Small Ships and D.E.M.S.

A number of adverse reports have been received from time to time on the state of the armaments of small ships and auxiliary vessels, on their return from sea or while under repair with ships' companies on board.

2. In some cases the armament has been in a condition which would have precluded its effective use against the enemy.

3. It is a matter of vital importance that the country's output of new weapons shall not be reduced by the necessity of replacing weapons which have deteriorated due to inefficient maintenance.

4. It must be understood by Commanding Officers that maintenance of the efficiency of their armaments in time of war is their personal responsibility, and attention is called to C.A.F.O. 595/41, Section I (B), in this respect.

5. In order to ensure that effective supervision is exercised over the maintenance of their armaments in a condition for battle, Commanding Officers are to arrange a daily inspection of them by a responsible officer, who is to report on them and make a suitable entry as to their state in the ship's log.

6. In the case of ships in harbour, or under repair, where port orders may not require the armament to be in a state of readiness, similar steps are to be taken daily to report and note that the armament is in a satisfactory state of preservation.

7. An analysis of the causes of jams and defects in automatic weapons supplied to Auxiliary craft and D.E.M.S. has shown beyond doubt that the majority of defects and failures in these guns are due to lack of proper maintenance and to injudicious and unskilled stripping.

8. It is realised that time does not permit the D.E.M.S. and Trawler Base instructors to teach stripping as it should be taught, particularly in view of the large number of different types of automatic weapons involved.

9. A number of weathering and firing trials have taken place and the results show that much of the stripping now carried out is not necessary.

10. Complete stripping is only to be carried out by Base Staffs who should be guided by the ship's report of numbers of rounds fired and failures to function correctly and the general standard of maintenance on board. The exceptions to this rule are those ships that are away from a port, in which there is a Base staff, for more than a month : or in cases when a gun has failed to fire either in action or when being tested and no obvious reason can be found. After complete stripping by Base staffs or on board, the gun is to fire a short burst as soon as possible.

11. Consequent upon this decision every effort must be made to carry out strictly the routine of maintenance laid down in the Appendix to this order. No deviation from this routine is to be made except in the circumstances laid down in paragraph 4 above.

12. This order is to come into force forthwith and all senior officers concerned are to ensure that it is brought to the notice of Fitting Out Gunnery Officers, Auxiliary Vessels Gunnery Officers and D.E.M.S. Staff Officers. Handbooks will be amended in due course. It is not intended that this order shall affect the existing routines of maintenance in H.M. ships other than D.E.M.S. and Auxiliary Vessels.

13. This order in no way affects instructions already in existence for guns in aircraft.

14. Whenever circumstances permit all guns covered by this order should fire a few rounds immediately on going to sea and then at weekly intervals until arrival back in harbour.

APPENDIX

Grease is *never* to be used in the mechanism or feed arrangements of automatic guns. Use a light oil such as G.S. mineral. In air temperatures below 20° F. oil D.T.D., 44D, or if this is not available mineral oil non-freezing should be used.

When carrying out weekly routines always check the state of ready-use ammunition, magazines, belts and strips. If the ammunition is corroded, unload the magazine, belt or strip, clean the ammunition and grease it very lightly with Cooper's Grease No. 4, then reload. In air temperatures below 20° F. grease D.T.D. 143C should be used. 2-pdr. ammunition should not normally be unbelted on board.

Gun	Daily	Weekly	After Firing
2-pdr., Mark VIII	Lubricate lock lightly and lock guideways without moving the lock or unloading.	Unload. Sponge out bore and chamber. Lubricate lock lightly without stripping and work it several times. Top up water jacket. Go over all grease points. Lubricate feed pawls.	Carry out a daily and weekly routine. Top up buffer cylinder.
2-pdr., Mark II*C	Unload. Lubricate lock lightly without stripping. Work gun in recoil with the tool supplied.	As above. Top up buffer cylinder.	As above.
20 mm. Oerlikon	Remove magazine. Sponge out bore, taking particular care to see that the chamber is left clean and greasy. Lubricate breech and breech block guideways in magazine opening, without easing the spring.	Remove magazine. Ease the spring and lubricate the top of the breech. Remove the shoulder piece handgrips, the trigger cover plate and trigger casing, drain out any water in the gun body. Lubricate the trigger mechanism and re-assemble. Cock the gun, ease springs again and recock.	Carry out a daily and weekly routine. See that the gun securing bolt at the front end of the cradle is free and grease it.

