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ADMIRALTY FLEET ORDER

GUNS AND MOUNTINGS, 20 mm. OERLIKON

ADMIRALTY, S.W.1,

25th March, 1943.

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

By Command of their Lordships,

J. 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.

Head of "P" Branch

1413.—Guns and Mountings, 20 mm. Oerlikon

(D.N.O. (W.O.) 14/43.—25.3.1943.)

I.—GENERAL

The following Order embodies all A.F.Os. in connection with Oerlikon guns, mountings, and accessories, which are in force at 25th March, 1943, excepting those mentioned in paragraph 4 below and A.F.O. 945/43 (*see* paragraph 6).

2. The only C.A.F.Os. in connection with Oerlikons which are in force are those mentioned in paragraph 6.

3. During 1942 the Handbook and Drill for the 20 mm. Oerlikon (B.R. 274/41) was distributed. The following amendments to this book have since been issued:—

Amendment No. 1	...	...	A.F.O. P.419/42
No. 2	...	...	A.F.O. P.552/42
No. 3	...	...	A.F.O. P.581/42
No. 4	...	...	A.F.O. P.51/43
No. 5	...	...	A.F.O. P.121/43

Holders of the book who have not received these amendments should demand them.

4. Instructions as regards care and maintenance of guns and ammunition, proof of ammunition at sea, lubrication, use of muzzle covers, cold weather precautions, etc., have been issued in A.F.Os. 1024–1025/43, to which special attention is drawn, since their contents are not repeated in this Order.

For cold weather lubrication *see* Part IX, paragraph 6, below.

5. The remainder of this Order is divided into the following parts:—

- II.—FITTING.
- III.—SHIPPING MAGAZINES, EASING SPRINGS, AND SHIPPING BARRELS.
- IV.—PRECAUTIONS, STOPPAGES, AND MISSES.
- V.—MAGAZINES.
- VI.—MODIFICATIONS (SHIPS AND BASES).
- VII.—MODIFICATIONS (BY DEPOTS AND O.C.A.S.).
- VIII.—TWIN MARK V MOUNTINGS.
- IX.—SUPPLY OF SPARES, STORES, ETC.
- X.—MISCELLANEOUS.
- XI.—CANCELLATION OF PREVIOUS ORDERS.

6. The following C.A.F.Os. are in force in connection with Oerlikons. Orders as regards fitting to individual ships or classes of ships are not included:—

Ammunition (General)	...	...	...	C.A.F.Os.
				893/42*
			*amended by	{ 1072/42
				{ 2277/42
				2340/42
Ammunition (withdrawal)	...	...	...	2561/42
Ammunition (Allowances)	...	...	...	217/43
				318/43
Sights	...	...	...	2257/41
Stops in Relation to Telephone Equipment	...	...	...	1480/42

(Note.—A.F.O. 945/43 deals with the withdrawal of certain lots of practice ammunition.)

II.—FITTING

20-mm. Oerlikon equipments will continue to be fitted generally in warships completing or coming in hand for refit or repairs, in merchant ships converted to auxiliary naval service, and in D.E.M.S.

Investigation is being made into the numbers and positions of mountings in each class of ship affected.

Drawings showing the positions tentatively selected will be provided to the Commanding Officers of ships affected, but final positions should be settled at the ship by ship's officers and refitting authorities.

In the case of ships coming in hand before the drawings referred to above are available on board, *immediate* application for the drawings should be made direct to the Director of Naval Construction, Admiralty, Bath.

2. An investigation has been made into the best design of handstand for Oerlikon mountings of the fixed column type. The existing design has been criticised on the following grounds:—

- (a) It is too low.
- (b) It is too bulky in certain classes of small craft.

Mock-ups were made, and trials carried out with the following designs:—

- (i) Sloped cone, about one-third up the mounting column (proposed by Captain, M. L., Brightlingsea).
- (ii) Flat plate with heel notches, one-third up the mounting column (proposed by D. E. M. S. Range Officer, A.A. Range, Ainsdale).
- (iii) Sloped ramp round mounting (proposed by C.O., H.M.S. "Edinburgh").
- (iv) Double sloped ramp round mounting (proposed by C.O., H.M.S. "Jervis").
- (v) A high handstand designed by Captain, H.M.S. "Excellent".
- (vi) The existing handstand raised 3 inches.

These designs fall under three general headings—

- (A) Foot platforms on the mounting.
- (B) Sloping ramps.
- (C) Stepped bandstands.

Designs under heading (A) have three advantages only. They are easy to make; they are not bulky, and the mounting is self contained. From the gunlayers' point of view they have no advantages. It is difficult for him to keep his footing if the platform is slippery and he is always in an unnatural and strained position.

Designs under heading (B) suffer from the disadvantages that the gunlayer cannot always be sure of keeping his footing and furthermore the ankle joint must be flexed to give a good stance. This is not easy in boots or heavy sea boots. These designs present no advantage from the production point of view.

Designs under heading (C) are admittedly clumsy and cannot be really satisfactory for men of all heights. They do, however, provide a sure foothold under all conditions and they do not constrain the gunlayer to an awkward position.

The views of a number of officers and ratings of various heights were sought and the majority of opinions are shown below:—

Height of gunlayer	1st Performance	2nd Performance
5 ft. 3 ins.—5 ft. 6 ins. ...	High bandstand ...	"Jervis" design ...
5 ft. 6 ins.—5 ft. 11 ins. ...	As above ...	As above.
5 ft. 11 ins.—6 ft. 3 ins. ...	Normal bandstand ...	High bandstand.

3. In ships already fitted, the Commanding Officers should arrange for the fitting of suitable gratings to the steps to increase the height as required. An item, Classification "A", should be included in their lists of As. and As. to cover the work involved, which should be carried out by ships' staffs with material and assistance provided by a Dockyard or Repair Base as necessary. D.E.M.S. S.O's. should arrange with base staffs for the necessary work to be carried out in merchant vessels.

4. For new construction arrangements have been made to supply the high type of bandstand in accordance with A.F.O. Diagram 9/43. If a protective screen is fitted, this should correspond with the reduced diameter, except in merchant vessels in which the existing type of 4-ft. 9-in. radius zarebas should continue to be fitted for the present.

Until the new type is in production, arrangements have been made with the manufacturers to increase the height of the present type of bandstand by 4 inches.

5. Subject to the above, a stepped ramp, constructed in accordance with A.F.O. Diagram 113/42 is to be fitted by the shipbuilder.

As a general rule, this will require to be supplied by the shipbuilder, but arrangements are now being made to purchase fabricated ramps in bulk quantities for supply to shipbuilders by Admiralty. These ramps will be generally as indicated in A.F.O. Diagram 113/42, but will be made in three segments to admit of nesting for easy transport. The vertical angle legs shown on the diagram will be supplied separately in lengths that will allow for cutting to suit the varying heights due to camber and sheer of deck. The three segments will comprise the whole circle which may need cutting to suit conditions at the ship. It is unlikely, however, that these will be available in sufficient numbers to cover requirements for some time. Demands should therefore be forwarded as soon as possible to the Director of Stores, Admiralty, London, after approval, to fit Mark IIA or IIIA equipments

is given, in order that, if ramps cannot be provided within a specified time, no delay will be caused in arranging local manufacture. Where time does not permit of the fitting of the fabricated arrangement shown, a temporary wood structure may be fitted. As a rule the ramp should enclose the mounting, but, where the arcs of fire will be improved by so doing, the gun should be positioned at a distance of 3 ft. from the outboard edge of deck or platform as shown on A.F.O. Diagram 113/42 and in special cases this distance may be reduced to 2 ft. if the advantage gained over-rides the disadvantage that reloading cannot then be carried out on all bearings. Ships supplied with Oerlikon mountings with the telescopic column, i.e. mountings manufactured in Switzerland or America, can dispense with the stepped ramp, subject to para. 21 below.

6. Protective screens or guard rails should be fitted at a minimum distance of 4 ft. 7 in. from the centre of the mounting (except that this minimum may be reduced where necessary in accordance with paragraph 5 above) and should be restricted in height so as to allow of 2½ inch clearance between top of screen or guard-rail and centre line of gun. At the minimum distance (4 ft. 7 in. from centre of mounting) and with maximum depression (5°) on the gun the screen must therefore not exceed 4 ft. 3 in. in height.

7. *Ammunition Stowage.*—Oerlikon ammunition manufactured in U.K. and U.S.A. is Classification Group VI for storage and the balance of outfit and practice which is not stowed in ready use stowages can be accommodated in S.A. or Q.F. magazines. In ships not fitted with these magazines, stowage should be arranged in accordance with N.M.E.R., Appendix III.

Ready Use Stowages.—Standard type lockers are provided as follows:—

- (a) *Magazine Locker*, for replenishment of Oerlikon magazine drums at gun positions.
- (b) *Ready Use Locker*, for stowage of Oerlikon magazine drums.

8. Details of the magazine and R.U. lockers are as follows:—

Magazine Lockers :—

- (a) Length 4 ft. 6 in., width 2 ft. 1½ in., height 3 ft.
- (b) Empty weight, 5 cwts.
- (c) Capacity, four boxes of ammunition.
- (d) Allowance, one per equipment, generally.

Ready Use Locker :—

- (a) Length 2 ft. 6 in., width 1 ft. 6 in., height 2 ft. 6 in.
- (b) Empty weight, 2 cwts.
- (c) Capacity, four magazines (240 rounds, total).
- (d) Allowance, two R.U. lockers per equipment.

Note.—For motor boats, a special light pattern of the standard R.U. locker, weighing 150 lbs. empty (design D.N.C. 2/A.574A) will be supplied.

9. (a) Where two or more Oerlikon guns are to be mounted in reasonably adjacent positions, and satisfactory stowage in magazines below exists, one magazine locker between each two guns should be sufficient for replenishing magazine drums—thus saving deck space and economising in lockers.

(b) Conversely, where no magazine is available for stowing the balance of outfit, such as in certain D.E.M.S. and auxiliaries, two magazine lockers will be required to stow the full outfit of 2,400 rounds.

(c) In other cases, particularly in small ships, lack of sufficient deck space may prohibit fitting any magazine lockers—in which circumstance reliance must be placed on R.U. lockers only and arrangements made for rapid replenishments from below.

10. Therefore, in each instance, the number of magazine lockers and R.U. lockers actually required should be demanded—the demand stating the number of Oerlikon guns mounted—direct from the Director of Stores, Admiralty, London.

11. If the lockers are not immediately available in any particular instance, lockers should be manufactured by the shipyard to drawings:—

D.N.C.2/A 574—Arrangement and details of R.U. locker.

Po.M.C.D.016598 (Sheet 1)—Arrangement and details of magazine locker.

Copies of these may be obtained on application to the Director of Naval Construction, Admiralty, Bath.

Alternatively, where time does not permit of the construction of the necessary lockers, magazines and outfit should be stowed in washdeck lockers, or other suitable weather-deck stowage provided, as a temporary measure until the standard lockers can be supplied.

12. Ammunition lockers should be fitted clear of the working radius, but close to and quickly accessible from the gun position. In cases where two magazine lockers per gun are required the relative positions of these lockers should be staggered as convenient, to obviate sympathetic detonation.

13. Two magazine loading frames and two loading handles per gun will be supplied. The loading frames should be secured to stools, or to folding brackets fixed to convenient bulkheads, the stools or brackets being about 2 ft. square and 2 ft. 6 in. above the deck.

Alternatively, where space is limited or it is more convenient to the lay-out, suitable studs to take the loading frames should be welded to the top of magazine lockers.

14. The deck ring for Mk. IIA and IIIA mountings should in general be of steel ½ inch in thickness at the point of highest deck camber, and is to be of the following dimensions:—

Extreme diameter : 2 ft. 5½ in.

Internal diameter : 1 ft. 11½ in.

Ten holes are to be drilled on a pitch circle diameter of 2 ft. 3¼ in. for ¾ in. diameter holding-down bolts.

15. In some instances the deck camber or sheer may be so considerable as to preclude the economical fitting of the steel deck ring. In these circumstances the fabricated arrangement of gun support and false floor shown on the A.F.O. Diagram 113/42, should be substituted.

16. Where the mounting is to be fitted on a wood-covered deck, the planking need be removed in wake of the seating only, the ramp being connected to the wood and steel deck by angle lugs. The bolts securing the angle lugs to the deck should be tapped through the steel plating and well grommetted and washered to ensure water-tightness. If the steel deck is of sufficient thickness to warrant plug tapping for these bolts, arrangements are to be made accordingly.

Wherever practicable, Oerlikon mountings should be supported by two stiffeners crossing at right angles below the mounting. If the plating of the existing deck or platform is less than 15 lb., a 15 lb. doubling plate should be fitted. The deck firing forces are 2.5 tons downwards at the rear and 1.26 tons upwards at the front of the mounting.

17. The mounting of guns on wood decks or wooden deck houses is the subject of separate instructions to the authorities concerned.

18. It has been found at a number of recent gun trials that the platform on which Oerlikons are mounted are not correctly stiffened and that excessive vibration of the mounting is thus caused.

For any existing ship not already fitted in accordance with para. 16 in which undue vibration of Oerlikon mountings is experienced, the Commanding Officer is to insert an item, Classification A, in his next list of As. and As. to cover the fitting of additional stiffening in accordance with the above.

19. It is desirable that Oerlikon ready-use ammunition lockers should be within the protection of the screens round the mountings but this is not often practicable.

Where ready use lockers have to be fitted outside the screens it is advantageous for the lockers to be fitted against the screens with their lids level with the tops of the screens. This enables the gun's crew to reach the magazine without climbing out of the screens. This arrangement where practicable should be fitted in ships building and is recommended for existing ships subject to—

- (a) The locker being supported at the base only and no additional fittings being secured to its sides.
- (b) Any additional weight involved in providing the necessary supports being acceptable.
- (c) No delay being caused in completion of ships refitting or under construction.

Commanding Officers of ships in service in which improvement in the position of Oerlikon lockers is essential should include an item, Classified "A", in the ship's list of As. and As. to cover the work involved.

20. To enable gun layers of less than average height to use the eyepiece at full depression with Oerlikon, Mark I and Mark IV, equipments, a firing step will be necessary, as shown on A.F.O. Diagram 269/42. In some cases the advantage of getting full depression may not be sufficient to justify the obstruction caused by the firing step, and in other cases a step on specified arcs only may suffice.

Commanding officers of ships concerned should, if desired, insert an item Classified "A*" in their next list of As. and As. to cover the work involved.

Firing steps are also to be provided and fitted by shipbuilders as required by ship's officers in ships being armed with Oerlikon, Mark I or Mark IV, equipments.

21. A few instances have been reported of gun securing bolts in the cradles of 20 mm., Marks IIA and IIIA mountings, fracturing after prolonged use. Such cases have occurred where the bolts have not been a good fit in their housings in the cradle.

As the fracture takes place at the top of the 0.6-in. portion of the bolt, it does not put the gun out of action but renders it difficult to remove the gun from the cradle.

A certain number of new and stronger gun securing bolts are now available for issue on demand from the Gun Mounting Overseer, Coventry.

All Fitting Out Depots should lay in a stock of these bolts numbering not less than 5 and not more than 15 according to anticipated commitments. These should be used to replace bolts which show signs of strain or are loose in their housings in the cradles.

Stocks should be made up from time to time as occasion demands.

22. All gun securing bolts in mountings on board should be examined and any which are found to be defective should be noted for replacement at the first opportunity.

23. Owing to a few instances having been reported of the gun securing bolts in 20 mm. Marks IIA and IIIA mountings fracturing after prolonged service, a new bolt as shown in A.F.O. Diagram 80/42 has been introduced in later mountings.

It has also been reported that a few mountings have been issued with bolts in which the $\frac{3}{16}$ -in. air relief hole has not been drilled.

All mountings on board and at depôts should be examined and any bolts of the type illustrated in the diagram which are found to be without the $\frac{3}{16}$ -in. hole should be drilled at the earliest opportunity as without the hole there is a danger of an air lock being formed above the bolt which would prevent it going right home in the gun.

24. Stocks of holding-down bolts for 20 mm. Oerlikon Mark IIA and IIIA mountings are being supplied to the gun mounting overseers at Coventry and Parkhead for issue to fitting-out and shipping ports where facilities for the manufacture of suitable bolts are limited.

The bolts, which will be supplied in lengths of 5-in., 7-in., and 9-in., should be demanded in sufficient quantities to meet anticipated requirements, based on recent issues of Oerlikon equipments. Fitting-out ports should, according to requirements, lay in stocks of from 300 to 800 bolts, consisting of about 25 per cent. of 5-in. length, 65 per cent. of 7-in. length and 10 per cent. of 9-in. length. Shipping ports should maintain a stock of 9-in. bolts to provide for 10 bolts for each equipment shipped for transport abroad. Ports dealing with both fitting-out and shipment should vary their stocks as necessary.

All depôts should report on the working of the scheme after a reasonable experience has been gained, so that demands for future requirements may be framed on the basis of the rates of absorption of the differing sizes.

The bolts being delivered to Coventry should be accounted for by the Superintending Naval Store Officer, Midland area, and the bolts for Parkhead by the Superintending Naval Store Officer, Clyde area.

The bolts were ordered on the 27th November, 1941, C.P. 9A/75763/41 from Messrs. Walker & Wilson Ltd. as a charge to Vote 8/11/B2W.

25. Depression control gear is not to be fitted to single Oerlikon mountings. Safe limits are to be arranged by training stops and muzzle rails as necessary.

Limits are to be arranged to protect ships structure and personnel. The possibility of hitting isolated stays etc., can be accepted where serious damage would not result, and where an appreciable arc would be gained.