APPENDIX—*contd.*

Gun	Daily	Weekly	After Firing
20 mm. Hispano	Remove magazine. Sponge out bore and chamber. Work breech block several times and lubricate guideways in the breech casing. See the gas cylinder piston joint covered with heavy grease.	Go over all grease points in the recoil mechanism. See the unlocking rods free and lubricated.	Strip the piston and gas cylinder only, clean off all carbon, reassemble and see that the two gas plugs are wired on and that the piston retaining bolt and magazine carrier arm nuts are tight and their locking plates in position.
0·5-in. Vickers and Colt (Browning). 0·303-in. Maxim, Vickers and Browning.	Open rear cover and lubricate the lock mechanism lightly without moving the lock or unloading.	Unload. Sponge out bore and chamber. Work guns in recoil and work lock with crank handle or cocking handle. Lightly lubricate lock and crank mechanism without stripping. Top up water jackets. Lubricate feed block and rear barrel gland without stripping. Go over all grease points.	Carry out daily and weekly routine. Fire a burst of about five rounds and sponge out barrel. In 0·5-in. Colt, see that buffer screw at rear of end cover is screwed up tight.
0·303-in. Hotchkiss	Unload. Sponge out bore and chamber. Work bolt several times and lubricate bolt guides and locking threads.	Lubricate feed ways and feed mechanism generally. Fire a burst of about five rounds and sponge out barrel.	Unload. Cock gun and put it to "SAFE". Unscrew the barrel locking nut until the locking catch on this nut is in line with the marking line on the gun body, then slide off the barrel. Clean the piston head and the cap in the end of it. Unscrew the gas regulator, clean out the gas chamber, clean the gas regulator piston head and leave very lightly oiled. Clean the gas nozzle and replace the barrel. Carry out daily and weekly routine. Fire a burst of about 5 rounds and sponge out barrel.

0·303-in. and 0·30-in. Lewis	Unload. Sponge out bore and chamber. Work bolt several times, make sure that it is sliding freely and lubricate the whole bolt action without stripping.	Lubricate feed pawls and feed arm without stripping. Check that magazines are not bent or damaged, and are clean and oily. Fire a burst of about five rounds and sponge out barrel.	See spring eased and cocking handle forward. Remove butt. Press trigger and slide off the pistol grip. Unhook the spring casing. Remove back body cover. Remove feed arm. Pull cocking handle to the rear and remove it. Slide out piston and bolt, clean the piston head, remove and clean out the gas regulator, lubricate all parts and re-assemble in reverse order. Fire a burst of about five rounds and sponge out barrel. The piston should be only very lightly oiled.
0·30-in. Marlin	Unload. Sponge out bore and chamber. Work bolt action several times and lubricate without stripping.	Lubricate feed ways and feed sprocket without stripping. Fire a burst of about five rounds and sponge out.	Carry out daily and weekly routine. Remove front screws securing side plates, spring the side plates out slightly and remove the gas cylinder. Clean the piston head, gas cylinder and all exposed parts. Re-assemble, fire a burst of about five rounds and sponge out.
0·303-in. Hefah (V)	Unload. Sponge out bore and chamber. Work bolt several times and lubricate bolt guides and locking tongue.	Lubricate generally and ensure that the magazine is functioning correctly by removing a few rounds by hand and then reload the magazine—fire a burst of about five rounds and sponge out barrel.	Unload. Ease the bolt forward. Remove butt trigger group and return spring. Withdraw bolt assembly complete and well lubricate. Remove the nut and lock nut in front of the gas block. Withdraw gas block and gas cylinder—clean gas port with reamer provided and remove carbon from gas chamber and cylinder. Very lightly oil the gas piston and reassemble. Fire a burst of about five rounds and sponge out barrel.

APPENDIX—*contd.*

Gun	Daily	Weekly	After Firing
0·303-in. Vickers G.O. ...	Unload. Sponge out bore and chamber. Work belt several times and lubricate bolt and bolt guides.	Lubricate magazine catch and mechanism generally. Fire a burst of about five rounds and sponge out barrel.	Unload. Ease the bolt forward. Remove trigger group and spade grip by withdrawing the top and bottom securing pin. Withdraw the bolt return spring, bolt and piston complete. Clean and lubricate, removing any carbon from head of gas piston, then reassemble. Remove gas plug under front end of gas cylinder by first removing the split pin. Clean out any carbon and replace, being careful that it is screwed right home in order that the split pin can be replaced. Fire a burst of about five rounds and sponge out barrel.

VI.—Ammunition in Tropical Weather

The following notes on the care and maintenance of ammunition and depth charges are promulgated for the information of small ships and D.E.M.S.

Although there is, in general, no risk of gun ammunition exploding spontaneously at temperatures below 150° F. (*see* paragraph 4 (i) below) there is likely to be some falling off in performance particularly if the daily temperature range is great and, for this reason, as much protection as possible from both sun and bad weather, at all times, should be given to all ammunition at gun position by extemporised shelter (wet sword matting, canvas or wooden covers fitted to the lockers) capable of speedy removal. (N.M.E.R. Arts. 27 and 36.)

2. If gun ammunition is exposed to temperatures in excess of 120° F. it should be returned to the nearest Naval Armament Depot after six months.