26. To simplify and speed up manufacture of Oerlikon guns it has been decided to omit the cooling fins from the barrels. This will result in making the mountings muzzle heavy, and in order to compensate, extra tension will be required on the balance springs fitted to the L.H. trunnion.

The procedure being followed by mounting manufactures for balancing the mountings at present, is as follows:—

- (a) Move cradle to maximum elevation.
- (b) Fit spring in position in such a manner that it is free from stress.
- (c) Turn spring box in a clockwise direction until it is advanced two or three notches on the housing secured to the trunnion bracket.
- (d) Push spring box home in the housing and secure with the nut on end of trunnion pin.

When barrels without fins are issued it will be found that the spring box will require turning in a clockwise direction through a greater angle to compensate for the greater weight of the gun barrel. This should be done until the gun is balanced in a horizontal position with a full magazine in position.

Hitherto so little force has been required to adjust balance springs that, although spanner slots are provided on spring boxes, no spanners have been required and none have been supplied.

It will probably be found that some form of spanner is necessary to balance guns having no fins. Such spanners should be improvised locally.

27. As it is not possible to provide special spare parts for Mark I (Swiss) Oerlikon guns, it has been decided that the few guns of this description remaining in service are to be replaced by Mark II or IV guns.

Ships mounting Mark I Oerlikon guns should accordingly demand replace Mark II or IV guns from the nearest R.N. Armament Depot. Depots should supply from stocks available and inform the Director of Armament Supply, Admiralty, Bath, if further guns are required to complete allocated equipments—depôts abroad to report by message.

Ships are to ensure that *all* spare parts remaining on board from the original equipment supplied with Mark I guns are also landed with the guns. Magazines should be retained on board.

28. Two types of 300 knot sights for 20 mm. Oerlikon guns have been made in U.S.A. One is 9-in. high and the other 10-in. high, measured from the centre-line of the sight bar to the bottom of the bracket. Neither bears any distinctive marking.

The 10-in. high sight *cannot* be used on British made guns (i.e., Marks I or II guns).

The 9-in. high sight can be used on British made guns provided the shoulder rest of the gun has been modified in accordance with Part VI, paragraph 2 (d).

III.—SHIPPING MAGAZINES, EASING SPRINGS AND SHIPPING BARRELS

An instance has occurred in which the drill for loading a magazine on to the 20 mm. Oerlikon machine gun was incorrectly carried out.

2. The magazine catch lever was not pushed far enough towards the muzzle to ensure that the magazine interlock lever engaged with the ejector. In other words, the magazine catch lever, instead of being pushed towards the muzzle to the full limit of its travel, was only moved just far enough to free the magazine from the magazine catch. When a fresh magazine was placed on the gun it was found that the magazine catch was still in its engaged position and the magazine catch lever had to be pushed again towards the muzzle before the magazine could be dropped into place. On this occasion again the magazine catch lever was not pushed forward to the full limit of its travel, with the result that the magazine interlock rod was not permitted to move forward out of engagement with the magazine interlock fork and, on pressing the trigger, the gun did not fire.

An accident has occurred due to the same cause. In this case, the magazine was shipped without also ensuring that it was in its fully forward position, and on the rear end of the magazine being lowered to be engaged by the magazine catch, the magazine catch lever was released. This allowed the magazine interlock lever to go forward and strike the cap, firing the round in the magazine mouthpiece before the magazine was locked in position on the gun.

3. It is most essential that, whenever a magazine empty or filled is removed from the gun, the magazine catch lever should be pushed towards the muzzle to the full limit of its travel. This operation will cock the magazine catch and, apart from obviating any necessity to handle the magazine catch lever again when the fresh magazine is shipped, will ensure that the interlock which prevents the gun being fired on an empty chamber is withdrawn by the operation of shipping a fresh magazine.

4. Oerlikon mountings of British manufacture are not provided with columns adjustable for height, and the recoiling mass of the gun must therefore be cocked by means of a double-ended lanyard of 2-in. hemp rope. Pending supply of this lanyard, it should be made up by ship's staff. When available these lanyards will be supplied with the guns, but replacements should be made on board. The tails of the lanyard should be approximately one fathom long, and a cut splice should be formed in the centre of the lanyard just large enough to pass over the exterior of the barrel spring casing and bear against the front ends of the breech bars of the gun, before the trunnions on the barrel spring casing.

Note.—See also X, paragraph 3, which describes the one-man cocking arrangement.

5. An instance has occurred in which the barrel of an Oerlikon Mark II gun was not securely locked on assembly, and was lost overboard on firing the gun.

6. To ensure correct assembly and locking, the following instructions are issued for guidance in assembling Mark II barrels in Marks I and II guns.

7. The barrels are engraved just forward of the breech casing with two pairs of arrows to show the correct position for inserting and when locked. One pair of arrows is for use with Mark I gun and the other pair for Mark II gun, the Mark of the gun being engraved between the pair of arrows applicable to the gun.

8. Before assembling, care should be taken to ensure that the plunger in the barrel which operates the double loading stop is pushed in until it is flush with the exterior of the barrel, and that the "Handle, locking, barrel" on the breech casing is in the unlocked position.

9. The barrel should be inserted with the appropriate "Insert" arrow for the Mark of the gun at the top, and then pushed in until it is hard home, after which it should be rotated as far as possible, clockwise, looking from the muzzle (approx. 60°), when the "locked" arrow should be at the top. The "Handle, locking, barrel" should then be released and pushed down to the "locked" position, and a check made by trial to confirm that the barrel cannot rotate.

10. In Mark II guns the "Lever locking barrel" should lie flush with the top of the casing if the barrel is properly locked, and this also should be checked.

11. Accidents have occurred owing to Oerlikon guns being fired without the barrel being properly secured.

12. A number of Mark II Oerlikon guns have been manufactured so that the left shoulder rest of the shoulder piece swivels clockwise instead of anti-clockwise when viewed from the muzzle of the gun. Instructions for the modification of these shoulder rests are given in VI, paragraph 1, below.

IV.—PRECAUTIONS, STOPPAGES AND MISSES

Several instances have occurred in which 20-mm. Oerlikon Machine Guns have been fired with two projectiles in the bore. The sequence of events leading up to this occurrence was as follows:—

- (a) Due to a Magazine failure, probably caused by insufficient tension on the magazine spring, the cartridge feeder in the magazine failed to exert sufficient downward pressure on the cartridge lying in the mouthpiece of the magazine and thus allowed the projectile end of the cartridge to drop and the cartridge case end to rise.
- (b) On the breech block moving forward, the breech face piece failed to engage with the base of the cartridge case but engaged the driving band of the projectile thus forcing the latter into the chamber of the gun and leaving the cartridge case in the magazine mouthpiece. In two cases this was aggravated by the fact that the mouthpiece of the magazine had been closed in by rough usage and the opening was thus insufficiently wide to permit the cartridge case to leave the magazine.

A similar state of affairs can be brought about by a misfired round. When the breech block comes to rest in the forward position the projectile, due to inertia, may separate from the cartridge case and be left in the bore when the recoiling parts are withdrawn.

2. In either of the above cases the gun will be left with a projectile in the bore and if firing is continued the gun will be double-shotted which may cause premature detonation of the projectile in the bore and in any case will expand the barrel and render it unserviceable.

3. The drill lays down that whenever a stoppage occurs the magazine must be removed and the bore must be examined to see that it is clear before firing is resumed. Mirrors examining bore, which will permit examination from the breech end are in course of supply but pending this the bore is to be examined from the muzzle end. At night-time the cleaning rod-cum-ejector should be passed cautiously through the bore from the muzzle end if it is not possible to examine the bore visually. In addition to the above, when the magazine is removed following a stoppage the mouthpiece should be examined to ascertain:—

- (a) that it does not contain a separated cartridge case.
- (b) that the cartridge feeder is exerting sufficient pressure on the cartridges. This can be done by forcing the cartridges into the mouthpiece with the thumbs. On releasing pressure the cartridges should fly smartly back.

4. Oerlikon magazines are susceptible to distortion due to rough handling and particular care should be taken to avoid this at all times.

5. If a separated or damaged cartridge occurs it is likely that the propellant charge will be scattered over the mechanism or be left in the chamber of the barrel. All traces of the propellant should be removed from the chamber before resuming fire and from the mechanism at the earliest opportunity if operational circumstances forbid that it be done immediately.

6. Instances have occurred of stoppages in 20-mm. Oerlikon guns being caused by caps blowing out of the cartridge cases.

A stoppage of this type usually takes the following form:—

- (a) After the gun has fired, the breech block is driven to the rear, ejecting the empty case, and leaving the loose cap which falls into the lip of the breech face piece.
- (b) As the breech block moves forward, the rim of the round being fed cannot reach its seating in the lip of the breech face piece because of the presence of the cap. This causes the round to enter the chamber at a higher level than normal.
- (c) As the breech block continues to move forward, interference between the chamber and the cartridge case attempts to drive the cartridge in a downward direction. The cap, however, prevents this and severe distortion and jamming of the cartridge case in the chamber results.

This type of stoppage is cleared as laid down on pages 17 and 18 of B.R. 274/41. If the cartridge is firmly jammed in the chamber it may be necessary to start the recoiling parts to the rear by means of a lead hammer on one of the breech bars while hauling on the cocking lanyard.

Some American manufactured ammunition and British made ammunition of early lots made up with cartridge cases marked "B.P.F." on the base are liable to produce this defect.

7. It has been found that after a number of rounds have been fired from the Oerlikon gun (Mk. I, II or IV) the set back forces on the front of the breech face piece cause the front end of the hole for the striker pin to close in until eventually a foul exists between the striker pin and the breech face piece which results in one or all of the following:—

- (a) Light blow of striker.
- (b) Broken striker pins.
- (c) Broken or scored hammers.

Efforts are being made to overcome this by amendment to design, but in the meantime ships' staffs should examine the fit of the striker pin in the hole in the breech face piece to ensure that the striker pin has complete freedom of movement. This examination should be carried out after the first 1,000 rounds have been fired and thereafter at intervals of approximately 500 rounds.

Where it is found that the hole in the breech face piece requires rectification, a No. 39 (0.0995-in. dia.) drill—Naval Store Pattern 2043 (subhead B, item 11)—should be passed through from the rear end. If not already on board, all ships, including D.E.M.S. carrying Oerlikon machine guns, should demand drills, Pattern 2043, from the nearest N.S.O. for this purpose, on the following basis:—

- 1 drill—where up to 8 guns are mounted.
- 2 drills—where more than 8 guns are mounted.

8. A hangfire after a missfire of greater duration than 1 minute in this gun has not been definitely experienced and the missfire interval will, therefore, remain at 1 minute.

9. In a gun heated by continuous fire, however, when a missfire occurs, the breech block as usual is brought up on its metal to metal stop and rebounds slightly; the effect of this is that the shell, due to its inertia may leave the cartridge case and proceed slightly up the bore, particularly in worn barrels. This will expose the propellant and may leave some grains in direct contact with the hot steel of the bore, and ignition of the whole charge may result with a very short or relatively long delay according to the temperature of the barrel. Should the shell not separate from the cartridge case the barrel heat must be transmitted to the propellant through the cartridge case and ignition of the propellant is not likely to occur without some minutes delay.

10. By experiments so far conducted it appears that the barrel heat is insufficient to ignite the propellant unless at least 240 rounds have been fired in rapid succession. "Cook-offs" of 4 to 6 minutes have been experienced after rapid fire of between 420 to 540 rounds in new guns, but there is also evidence pointing to a "cook-off" (mistaken for a hangfire) occurring in similarly heated but worn barrels in times varying from 30 seconds to 2 minutes.

11. When a "cook-off" occurs after a period of time exceeding say 3 minutes, the propellant charge as a whole has reached such a high temperature that the chamber pressure developed is extremely high and has been known to bulge the chamber and cause material damage to the breech face piece, breech block and striker, in addition to leaving a part of the cartridge case in the chamber. A change in propellant to avoid this and other features is under consideration.

12. In the event of a magazine becoming defective, a round will sometimes be fed into the chamber ahead of and disengaged from the breech face piece. An apparent missfire will ensue. Whereas this can by the normal drill and the use of the ejector be rapidly overcome in a cool gun, the liability to "cook-off" in a hot gun must not be overlooked. This "cook-off" if it is allowed to occur with the breech block to the rear (or cocked) will put the gun out of action, by damage to the breech block and breech face piece and by driving the shell part of the way up the bore. Should the shell be a H.E.T. or H.E.I.T. the tracer composition will be ignited and may, by transferred heat, cause the T.N.T. or C.E. filling to explode and expand the barrel and shell together.

13. It must be remembered that the position of the horns of the double loading stop give an immediate indication as to whether a cartridge case is in the chamber or not (whether the breech block is back or forward).

14. From the above it should be clear that in a gun heated by firing more than 240 rounds rapid, removing the magazine and re-cocking the gun after the elapse of the 1 minute missfire interval may be attended by a risk of "cook-off" occurring during (or if as in paragraph 5 during or after) the operation. No attempt either to remove the magazine or re-cock should, therefore, normally be made after a missfire in a heated gun until the barrel has been adequately *externally* cooled by a hose. Care should be taken that water does not enter the muzzle. In order to avoid "cook-off" the hose should be applied as quickly as possible.

15. Missfires in this gun are in general caused by bent or broken strikers or by closing up of the central hole in the breech face piece under the stress of firing many rounds, as described in paragraph 8 above.

16. Owing to the length of the tool, withdrawing separated cartridge cases, not being sufficient to grasp firmly or for a tommy bar to be inserted through the slot, when only a small portion of a separated cartridge case becomes lodged in the front end of the barrel chamber, difficulty in removal of the separated case may be experienced.

This can be overcome by first inserting from the breech end the tool, withdrawing separated cases, pulling the handle to the rear to lock the tool in front of the separated case, then entering the ejector on the end of the cleaning rod down the bore from the muzzle end and gently tapping the front end of the tool, withdrawing.

V.—MAGAZINES

Investigations into the failure of Oerlikon magazines indicate that in many cases it has been caused by stripping and re-assembly by unskilled personnel.

2. No magazine should be stripped unless this becomes an absolute necessity where exchange cannot conveniently be effected.

Should stripping be essential it is only to be done by an experienced artificer.

3. Magazines will, in future, be stencilled with the following instructions:—
"Handle with care. Do not strip."

4. Magazines will, following proof, inspection or overhaul at R.N.A. depots, be sealed with a wire and lead seal.

5. All serviceable magazines should accordingly be sealed and stencilled by R.N. Armament Depots and O.C.A.S. as shewn on A.F.O. Diagram 275/42, before issue. Bolts, sealing (item 471) are on order and should be demanded from D.A.S. (Branch A), Bath. The seals which are to be made locally, are to bear the monogram of the sealing authority. Magazines manufactured in the future will be sealed by the manufacturer and stamped with a monogram after passing proof.

6. Failures of 20 mm. Oerlikon machine guns have been reported which on investigation have been found to be due to magazines having been damaged by rough handling.

Every possible care should be taken to avoid rough handling these magazines, which are, of necessity, made light to assist loading.

7. Before loading a magazine, it should be tested for freedom of its moving parts by first ensuring that the tension indicator is showing zero after which the clutch should be lifted and the axis shaft rotated through its full travel by means of the boss on the side of the loading lever handle. Should there be any stiffness, the magazine should be carefully examined. The outside of the magazine should be examined for damage. Dents in the outer casing or end plates may foul the rounds, cause mal-alignment of the moving parts and result in failures.

8. It should be borne in mind that even with a fully serviceable magazine there is very little spare power available to ensure that the rounds are correctly presented to the gun.

9. Magazines found to be defective are to be landed at the first opportunity for examination and, if necessary, exchanged.

10. Instances have been reported of 20 mm. Oerlikon magazines failing to function owing to insufficient tensioning of the magazine spring due to wrong assembly after stripping.

11. When the magazine is empty the initial tension of the magazine spring should be 95.5-in. lb. to ensure that the last few rounds in the magazine are fed correctly into the gun.

The initial tension may be tested by shipping the magazine lever as for tensioning the magazine spring, with the magazine empty, and all tension taken off.

A spring balance should then be applied at right angles to the magazine lever at a position 9.1 in. from the centre of the magazine axis.

When the balance reads $10\frac{1}{2}$ lb., the magazine lever should just commence to tension the magazine spring. To facilitate the above operation, all magazine levers are to be modified by ships' or base staffs and by R.N. armament depôts by drilling a 0.25-in. diameter hole through the minor axis of the handle of the lever at a distance of 9.10 in. from the centre of the ratchet wheel. The spring balance is to be attached by means of this hole and the pull applied at right angles to the lever. The pull should be $10\frac{1}{2}$ lb.

12. Should the spring become weak, causing part of the initial tension to be lost, it must be adjusted by turning the magazine spring casing in a clockwise direction, the new position of the spigot screw, which is secured to the front side plate, being marked "O" on the spring casing flange and the old mark "O" barred out.

13. When the magazine is fully loaded with 60 rounds, it should be fully tensioned by rotating the magazine loading lever as far as possible.

Should the magazine be partly loaded, e.g. 30 rounds, it is to be tensioned until the indicator reads 30 followed by two further clicks on the ratchet.

Important—When tensioning a fully or partly loaded magazine, the knurled ratchet sleeve should be held with the left hand to prevent it from turning, otherwise the correct tension will not necessarily be applied.

Provided the initial tension is adjusted as stated in paragraph 11, correct functioning should be obtained.

Should the indicator block be removed, care must be taken when re-assembling that the end nearest the stud on the back of it is towards the bottom, i.e., magazine axis shaft, otherwise mal-functioning will occur. On new manufacture, the top end is marked 'Top'.