3. The normal inspections laid down in N.M.E.R., Chapter V, should be carried out.

4. The following remarks apply to particular types of ammunition :—

(i) 0·303-in. B. IV–IV*Z ammunition is liable to spontaneous combustion if its temperature exceeds 105° F. Instructions regarding this ammunition are in N.M.E.R. 269.

(ii) 2-pdr. 20-mm. and 0·5-in. should be kept greased with Cooper's grease and fired periodically as laid down in N.M.E.R., Art. 36 (7–14).

(iii) *Depth Charges.*—See N.M.E.R., Art. 293, for instructions as to the permissible temperatures for depth charges, etc., filled with T.N.T. or Amatol. Amatol expands slightly when heated past 32° C. (90° F.), and after several repeated cycles of heating and cooling the effect may be to split or bulge the casing of the depth charge ; such depth charges are to be dumped in deep water. To avoid this trouble, depth charges in hot climates should be shielded from the direct rays of the sun as much as practicable by canvas screens or other suitable means. Depth charges are to be stowed so that their longitudinal seam on the outside of the case is visible and in the event of the weld splitting the charge is to be dumped, and a report forwarded, stating the number of the charge and the particulars of filling.

5. If any doubt exists as to the serviceability of the ammunition or its general stowage conditions the services of the local Naval Ordnance Inspecting Officer should be requested.

Note.—Rocket ammunition is subject to more severe temperature restrictions, which are laid down in the specific handbooks.

VII.—Ammunition Generally

Fixed and separate Q.F. ammunition is not fully watertight, either at the primer or at the junction between shell or lid and cartridge case.

2. If water obtains access to the cartridge case interior, the primer magazines or igniters, neither of which is watertight and both of which contain gunpowder, will readily become soaked and inoperative, resulting in missfires.

3. If the gunpowder subsequently dries out it will not result in correct firing but in a hangfire or missfire.

4. It is essential that every care should be taken to ensure that ammunition in ready use lockers and at gun positions is kept as free from spray, etc., as possible.

5. Attention is drawn to the fact that small arms ammunition of all natures and types will in time deteriorate if exposed to moisture or moist atmosphere.

6. Packages once opened are not to be stored in the open. Trials have shown that even if such packages are covered with tarpaulin, moisture will find its way into the cartridges.

VIII.—Ammunition for Automatic Guns

Sea trials have been carried out with very successful results with links lightly coated inside and outside, and ammunition lightly coated all over the outside, with Cooper's grease. It was found that such ammunition left in the gun-ready positions for four weeks was, notwithstanding the appearance of some rust and corrosion, in a fit and serviceable condition for firing.

2. All ships and establishments should arrange that during war and emergency the ammunition, 2-pdr., and 0·5-in., actually on 0·5-in. and 2-pdr., Marks VIII and II* C guns, is lightly coated all over the outside of the links, and outside of the ammunition with Cooper's grease and that, as far as may be possible, the grease is applied on that part of the ammunition covered by the links, using a painter's tool or other suitable brush. Ammunition supplied linked should not be unlinked for this purpose and the grease application is only to be applied to ammunition which may be expected to be exposed on the guns to weather conditions for a protracted period.

Note.—20-mm. Oerlikon and Hispano machine gun ammunition must always be lightly coated with Cooper's grease No. 4 before being loaded into the gun magazines, otherwise short recoils and/or separated cases will occur.

3. In the case of ammunition supplied unbelted in bulk, the links should be lightly coated inside and outside and the ammunition lightly coated all over the outside with Cooper's grease, before being belted up, when it is expected to be exposed on the guns to weather conditions for a protracted period.

Climatic trials are in progress to ascertain whether it will be possible to supply packed and linked ammunition from naval armaments depots already lightly coated with Cooper's grease.

4. A report has been received from the Fleet in which 0·5-in. Vickers III guns have failed to function correctly owing to excessive Cooper's grease on the ammunition. Trials have established that excessive greasing of the ammunition is always productive of No. 3 stoppages. Attention is, therefore, drawn to the need for care in the use of Cooper's grease and of wiping surplus grease off the belts before placing them on the mountings.

5. On no account is the ready use ammunition 2-pdr., 20-mm. or 0·5-in., to be lubricated except lightly with Cooper's grease No. 4.

6. Several cases have occurred during gun trial, of automatic guns failing to function correctly due to dirty ammunition.

7. This has been caused by the ammunition being in the ready use position during building or refit of the ship, becoming covered with dirt which liability is accentuated through the ammunition being lightly greased with Cooper's Grease No. 4 in accordance with C.A.F.O. 1245/40.

8. In order to avoid failure due to this, every care is to be taken to maintain the ammunition in a serviceable condition by weekly inspection, and cleaning where found necessary. Such inspection and cleaning is invariably to be carried out immediately prior to gun trials.

The ready use ammunition and magazines are, where possible, to be covered with quickly detachable unpainted canvas covers to exclude all rain and dirt.

9. As much protection as possible, from both sun and bad weather, at all times should be given for 2-pdr., 20-mm., and 0·5-in. ammunition at gun positions by extemporised shelter, capable of speedy removal.