14. An instance has also occurred of the breech block failing to remain in the rear position, i.e., cocked position, on the last round being fired from the magazine. This is due to the bolt interlock magazine, which is spring-loaded and situated in the magazine cartridge feeder, becoming stuck up, and failing to engage the lever magazine interlock. Care is to be taken to ensure that the bolt is perfectly free.

This stickiness may be caused by the pin retaining the bolt interlock magazine working loose and protruding on one side. The pin should be replaced and centre popped each end to secure it in position.

15. Some American made magazines for use with 20 mm. Oerlikon machine guns have failed to seat properly on the breech casing of the gun. This is caused by the 4 mm. radius on the front corners of the mouthpiece adjacent to the trunnions not being maintained.

All such magazines in service and in store should be checked. Any found defective are to be adjusted in accordance with A.F.O. Diagram 247/42 by Ship's Staff if an Artificer is borne or by Base Staffs and Armament Supply Department. Ships not carrying an Artificer should land defective magazines.

Magazines in store are to be checked and modified, if necessary, before issue.

After check or adjustment, magazines are to be stencilled with letter "C" in white near mouthpiece trunnions. Boxes containing magazines which have been checked or adjusted are also to be stencilled with letter "C".

16. All 20-mm. Oerlikon gun magazines of American manufacture in ships are to be examined to ascertain if the rounds indicator reads "Zero" when the magazine is empty. Magazines which do not pass this test are to be exchanged at the nearest Naval armament depot. Stocks in Naval armament depôts are to be similarly examined before issue. So far, this defect has been found only in magazines made by Murrays, Ohio.

Defective magazines are to be modified by Armament Supply Department by grinding away the indicating lines and numbers on the cover plate (with the exception of number 60 and its line, which are correct) and re-engraving in the correct position. Os.C.A.S. who have no facilities for doing this work should send the magazines to the nearest main Naval Armament Depot.

American magazines can be distinguished by the end plates which are embossed by a continuous spiral approximately $\frac{1}{8}$ -in. wide. In the case of British magazines the ends are riveted or plain.

17. A small quantity of levers, magazine, for 20 m.m. Oerlikon guns has been received with the ratchet incorrectly cut, and some may have been issued to H.M. Ships.

All levers, magazine, in ships or in store should be checked and any found defective are to be replaced at the nearest R.N. Armament Depot.

Defective levers are to be retained in N.A. Depots and report forwarded to D.A.S. (Branch A).

VI.—MODIFICATIONS (SHIPS' STAFFS AND BASES)

In the event of the Oerlikon sight being found to be too high and/or the length of the shoulder rest strap too short, the following action should be taken:—

(a) *Para. 2.*—A.F.O. Diagram 539/41 (Fig. 1) contains instructions on how to increase the height of the shoulder rest approximately $1\frac{1}{8}$ in. by welding a new ferrule and distance piece. This modification should be used for guns fitted with 200-knot sights or 300-knot sights of American manufacture. The centre line of 300-knot sight, Mark II, was lowered $1\frac{1}{2}$ in., making alteration to shoulder rest unnecessary.

(b) *Para. 3.*—A.F.O. Diagram 180/42 contains instructions on how to increase the width of the shoulder rest $1\frac{3}{8}$ in. by cutting the frame arm and welding a distance piece in position.

(c) To lengthen the straps on the shoulder rest one of the straps should be cut away from its link and a double thickness of webbing (as used for rifle slings, etc.) of required extra length, inserted and riveted or stitched to the strap. This work is to be done by ship's staff.

2. (a) Early supplies of guns, machine, Oerlikon, 20 mm., Mark II, were fitted with shoulder rests incorrectly manufactured, in that the left-hand shoulder pieces swivel anti-clockwise instead of clockwise.

(b) Any shoulder rest found with this defect should be modified by (a) Ships' staff, (b) Base staffs, or (c) N.A. Depot staff if it cannot be modified by (a) or (b), in accordance with A.F.O. Diagram 539/41 (Fig. 11), to ensure that the top ends of the shoulder pieces swivel towards each other.

(c) After modification, the left-hand shoulder piece will swivel 30 degrees on either side of the vertical, but this will in no way affect control of the gun.

(d) All guns fitted with 200-knot sights may be modified in accordance with A.F.O. Diagram 539/41 (Fig. 1) by (a) Ships' staff, (b) Base staffs, or (c) N.A. Depot staffs if they cannot be modified by (a) or (b), should the vertical distance between the shoulder rest and the line of sight be found too great.

(e) It should be noted that the correct way up for the two curved shoulder pieces is long end uppermost.

(f) A 300-knot sight, Mark II, is now supplied with new guns of British manufacture and no modification to the shoulder rest is required with this type of sight as the sight bracket has been shortened in order to lower the line of sight.

N.B.—American manufacture 300-knot sights are to the original height.

(g) Should any gun modified in accordance with paragraph (d) be fitted with a 300-knot sight, Mark II, the shoulder pieces should be re-assembled on their original pivot holes.

3. (a) Reports have been received that there is insufficient adjustment for width between the shoulder pieces when extra clothes have to be worn in cold climates.

(b) Shoulder rests, with a width of 280 mm., adjustable to 320 mm., may be modified, if required, in accordance with A.F.O. Diagram 180/42, (the

heading of which should be amended to read 20 mm. instead of 2 mm.) by (a) ship's staff, (b) base staffs, or (c) N.A. depot staffs, if they cannot be modified by (a) or (b), in order to increase the width to 326 mm., adjustable to 366 mm.

4. (a) To prevent water collecting in the trigger casing and rear end of the breech casing of 20 mm. Oerlikon machine guns, drain holes as shown in A.F.O. Diagram 59/42 are to be drilled at the first opportunity in the breech casing, trigger casing, hand grips and shoulder rest. Care is to be taken that all drillings are removed before re-assembly of the gun.

(b) As regards guns mounted on board ships the work is as far as possible to be carried out by ships' or base staffs, the assistance of Os.C.A.S. or R.N. Armament Depôts being requisitioned only in those cases where the work is beyond the capacity of ship's staff.

Guns in store will be modified by depot staffs.

(c) When the holes have been provided, care is to be taken to ensure that they are kept clear.

5. (a) A design of cover for the magazine and magazine opening of the 20 mm. Oerlikon gun is shown in A.F.O. Diagram 188/42.

(b) If required these covers should be made by ships' or base staffs.

6. (a) Difficulty has been experienced in the removal of the pins securing the handle locking barrel, and pins securing trigger, on Oerlikon M.Gs., Marks I, II and IV.

(b) All guns should be modified by Ships' Staffs, Base Staffs and Armament Depôts at the first opportunity by removing these pins and replacing them with a $\frac{1}{8}$ -in. diameter steel split pin, after drilling out the holes to $\frac{1}{8}$ -in diameter.

7. (a) A.F.O. Diagram No. 226/42 shows a modification to the shields for the 20-mm. Marks IIA, IIIA, IV U.S.N., and V U.S.N., mountings, to facilitate the sighting of low angle targets, by cutting away the inner top corners.

(b) This modification has been embodied in all mountings of U.K. manufacture, and will be, in all future mountings, manufactured in America.

(c) All mountings in service which have shields which have not been cut away should be modified as shown in the diagram.

(d) The work should be carried out by ship's staff, but where this is not possible, arrangements should be made for it to be done by dockyards or repair depots, at the earliest opportunity. The shield plates may be flame cut.

(e) In the case of mountings which have been received from America, but not yet fitted on board, fitting-out depots should arrange for the modification to be carried out before issue of the mountings.

8. The following modification is to be carried out:—

Gun	...	...	20-mm., Oerlikon, Mark II, and U.S., Mark IV.
Parts affected	...	...	Stop, double loading, Part 2.
Purpose	...	...	To allow escape of grease or water.
Nature of Modification	...	...	Slot to be cut in the head of the stop, double loading, Part 2, as shown in A.F.O. Diagram 232/42.
By whom to be done	...	...	Staffs of H.M. ships, Base Staffs and Armament Supply department.
Degree of urgency	...	...	As soon as possible. Guns in submarines to be given priority.

Note.—This modification will not be applicable to Mark II guns, fitted with Mark II simplified breech casings, which have a different type of plunger on which a slot is incorporated to release the grease and water.

9. Empty cylinder bags manufactured for the earlier Oerlikon equipments had stiff leather bottoms.

Reports have been received which indicate that some gunlayers find these bags inconvenient at high angles of elevation.

Where this is the case ships' staffs may modify the bags, replacing the leather by canvas of the same thickness as the rest of the bag.

10. (a) To provide for the easy loading of Oerlikon guns in Marks IIA or IIIA mountings, new mountings are being provided with a loader's step fixed round the pedestal.

This consists of a ring measuring approximately 24.2-in. outside dia. \times 18.2-in. inside dia. \times $\frac{3}{8}$ -in. thick, welded to the pedestal at a height of approximately 2-ft. up from the base.

(b) To provide for mountings already on board or which have left the manufacturer's works without this step, the following action should be taken, viz.:—

A step as described above, or if more convenient, a step consisting of a $\frac{3}{8}$ -in. dia. bar, bent into the form of a circle of 24 $\frac{1}{2}$ -in. outside dia. and fitted with suitable supports, should be welded or otherwise secured to the pedestal, 2-ft. up from the base.

(c) Where possible the work should be carried out by ships' staffs.

Where this is not possible, arrangements should be made for the work to be carried out by dockyard or repair establishments at a convenient opportunity.

(d) So far as can be arranged, dockyards and repair establishments should arrange for this modification to be carried out to all mountings allocated to ships before they are fitted on board.

11. (a) It has been reported that difficulty has been experienced in lubricating the top pivot bearing of the 20-m.m. Mark IIIA mounting.

(b) A modification to the lubrication to ensure that grease is supplied to this bearing is shown on A.F.O. Diagram 26/43.

(c) An additional lubricator, Pattern No. 4986 is fitted as shown in the diagram and positioned so that the $\frac{3}{8}$ -in. diameter radial hole through the bearing housing and the top pivot bearing does not penetrate any of the existing grease grooves.

The new lubricator should be positioned 60° round the bearing, from the existing one.

(d) A vertical groove is cut in the bearing from the $\frac{3}{8}$ -in. hole to the annulus at the bottom of the bearing.

Care should be taken to ensure that all swarf is removed from the lubrication holes and the bearings.

(e) The work involved should be done by Dockyards and Depôts concerned. Arrangements should be made by Base Staffs for this work to be carried out to mountings in D.E.M.S.

(f) Commanding Officers of ships concerned should insert an Item, Classification "A" in their next list of As. and As. to cover the work involved.

VII.—MODIFICATIONS (BY DEPOTS AND O.C.A.S.)

The following Depot modifications have been ordered up to date under the A.F.Os. shown which remain in force and should be quoted in reference to each modification:—

A.F.O. 3815/41

All 20 mm. Oerlikon guns, Mark II, in Naval Service are to be modified by the addition of a 1 mm. chamfer at 45° to the top edges at the rear end of opening for magazine on the breech casing.

2. The modification will be carried out at the first convenient opportunity, by the staffs of R.N. Armament Depôts or Officers in Charge of Armament Supply in accordance with A.F.O. Diagram 367/41.

3. Where copies of Drawing N.O.D. 3114/13 (sheet one) are held, item 57 of the drawing should be amended in accordance with A.F.O. Diagram 367/41, under date 5th July, 1941.

A.F.O. 1011/42

To prevent the main spring catching on the edge of the spring casing and so causing varying initial tension, a spring retaining plate is to be fitted to the spring casing of all Mark I Oerlikon magazines. The work is to be done at the first opportunity by R.N. Armament Depôts or Officers-in-Charge of Armament Supply in accordance with Instructional Print N.O.D. 3114/45. After modification a star will be added to the mark of the magazine.

2. Plates required should be demanded from Chatham, Priddy's Hard or Plymouth.

3. Mark II magazines are fitted with a new design of spring casing and will not require this modification.

A.F.O. 2248/42

To guide assembly, the indicator blocks of Magazines 20 mm. Oerlikon, Mark II, are to be stamped "TOP" as shown on A.F.O. Diagram 119/42. The work is to be done by R.N. Armament Depôts and Officers-in-Charge of Armament Supply, as opportunities offer.

2. Depôt copies of drawings N.O.D. 3114/35 (Item 446) should be amended accordingly under date 29.9.41.

A.F.O. 3640/42

The following modification is to be effected as shown :—

<i>Gun</i>	Guns, 20-mm., Oerlikon, Mark II. Gun Nos. S.1511 to 1555 inclusive. S.1557 to 1563 inclusive. S.1565 and 1566. S.1568 to 1574 inclusive. S.1577, S.1579 and S.1580 only.
<i>Parts affected</i>	Stops, double loading, Parts III and IV. Springs, Mark I, for stop, double loading, Part III.
<i>Nature of modification</i>	Metal to be removed from stop, double loading, Parts III and IV, in accordance with N.O.D. 3114/46. A star is to be added to the mark of the modified stop, double loading, Part IV. Fit Mark II, spring for stop, double loading, Part III.
<i>Purpose</i>	To ensure correct functioning of gun.
<i>By whom to be done</i>	Armament Supply Department.
<i>Degree of urgency</i>	At the first convenient opportunity.

This modification has been incorporated in guns other than those stated.

2. All Mark I springs for stop, double loading, Part III, in service, both component and spare, are also to be replaced by Mark II springs as opportunities offer. Mark II springs should be demanded from Admiralty, Director of Armament Supply, (Branch A), as required. Mark I springs, when replaced, should be scrapped.

A.F.O. 4385/42

The following modification should be carried out :—

<i>Gun</i>	20-mm. Oerlikon-Marks I & II.
<i>Item affected</i>	Sleeve barrel spring centre (made of "B" bronze).
<i>Purpose</i>	To eliminate risk of fracture of sleeves made of "B" bronze.
<i>Nature of mod.</i>	All sleeves barrel spring centre made of "B" bronze are to be exchanged for a new pattern sleeve, made of steel.
<i>By whom to be done</i>	Armament Supply Department.
<i>Degree of urgency</i>	As soon as possible.

2. Intermediate demands for the steel sleeves should be sent by R.N. Armament Depot or O.C.A.S. to D.A.S. (Branch A), Admiralty, Bath.

A large number of guns in service are fitted with steel sleeves.

Guns of future manufacture will incorporate the steel sleeve.

VIII.—TWIN MARK V MOUNTINGS

1. Attention is drawn to the correct method of inserting the drop-nose pin into the locking-pin which secures gun to cradle in the above mountings.

The drop-nose pin is to be fitted in its hole so that the drop-nose end is remote from the muzzle-end of the gun, thus ensuring that there is no possibility of the pin falling out during elevation of the cradle and gun assembly.

As an additional precaution the drop-nose end of the pin is to be secured in the down position by a simple wire-seizing.

2. Instances have been reported of damage to the firing gear of the above mountings when elevating, or depressing, with the gun safety catches to "SAFE". This can only occur if the gear is out of adjustment, and the following procedure is to be adopted when adjusting or testing the firing gear :—

- (a) Unload, train mounting on to a safe bearing to ensure that the safety firing gear is inoperative, put gun triggers as far to "FIRE" as they will go and tie them in this position (gun safety catches must be to "FIRE").
- (b) Press control-handle firing trigger and check that the clearance between the firing levers and gun triggers does not alter appreciably while elevating and depressing through the full range, i.e. surface of the firing cam must be concentric with the trunnion centre under "FIRE" condition.
- (c) Release firing trigger and check that firing piston movement is 0.875-in. minimum and 1.0 in. maximum.
- (d) Untie gun triggers, ensure that firing piston is in "OFF" position and is as far down as it will go, leave gun safety catches to "FIRE" and elevate to maximum elevation.
- (e) Adjust lengths of firing rods so that when gun safety catches are to "SAFE" there is $\frac{1}{32}$ of an inch clearance between the firing levers and the triggers of the guns.

On depressing the guns it will be noted that this clearance increases considerably up to 20° elevation and reduces again towards 10° depression.

3. The fluid in the hydraulic system of the 20-mm. twin, Mark V mounting, does not provide sufficient hydraulic locking action under conditions of heavy roll when the main pump is not running.

Mountings now under manufacture are being fitted with a training housing-stop, positioned in such a manner that the gear can be disconnected by the gunner from his seated position.

A.F.O. Diagram 327/42 shows a design of housing-stop and the method of fitting to mountings now in service.

Vessels concerned are to treat the manufacture and fitting of the gear as a defect item, to be carried out by ships' staffs and Coastal Force Base maintenance staffs, assisted by dockyards as necessary.

4. In a number of ships some difficulty is being experienced in finding a position for the power units close to the 20-mm. twin, Mark V, mountings.

A distance not exceeding 20-ft. between the power unit and the mounting can be accepted without undue loss of pressure. It is, however, most important that the power unit should be fitted as close as possible to the mounting so as to reduce the risk of splinters cutting the power supply pipes.

When a position cannot be found on the gun deck, it will usually be necessary to fit the unit on the deck below, but it may sometimes be practicable to sling it from the underside of the gun deck and consideration should be given to this if the length of exposed supply piping is thereby reduced.

It is an important requirement that the power unit should be easily and quickly accessible from the gun mounting position.

The supply piping should be guarded from accidental damage and if the mounting has a screen of protective plating the exposed pipes should be protected by plating of similar quality.

5. Reports have been received concerning corrosion of the elevating ram spindles on the above gun mountings.

Such corrosion, if permitted to continue, will eventually result in damage to the hydraulic seals in the ram cylinder glands.

Modification to the material surface of new manufacture ram spindles is in hand, in order to stop corrosion taking place, but it can be arrested, if not altogether prevented, on existing mountings, by observance of the following procedure :—

- (a) When the mounting is not in use, and the canvas cover is not in place, the guns are to be set at maximum elevation, in which position the ram spindles are fully withdrawn inside the ram cylinders.