10. At the end of four weeks, or earlier if the appearance of the ammunition gives cause to doubt its serviceability, a few rounds should be fired from each barrel to test the functioning of the cartridge and the fuze.

The number of rounds to be fired should normally be :—

2-pdr. guns	14
20-mm. guns	10
0·5-in. guns	10

The firing, in the case of the 2-pdr. and 20-mm. guns, should be at low elevation so that the fuze can be seen or heard to function on the water, bearing in mind that at small angles of entry it is possible that the 20-mm. fuze may not function.

When muzzle covers are in place, they should be removed before firing.

11. If the above proof has been correct the following action should be taken :—

2-pdr. guns.

Unload the gun. Link two practice rounds on to the front of the next belt. Load a new belt on to the rails at the outboard end and clip on. Load the gun and replace the muzzle cover.

A record should be kept of the date that each belt was loaded on to the rails, vide paragraph 12 below.

20-mm. guns.

Remove the magazine and unload it. Clean and re-grease the ammunition. Reload the magazine, starting with new rounds (normally 8) and finishing with two new practice or practice tracer rounds. Load the magazine on to the gun and replace the muzzle cover.

0·5-in. guns.

Normal maintenance only.

12. In the event of the proof *not* being correct the following action should be taken :—

2-pdr. guns.

Remove from the gun all belts that have been on the gun as long as the belt which failed and return the ammunition at the first convenient opportunity to the nearest Naval Armament Depot for examination. If more recently loaded ammunition remains on the gun, test it for functioning as in paragraph 10 above. Reload the rails as necessary with fresh ammunition.

Finally leave the gun so that the next firing will start with two practice rounds.

20-mm. guns.

Remove the magazine from the gun, unload it and return the ammunition at the first convenient opportunity to the nearest Naval Armament Depot.

Reload the gun with a fresh magazine in which the first rounds to be fired should be practice or practice tracer.

Reload the old magazine with fresh ammunition.

0·5-in. guns.

Remove the drum, pan, or box, unload it and return the ammunition at the first convenient opportunity to the nearest Naval Armament Depot.

Reload the mounting and drum, pan, or box.

13. All ammunition returned to Naval Armament Depots under the terms of paragraph 12 above should be clearly marked to show that it has been kept on gun mountings and with the number of this Order. Forms S.1148(i) and (j) should also be forwarded.

This ammunition is then to be subjected to the inspection normal to ammunition suspected of failure at sea.

14. The periods for which ammunition may be permitted to remain loaded on guns are :—

2-pdr. guns.

Indefinitely subject to the monthly proofs laid down in paragraph 10, which will, in fact, limit the period according to the number of rounds carried on the rails.

20-mm. guns.

Four months.

Proofs are to be fired monthly (*vide* paragraph 10) for the first three months.

At the end of the fourth month the magazine is to be removed, unloaded and the ammunition returned to Naval Armament Depot.

0·5-in. guns.

Four months.

Proofs are to be fired monthly (*vide* paragraph 10), the belt getting progressively shorter.

At the end of the fourth month the belt is to be removed and the ammunition returned to Naval Armament Depot.

15. None of the ammunition referred to above is completely oil or water-tight and officers should therefore fully exercise their discretion in ordering proofs at more frequent intervals as they may consider necessary.

16. In the case of the 2-pdr., Marks II* C and VIII, one of the reasons for testing by firing as described above is to determine that no round separates its shell from the cartridge case in the feed box when the gun recoils on firing.

17. From reports which have been received at the Admiralty it appears that no trouble with loose ammunition has occurred in ships which have complied with the Fleet Orders and have fired a few rounds regularly from every pom-pom which has ammunition at the guns.

IX.—Preservation of Fuzes in Ready-Use Positions

Considerable care is necessary to maintain ammunition stowed in ready-use racks or ready-use lockers in a serviceable condition. Particular attention is, therefore, drawn to the following information concerning composition R.D.1154 and its use, the use of metal fuze covers, and also to the general instructions for preservation of fuzes.

2. *Composition R.D.1154.*—Composition R.D.1154 for preserving time fuzes and fuzes D.A. and D.A.I. is to be used as described in the following paragraphs. The composition is similar to putty, but does not harden with age. It does stiffen somewhat, but can be softened by warming in the hands. Supply is made in 1-lb. tins on the basis of 1 tin per 400 fuzes. It is in no way a substitute for the water-tight cap, which is still to be used where fitted.

(a) *Time combustion fuzes.*

(i) *New manufacture and repair.*—The composition will be applied at the joints between the time rings and body and cap of the fuze after filling.

(ii) *Fuzes on board.*—The composition is to be applied to fuzes when stowed in ready-use positions, and is to be smeared on with the fingers so as to fill the cracks between the time rings and the body and cap, but not so thickly that it obscures the graduations. Care must be taken not to move the time ring from the "Safe" position during the operation. If fuzes are to be kept set on board as in star shell or shell for barrage fire, the break made in the composition when setting is to be repaired by smoothing the surface with the fingers.