(b) Before the mounting is finally secured, with canvas cover in position, the ram-spindles are to be carefully wiped off and the exposed surfaces coated with a grease suited to the climatic conditions.

Should a mounting be in use for look-out purposes, when it would normally only be operated in training, the guns are to be elevated and depressed through the full range at frequent intervals, in order to clear deposits of moisture which are likely to accumulate on the ram spindles.

IX.—SUPPLY OF SPARES, STORES, ETC.

1. (a) A number of Admiralty pattern 4720 Tecalemit grease guns, for use on 20-mm., Marks IIA and IIIA mountings, are now available for supply on demand by the Admiralty Gun Mounting Overseer, Coventry, or the Admiralty Gun Mounting Overseer, Parkhead.

(b) Provision has been made for an allowance of one grease gun per ship, or in cases where mountings are issued in batches for shipment abroad, one grease gun per four mountings.

(c) Depôts concerned should, from time to time, forward demands for sufficient grease guns to cover anticipated commitments.

Ships carrying these mountings should each demand one grease gun from the nearest depôt, but this is only to be done in cases where no suitable grease gun is already on board.

2. To assist in the sighting of bores, after stoppages, etc., of 20 mm. Oerlikon machine guns, "reflectors, mirror, Mark II" will be supplied in the proportion of one reflector per gun to all ships mounting Oerlikon guns. The bore should be examined from the breech end, the mirror being held close to the chamber at a convenient angle.

3. (a) Several reports have been received of sights for 20 mm. Oerlikon guns having been damaged beyond repair. Attention is drawn to the need for care to avoid damage to the sights of these guns.

(b) Spare grids, foresight, will now be allowed to all ships carrying Oerlikon guns in the proportion of 1 to every 4 or less number of guns mounted on single mountings.

4. (a) Spare Oerlikon barrels are allowed to all H.M. ships including Combined Operation craft but except Coastal Force craft, and to all D.E.M.S. mounting Oerlikon guns.

The allowance of spare barrels for ships mounting these guns will be:—

1 per gun (for Mark I guns only).

1 per 4 guns or less (for all guns other than Mark I).

Coastal Force craft bases will be allowed spare barrels on the same basis according to the number and type of Oerlikon guns mounted in attached craft.

(b) The types of Oerlikon machine gun barrels in supply and the guns for which they are suitable are shown below:—

Mark of barrel.	Mark of gun for which suitable.
Mark I	Mark I only.
Mark II	Mark I and II and U.S. Mark II and IV only.
Mark III—III* and IV	Mark II and U.S. Mark II and IV only.

Attention is drawn to the fact that Mark I or II barrels only are suitable for Mark I guns and that barrels of other marks cannot be assembled in Mark I guns.

(c) A quantity of barrels received with 20 mm. U.S. Mark IV guns, although stamped Mark IV, are actually of the Mark III design. A true Mark IV barrel has been manufactured in the U.S.A. and can be distinguished by its possessing a dumb-bell shaped Part I double loading stop. As interchangeability is not affected the stamping of the barrels need not be changed.

(d) Ships and bases concerned should demand spare barrels of the type required to complete to this allowance from the nearest R.N. Armament Depot. All U.S. Mark II and U.S. Mark IV guns have been distributed with one spare barrel packed with each gun and any ships carrying spare barrels in excess of the allowance given in paragraph (a) are to land the surplus barrels at the nearest R.N. Armament Depot at the first opportunity.

(e) Spare barrels for issue to ships and bases are to be supplied with the bore well coated with mineral jelly and the interrupted collars at the breech end similarly coated and protected with hessian or spun yarn. Ships are to ensure that this protection is retained in place and renewed as necessary while barrels are on board. Before assembly of a new barrel, care should be taken that the bore and double-loading stop, Part I (plunger entering chamber near rear end of barrel) is cleared of heavy grease and that the latter operates freely.

5. (a) Zebo grate polish is to be used for the lubrication of barrels and barrel springs of guns, machine, Oerlikon, 20 mm.

The polish should be applied sparingly to the barrels and springs with a brush.

(b) The first supply and minimum stock quantity of the polish per gun of this type fitted is one pound.

Ships and shore establishments concerned should demand the necessary quantities from the (Superintending) Naval Store Officer of their storing yard, quoting this Order. Supply to ships of new construction should be arranged by storing yards.

(c) Purchase of 6,000-lb. of Zebo grate polish in 1-lb. tins has been arranged, under Vote 8/11/E.8, for delivery as follows:—

Chatham.	Sheerness.	Portsmouth.	Devonport.	Rosyth.	Mersey Area.	Severn Area.
750-lb.	250-lb.	750-lb.	250-lb.	750-lb.	1,125-lb.	2,125-lb.
					(a)	(b)

(a) Shipment to be arranged as follows:—
250-lb.—Gibraltar.
500-lb.—Alexandria.
250-lb.—Malta.

(b) Shipment to be arranged as follows:—
500-lb.—Bermuda.
500-lb.—Simonstown.
500-lb.—Colombo.
500-lb.—Durban.

(d) The Sea Store Establishments concerned will be amended.

6. (a) At temperatures below -5°F . the Oerlikon gun cannot be relied upon to function if the normal lubricants are used for the magazine, gun mechanism, and ammunition.

(b) When temperatures below -5°F . are likely to be experienced, the following action is to be taken:—

(i) Remove all traces of existing lubricant from the gun mechanism and magazines. This is best done by washing the parts in oil, gun, cleaning, Type "A", or petrol, and then thoroughly drying them.

To achieve this in the case of magazines it will be necessary to strip them. This operation should be carried out by an experienced artificer or by base staffs (*vide* V, para. 1).

Ammunition which is coated with Cooper's grease should be wiped as clean as possible. It must *not* be cleaned with oil or petrol.

(ii) The gun mechanism is then to be lubricated *sparingly* with oil, anti-freeze, D.T.D.44D.

(iii) The interior of the magazine and the exterior of the ammunition is to be *lightly* lubricated with grease, anti-freezing, D.T.D.143C.

(c) The following quantities of anti-freezing grease D.T.D.143C have been requisitioned for delivery as shown:—

	Rosyth	Chatham	Preston	Portsmouth	Scapa	Greenock
Anti-freezing grease.	lb.	lb.	lb.	lb.	lb.	lb.
D.T.D.143C. in 1 lb. tins.	1820	616	336	616	1064	84

Rosyth is to arrange distribution of the quantities indicated to the following D.E.M.S. officers:—

	Anti-freezing Grease 143C.	Oil anti-freezing D.T.D.44D.
Tyne Area	140 lbs.	20 galls.
West Coast of Scotland (Greenock)	—	9 galls.
Humber	84 lbs.	10 galls.
Leith	84 lbs.	10 galls.
Liverpool	84 lbs.	10 galls.
Bristol Channel Area	84 lbs.	10 galls.
Halifax (for Canadian ports)	140 lbs.	10 galls.
New York	140 lbs.	20 galls.
Iceland (c)	140 lbs.	20 galls.
North Russia	336 lbs.	50 galls.
Hvalfjord	336 lbs.	50 galls.
Iceland (c) } For D.E.M.S. and H.M. Ships	—	150 galls.
Scapa		

(d) The oil D.T.D.44D (previously known as D.T.D.44C) is available in stock at the yards.

(e) Ships concerned fitted for service in cold climates or under orders to proceed to Arctic waters, should demand on the appropriate yard or depot on the basis of 7 lbs. of anti-freezing grease D.T.D. 143C and 1 gallon of oil anti-freeze D.T.D.44D for each Oerlikon gun fitted. Staff Officers, D.E.M.S. are to inform N.S.Os of requirements for merchant ships.

(f) Supply as necessary to ships of new construction fitted for service in cold climates should be made by storing yards.

(g) Existing stocks of Bell's L.T. grease may be utilised in lieu of D.T.D. 143C.

7. 20mm. Oerlikon guns mounted in Haszard type mobile mountings should be supplied with 12 magazines per gun. The magazines are to be packed in six magazine boxes. Two boxes will be carried with the gun and the remaining four in either the ammunition trucks, or in other locally arranged bulk ammunition transport.

8. A gauge striker protrusion and high diameter for guns, machine, 20mm. Oerlikon, Marks I, II and U.S. IV, is in production and will be allowed in the proportion of one gauge per ship to Corvettes and above. Stocks of gauges will also be sent to Bases, etc., for their use in guns mounted in small craft and D.E.M.S.

H.M. Ships concerned should demand from the nearest R.N. Armament Depot. Armament Supply Officers are to render Intermediate Demands for the quantities required to D.A.S. (Branch A), Bath.

X.—MISCELLANEOUS

1. (a) Instances have been reported of difficulty in removing Oerlikon guns from their mountings due to the gun securing bolt on the cradle seizing in the securing bolt hole of the gun.