(b) *Time mechanical fuzes.*

(i) *New manufacture and repair.*—The composition will be applied at the joints between the screwed ring and dome and body.

(ii) *Fuzes on board.*—The composition is to be similarly applied to fuzes when stowed in ready-use positions and the break similarly repaired if the fuzes are to be kept set.

(c) *Fuzes D.A. No. 44.*

(i) *New manufacture and repair.*—R.D. cement will be omitted from the head of the fuze and from the safety pin hole and R.D.1154 will be applied in lieu.

(ii) *Fuzes on board.*—R.D.1154 is to be applied as above to any fuzes in exposed positions. The safety pin must not be withdrawn during the operation.

(d) *Fuzes D.A.I. No. 45 P. (except Mark VIII, VIII** and X).*

(i) *New manufacture and repair.*—R.D cement will be omitted from the head of the fuze, the neck of the safety pin and the side escape hole disc, and R.D.1154 will be applied in lieu.

(ii) *Fuzes on board.*—R.D.1154 is to be applied as above to any fuzes in exposed positions. The safety pin must not be withdrawn during the operation.

Note.—Fuzes D.A.I. No. 45 P. Marks II, VII/II, VII*** 2/11, XI 2/11 and XI/11, withdrawn from service will be dealt with in Naval Armament Depots and will be re-issued as convenient to the ships concerned in exchange for the loose Mark VIII** fuzes at present carried.

3. Ships which have not yet demanded composition R.D.1154 should obtain supplies from the nearest Naval Armament Depot at the earliest opportunity.

4. *Metal fuze covers.*—The present metal watertight covers have proved superior to specially designed rubber fuze covers and development of the latter type has been abandoned. The following procedure is to be carried out, viz :—

(*a*) Metal fuze covers are not to be removed until absolutely necessary, due regard being had to operational and weather conditions.

(*b*) In the event of fuze failures the routine report on Form No. S.1148 (*j*) is to state the period of time between the removal of the fuze cover and firing, together with any remarks as to weather conditions, etc., to which the shell had been exposed before and during that period, which may be helpful in determining the cause of failure.

5. *General.*—The following practices should be observed once a week, or more frequently, if found desirable as the result of experience, to minimize the possibility of ammunition in ready-use positions becoming unserviceable, viz. :—

(a) *Time fuzes.*

(i) Covers should be examined and removed and the fuzes and interior of the covers dried if necessary. Composition R.D.1154 should be applied as described in paragraph 2, the covers replaced and a fillet of R.D.1154 applied between the covers and bodies of the fuzes.

(ii) In very cold weather the covers tend to become tight and should be removed more frequently to ensure freedom.

(iii) No. 11 Mark I fuze covers for No. 207 fuzes require the working surfaces between the locking ring and the slotted lips of the securing band to be coated with a light coat of "Cooper's Grease" to ensure freedom from seizure after continued exposure.

(iv) It is important to ensure that after removal of the covers the fuzes are still set to "Safe", especially when they have once been "Set", since it is essential that the fuzes should be at "Safe" before insertion into the fuze-setting machine. This particularly applies to No. 206, No. 207 and No. 401 fuzes.

(v) Fuzes Nos. 124 and 125 should be waterproofed with R.D.1154 as described above in paragraph 2.

(b) *D.A. Fuzes.*

(i) *Fuzes No. 44.*—The cap should not normally be removed, because it is usually difficult to replace the safety pins after removal of the cap. However, with No. 44, Marks VIII/II**, VIII/III* and VIII/IV, the pins securing the safety cap can be removed periodically to ensure that this can be done by the becket provided and the cap moved rotationally to ensure freedom on replacement of the pins securing the safety cap ; a fillet of R.D.1154 should be applied and subsequently maintained at the joint between the head and the cap.

(ii) *Fuzes No. 45P.*—The caps of a percentage of fuzes should be removed, and the fuzes and interior of the caps dried if necessary. Composition R.D.1154 should be applied to the head of the fuze, and a fillet of the composition smeared round the joint between the head and cap after replacement of the cap. If any difficulty is encountered in replacing the safety pin and cap the fuze should be returned to a Naval Armament Depot.

(iii) *Fuzes No. 230.*—The caps of a percentage of fuzes should be removed, and the brass striker cover and interior of the cap dried if necessary. R.D.1154 should be applied to the joint between the cap and the fuze as for No. 45 P. fuzes.

(c) *All fuzes.*—Care should be taken to ensure that all fuzes are properly screwed into the shell and that a fillet of luting, Mark IV, or composition R.D.1154, covers the joint between the fuze and the shell.

(d) *Primers.*—Primers in cartridges should be inspected. The safety clips should be removed, any corrosion or deposit wiped from the primer and the safety clip replaced.

(e) *Cartridge Cases.*—Cartridge cases should be wiped clean.

(f) *Tubes V.S.*—Any tubes showing signs of dirt or corrosion should be wiped clean with a dry rag.

6. It is particularly important that the above instructions should be thoroughly understood and carried out in auxiliary vessels and small craft generally, in which the personnel is comparatively inexperienced in handling ammunition. Authorities concerned at bases are, therefore, to ensure that these instructions are on board such ships, that the personnel receive practical instruction accordingly, and that an ample supply of waterproof composition R.D. 1154 is demanded and available.

7. With reference to the above it is anticipated that there may be a risk of composition R.D.1154 accumulating inside fuze-setting machines, and on the fixed and moving grips in particular.

It is, therefore, necessary that where this composition is being used, the grips should periodically be removed for cleaning, and this should include the space outside the moving grips in the case or all machines except Mark V, in case any of the composition may have penetrated past the chip seal.

Either Service white spirit or carbon tetrachloride may be used as a solvent, but, in the use of either of these substances, care must be exercised, as the former has a flash point of approximately 90° F., and the fumes of the latter are slightly toxic.

The following A.F.Os., embodied in the various parts of this Order, are cancelled :—

I	... ...	*1916/42, 2625/42.*
II	... ...	*1929/41, 3514/42.*
III	... ...	*1138/42, 5524/41.*
IV	... ...	*1399/41, 5521/41—not in annual volume—1137/42, 5157/41, 6147/42, 5772/42, 6155/42, 6163/42, 4734/42, 5158/42.*
V	... ...	*1696/41, 2040/42.*
VI	... ...	*4630/42.*
VII	... ...	*1492/41—not in annual volume—1664/42.*
VIII	... ...	*648/41—not in annual volume—3247/42, 639/42, 2503/42.*
IX	... ...	*1932/41, 4157/41, 2372/41, 4394/41—not in annual volume—38/42, 1268/42,*

and the following Orders which are considered to be embodied in this Order are also cancelled : A.F.O. 3804/39 ; C.A.F.O. 1777/41—not in annual volume.

1025.—Weather—Maintenance of Guns, Breech Mechanisms (including Breech Blocks on A.W. Torpedo Tubes), Gun Mountings and Director Firing Gear, under Low Temperature Conditions

Ships concerned Dockyards and Bases

(G. 01711/43.—4.3.1943.)

Reports forwarded in accordance with C.A.F.O 1333/41 indicate that Cooper's grease No. 4 is not a satisfactory lubricant and the following revised instructions are issued for guidance in the lubrication and protection of guns, breech mechanisms, gun mountings and director firing gear. Heating arrangements have been promulgated in A.F.Os. 6305/42 and 6309/42.

2. If the temperature does not fall below 20°F, no great difficulty in keeping the material efficient need be expected. Regular working of the gear should, wherever possible, be carried out and will be found of considerable assistance. One of the chief concealed dangers to be anticipated is reduced weight of blow of percussion strikers and failure of electrical contact due to congealed oil or luting or ice. If circumstances permit, these parts should be frequently tested to ensure correct functioning.

3. The principal factors affecting the performance of guns and gun mountings in temperatures of 32°F and below are as follows :—

(i) Ice formation in the bore.

(ii) Frozen or congealed lubricant in the mechanisms producing sluggish action or a cushioned striker blow and consequently a misfire.

(iii) Ice formation in the mechanism causing complete failure to function and ice formation in the feed box causing failure to feed.

(iv) Ice formation on the training, elevating, firing and semi-automatic gears and loading trays of the mountings and sluggishness of the mountings in operation due to this ice formation and thickening of the lubricants used.

4. All the above (i) to (iv) are dealt with by suitable covers, by heat from the barrel casing heaters or steam heating system, combined with suitable lubrication. Steps should be taken to defeat the formation of hard ice on mounting and gun mechanism and to adopt a maintenance routine aimed at breaking up and removing such ice as will inevitably form.

5. The following remarks are issued as a guide to assist officers in the maintenance of armament in very cold weather, the rigidity with which they are adhered to must of course vary with local conditions and service, but it should be remembered when estimating temperature that wind has a most important effect and that conditions may well arise that the temperature at an exposed mounting or director may be as much as 10°F below the temperature of still air.

6. *Preparation of guns and mountings for low temperatures.*—The object of the following preparations is to remove *all* traces of normal lubricants which are known to be sticky at low temperatures, washing them out if necessary with petrol or mineral vapouring oil and to replace them in accordance with the instructions below. It is also necessary to protect the ammunition on the mountings and in ready-use stowages and the mechanisms of automatic and machine guns from spray and sea water freezing on :—

(i) Replace all general service mineral oil by oil anti-freezing D.T.D.44D, or by oil mineral non-freezing if D.T.D.44D is not available. Should the temperature remain below −20°F for prolonged periods, oil D.T.D44D. may be mixed with mineral vapouring oil (M.V.O.) to the maximum proportion of 50 per cent. of M.V.O. When lubricated with this mixture, however, bright steel parts will soon become rusty unless the highest standard of maintenance is achieved. This mixture should be replaced by the normal lubricant on return to higher temperatures.

(ii) Except where otherwise ordered anti-freezing grease D.T.D.143C. should be used for grease gun and grease cup lubrication of gun mountings directors and breech mechanisms and for the coating of all exposed surfaces of guns, breech mechanisms and gun mountings. If under extremely low temperatures it is found that grease D.T.D143C. is too thick, it should be thinned with M.V.O., thorough mixing being essential. A heavy coating of grease is not essential but all exposed surfaces should be kept coated so that when snow or ice form on such surfaces they can be readily removed. It should be noted that grease D.T.D.143C. is of a much thinner consistency than Cooper's No. 4 grease or other greases hitherto used for general lubrication. This is necessary in order that it may retain its lubricating properties and be suitable for grease gun and cup application at low temperatures. This is, however, in no way prejudicial to its lubricating properties at higher temperatures. Where lubrication is by means of grease gun or cup it is undesirable to change the grease used on account of the difficulty of removing the previous lubricant. Except where other special lubricants are already specified the use of grease 143C. is acceptable for grease gun and cup lubrication of breech mechanisms, gun mountings and directors for all temperature conditions except for ships operating in the tropics where it may be found that the grease becomes too thin. Separate instructions will be issued to cover these conditions, meanwhile the existing approved lubricants should be used.

(iii) Grcasegraph No. 3 should be replaced by colloidal graphited grease Z.E. Except where otherwise ordered colloidal graphited oil Z.A. is suitable for low temperature use. Instructions for the use of graphited lubricants are given in Chapter IX, 10 and 18 of B.R.292 " Instructions for the Maintenance of Naval Ordnance and Gun Mountings ". At extremely low temperatures graphited lubricants should be thinned down with M.V.O.

(iv) Admiralty compound oil, used in gear boxes of gun mountings in accordance with C.A.F.O. 2276/42 should be mixed with oil D.T.D.44D. thorough mixing being essential. At extremely low temperatures Admiralty compound oil should be completely replaced by oil D.T.D.44D.

(v) All ammunition must be kept free from ice and that stowed in ready-use positions should be *lightly* coated with grease D.T.D.143C. Where, however, electric firing is employed the bases of cartridges and primers or tubes are not to be so coated. Loading trays should be coated with grease D.T.D.143C. and kept clear of ice and snow. It is important that ice and snow is not allowed to collect in loading trays or it will be rammed into the breech opening.

(vi) Locks should be lubricated extremely lightly with oil D.T.D.44D. where other special lubricants are not already specified.

(vii) All openings into mountings, directors or breech mechanisms should be kept covered as far as possible with easily removable canvas covers. For this purpose unpainted canvas well coated on both sides with grease D.T.D.143C. has been found to remain pliable and efficient. Many parts can remain covered during firing (*see* also viii). Canvas skirts secured to the gun shields and reaching to the deck should be fitted where applicable, care being taken that these will not form an obstruction to the movement of the mounting.

(viii) Ammunition, e.g. on 0·5-in. drums and 2-pdr. gun rails, should be kept covered. The covers over 2 pdr. ammunition rails and rear casings of guns can remain in place during firing provided that they do not interfere with the functioning of the guns or mounting. With belted ammunition the exterior of the cartridges and the links are to be lightly greased with grease D.T.D.143C. Cartridges are not to be unbelted for this purpose.

(ix) In the case of Oerlikon guns when degreasing as above particular care must be taken to remove all trace of the previously used lubricant from the gun and magazine, particularly the magazine spring.

The magazine spring, interior of the magazine, and exterior of the ammunition is then to be lightly lubricated with grease D.T.D.143C. The mechanism of the gun is to be lubricated sparingly with oil D.T.D.44D.

(x) All guns whether loaded or unloaded should be kept at full depression, where possible, to avoid water collecting or ice forming in the bores. If possible, mountings should be trained so that the muzzles are facing across the wind and spray. Rubber or Bexoid muzzle covers should be used for automatic and machine guns as instructed in Fleet Orders and Handbooks.

(xi) For sponging out bores, filling water jackets of machine guns and Pom-Poms, buffers and recoil cylinders, except where otherwise specifically ordered, a mixture of 50/50 glycerine and saturated solution of lime water should be used. The amount of glycerine in recoil cylinders may be increased to 60 per cent. but the reliable functioning of automatic guns cannot be assured if a mixture thicker that 50/50 is used in the recoil buffers. (*see* paragraph 7). The instructions in B.R. 292 " Instructions for the Maintenance of Naval Ordnance and Gun Mountings ", paragraphs 384 and 385 should be observed.

(xii) If circumstances permit, obturator pads of B.L. guns should be soaked in warm water or warmed by the application of warm cloths before use.

(xiii) Where permissible locks of B.L. and Q.F. guns should be kept in a warm dry place until required for firing. Where this is not practicable, efficiency can be maintained by frequent testing and use of the correct lubricants. (*See* (vi) above.)

Alternatively, component and spare electric locks should be shipped in turn, the locks not in use being returned to the Ordnance workshop to be cleaned and tested for continuity and resistance, then lubricated and retained in a warm atmosphere until required for use.

(xiv) Fire control circuits should be left on continuously, with voltage kept up and directors and fire-control systems should be worked at steady speeds for a quarter of an hour at regular periods, say, every six hours, to ease the mechanical gear of transmitters, receivers, etc. Desiccators should be kept drained ; B, Mark III type, oil units should be lagged and worked at regular intervals.

(xv) Keep voice pipes covered when not in use. It is considered that, whatever precautions are taken, voice pipes cannot be relied on.

(xvi) Heating systems should be employed in accordance with paragraph 8.

(xvii) Water-cooled automatic and machine guns not fitted with barrel heaters are to be started in recoil at frequent intervals in order to keep the glands free.

(xviii) Where operational circumstances permit the mechanisms of automatic and machine guns are to be worked by hand at frequent intervals and opportunity should be taken to fire a few rounds occasionally.

7. A mixture of 50/50 by volume of glycerine and distilled water will remain completely fluid down to minus 20° F. and a 60/40 mixture down to minus 40° F. These mixtures freeze to a " slush " and no harm is likely to be done to material on that account but care is necessary to ensure that the recoil liquid *is not frozen when the guns are fired.*

At exposed mountings a ready indication of the condition of the recoil liquid can be obtained from a clear bottle, half filled with the same liquid hung in the vicinity. Guns should not be fired if the liquid in the bottle is frozen.

Note.—The proportion of 60 per cent. glycerine should not be exceeded and the glycerine and water should be thoroughly mixed before filling the recoil cylinders. There is a tendency for them to separate when left undisturbed for a long time in cold weather and this may have a very adverse effect on the temperature at which it is safe to fire.

If practicable, guns should be pulled back and eased out to the firing position occasionally.

8. *Instructions for the use of heating systems at low temperatures.*—(i) Attention is drawn to A.F.O. 6303/42.

(ii) When the temperature reaches 30° F., the heating circuits should be made and heating steam, where fitted, applied.

The heaters for barrel casings of automatic guns have the heat regulated to produce a temperature of 180°–190° F. in the barrel casing at an air temperature of 0° F. on a still day. If the conditions encountered exceed this in severity there will still be sufficient heating effect to ensure functioning ; but if, on the other hand, the conditions are less severe, then the temperature of the cooling liquid will rise to a point when the water will evaporate and necessitate frequent topping up.

(iii) It is, therefore, essential to apply the heat with care and intelligence and adapt the amount of heating to the prevailing weather conditions. The following rough-and-ready rule may be used as a guide :—

Make the heating circuits at 30° F., keep cork plugs lightly fitted into the barrel casings, if and when they blow out, switch off the heating circuit for one hour.

(iv) Ammunition precautions to be taken when heating is used :—

2-pdr., Mark VIII L.V.—The first round of the belt is to be practice ammunition.

2-pdr., Mark VIII H.V.—The first round of the belt is to be reduced charge practice ammunition.

0·5-in., Vickers.—The first round of the belt is to be S.A.P. or ball and not tracer or incendiary.

9. *Hand-worked mountings.*—Carry out the following routine at least hourly :—

(i) Put all guns to " SAFE " and where applicable work the interruptor gear.

(ii) Run the mounting through full limits of elevation and training leaving them at full depression for two or three minutes to drain the barrels.

(iii) Remove any ice formation found, paying particular attention to exposed parts of the firing gear.

(iv) Work the firing gear in hand and, where applicable, in electric, checking first that guns are to " SAFE ".

(v) Replace any grease, D.T.D.143C, which has been removed when clearing away ice.

(vi) Return the mountings to the selected bearing.

Power-worked mountings and directors.—Carry out a similar procedure as for hand-worked mountings, it being assumed that the power unit is kept running with the bye-pass valve closed. If this is not the case the power unit should be run for 15 minutes every hour and the oil in the hydraulic system circulated. In the case of mountings using water-argolene mixture as a pressure medium it should be noted that this will freeze at approximately 32° F. It is, therefore, necessary to ensure that in addition to the heating system being put into operation the pumps are run and the system circulated frequently.

10. Ships should report if any of the above arrangements are found unsatisfactory in service.

11. B.R. 292, Appendix 1, will be amended.

(A.F.Os. 6305/42, 6309/42 and 1024/43.)

(A.F.O. 3802/39 and C.A.F.O. 1333/41 are cancelled.)

3/43 (62549) (63955-2) Wt. 8153/2290 1,000 7/43 Hw. G.338/10.