In all cases, when guns are being mounted, the inside of the securing bolt hole and the securing bolt itself are to be thoroughly greased to protect their surfaces and prevent the ingress of water.

(b) All mountings in service should be examined to make sure that the gun securing bolts are free, and grease should be applied as necessary.

Depots at which mountings are stored should ensure that the securing bolts are free from rust and protected with grease.

(c) Cooper's grease No. 4 should be used.

2. (a) Attention is drawn to the need for care to protect the sights of Oerlikon machine guns from damage by gun covers, heavy weather, blast, etc.

(b) A sight box to take the complete sight assembly, including the sight bracket, is allowed for and is supplied with each gun. The spanner for detaching the 200-knot sight from the gun is in the box. No spanner is needed for 300-knot sights, which are quickly detachable.

(c) Sight boxes for guns exposed to seas and blast should be secured in protected positions near the guns. The remaining boxes may be kept on board for use during refits at ports where guns are not required to be manned and for landing party purposes, or landed at the discretion of the Commanding Officer. Return Notes should quote this order.

(d) When conditions admit and particularly where guns are exposed to heavy weather or blast, sights should be removed from guns and stowed in the boxes. In any case, when not in use sights should be turned down by slacking off the clamping screw at the top of the sight bracket to release the sight bar, as specified on page 9, paragraph 17, of B.R. 274/41—Handbook and Drill. The 200-knot sights turn down to the Left and the 300-knot sights to the Right.

3 (a) The arrangement of a one-man cocking device shown on A.F.O. Diagram No. 264/42 (G.R.6013A) has been tried and proved to be satisfactory.

(b) The device consists of a steel pin "B" which fits into the crosshead on the gun and is held in place by the bolt securing case, barrel spring. One eye of a wire lanyard "A" is fitted over the pin "B" and the other permanently secured round a sleeve "C" on a bolt, inside the trunnion bracket. This bolt is $\frac{1}{4}$ -in. longer than, and replaces the centre bolt of the three which secure the shield support to the trunnion bracket. The sleeve "C" is inserted between the nut and the trunnion bracket.

The lanyard "A" is of $\frac{5}{8}$ -in. extra flexible steel wire, about 24 $\frac{1}{2}$ -in. long, measured to ends of eye-splices, and is arranged so that, when the gun is horizontal, the lanyard is just capable of being slipped over the pin "B".

(c) To cock the gun, remove the elevating locking pin, place the free end of lanyard over pin "B" and bear downwards on the shoulder pieces until the gun is cocked. On raising the shoulder pieces from this position the lanyard will fall clear.

(d) Where possible the work involved should be done by the ship's staff.

Where this is not possible, arrangements should be made for the work to be done by a dockyard or a repair establishment at a convenient opportunity.

(e) As regards paragraph (b) above, it has been found that the lanyard is liable to chafe on the trunnion bracket.

A.F.O. Diagram No. 326/42 (G.R. 6013B), shows an alternative method of assembling the bolt and sleeve "C" that will prevent this chafing.

The modification where considered desirable should be carried out by ships' staff, if possible, or by dockyards and repair establishments.

For guns mounted in D.E.M.Ss, the work should be done by Base Staffs.

(f) Reports have been received that indicate that the length of the flexible wire strop required for the one-man cocking device for 20mm. Mark IIA and IIIA mountings varies owing to the bolt to which one end of the strop is attached not being at a definite distance from the centre line of the trunnions.

The length of the strop therefore varies to suit different mountings, as the shorter strops could not be slipped over some gun bolts and the longer ones would in some cases necessitate bringing the gun to full elevation before it cocks, entailing loss of control and requiring the assistance of a second man.

(g) A.F.O. Diagram 46/43 shows a form of attachment that has proved satisfactory.

The bolt is positioned centrally in the lifting holes in the trunnion bracket.

The strop should be made so that it just slips over the gun bolt when the gun is at maximum depression.

(h) The modified arrangement should be adopted for all mountings not already fitted with a satisfactory one-man cocking device.

Mountings already fitted with a one-man cocking device should be supplied with the new arrangement where considered necessary.

(i) Difficulties in the use of the one-man cocking device also arise due to the stretching of the strop. If the strop is found to be too long it may be shortened slightly by twisting up a few turns.

4 (a) To assist loading of 60-round, 20-m.m. Oerlikon M.G. magazines, a simple tool as shown on A.F.O. Diagram 20/43 has been evolved and tested. The tool may be made if desired by ships' or base staff.

(b) *Method of applying the tool.*—Slip the fingers of the right hand through the webbing with the back of the hand next to the felt.

Pick up a round with the same hand and insert it into the magazine mouthpiece keeping the left hand on the magazine loading lever to prevent the follower from leaving the first round in the magazine, otherwise the rounds will topple over and jam the magazine.

Press the round into the magazine with the tool.

Repeat until the magazine is loaded with the required number of rounds.

5. Reports received from Naval Armament Depots indicate that a high percentage of the empty Oerlikon packages returned to store are deficient of their packing pieces.

The provision of these items, particularly the felt packing, is costly both in material and labour. Arrangements should, therefore, be made for them to be replaced in the package from which they are taken immediately after removal of the ammunition in order to prevent unnecessary expenditure in replacing them when the packages are re-filled.

6. (a) Oerlikon machine guns of British Mark II pattern manufactured in the United States of America for the British Government are designated Mark IV, except for guns of early manufacture which are stamped Mark II.

(b) American made Mark II and Mark IV guns are completely interchangeable with each other: and a trial has indicated that components of these guns can generally be interchanged with corresponding parts of British made Mark II guns subject to fitting where necessary.

American and British made magazines and sights (200 and 300 knot) are interchangeable as units but sub-assemblies are not interchangeable.

(c) To avoid difficulty in making replacements, however, spare parts of British and U.S.A. manufacture are, for the present, to be held on charge separately under the respective marks of gun, and demands from H.M. ships are to show clearly the mark of gun for which parts are required.

(d) A number of 20-m.m. Oerlikon machine guns and barrels manufactured in U.S.A. bear registered numbers and prefixes which correspond to those already assigned to guns manufactured in the U.K. To avoid confusion between guns and barrels of British and American manufacture, the mark of gun or barrel and all other markings should be quoted in all correspondence and reports, as well as the registered number and prefix.

7. Clips fitted to Oerlikon magazine lockers tend to slip off the clip plates when tightened.

C.Os. of ships affected should arrange to insert an item in the next defect list for the fitting of clip plates, in accordance with A.F.O. Diagram 114/42.

8. 20-mm. Oerlikon machine guns are to be treated in the same manner as other machine guns for inspection purposes. Instructions are laid down in B.R. 291, Table F.

The Memorandum of Inspection for this gun thus becomes redundant, and those already held may be treated as waste paper.

Forms S.1404 are not required to be rendered in respect of these guns.

B.R. 274/41 is being amended.

9 (a) It has been found, owing to the use of an excessive amount of solder when sealing boxes containing 20-mm. Oerlikon ammunition of British manufacture, that the solder has run inside and in some instances has stuck to the cartridges.

Care should be taken when loading magazines to see that no solder is attached to the rounds.

(b) Isolated rounds of ammunition found in this condition should be thrown overboard into deep water; but if a number are present they are to be returned to the nearest N.A. Establishment for rectification.

10. Attention is drawn to A.F.O. P. 552/42, which states that steps should be taken to see that fuzes are screwed tightly into Oerlikon shell before the rounds are loaded into magazines.

11. Muzzle covers made of a transparent plastic known as Bexoid are in supply for 20-mm. Oerlikon Guns.

The outside diameter of the barrel at the muzzle has until recently varied widely. 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.

XI.—The following Orders, embodied under the different parts of this Order as shown, are cancelled:—

II.—A.F.O. *4952/41	V.—(contd.)	IX.—A.F.O. 891/42
A.F.O. 1134/42	A.F.O. 5004/42	A.F.O. 894/42
A.F.O. 1661/42	A.F.O. 5282/42	A.F.O. 2505/42
A.F.O. 2149/42	A.F.O. 5773/42	A.F.O. 3875/42
A.F.O. 2153/42	A.F.O. 40/43	A.F.O. 4515/42
A.F.O. 2249/42	A.F.O. 941/43	A.F.O. 6148/42
A.F.O. 5001/42		A.F.O. 474/43
A.F.O. 5009/42	VI.—A.F.O. *4856/41	A.F.O. 594/43
A.F.O. 149/43	A.F.O. 5523/41	
A.F.O. 592/43	A.F.O. 1384/42	X.—A.F.O. 5050/41
	A.F.O. 3641a/42	A.F.O. 2035/42
	A.F.O. 3379/42	A.F.O. 2154/42
III.—A.F.O. *4153/41	A.F.O. 3641/42	A.F.O. 3242/42
A.F.O. 2036/42	A.F.O. 4120/42	A.F.O. 4870/42
A.F.O. 3380/42	A.F.O. 4272/42	A.F.O. 4872/42
	A.F.O. 4386/42	A.F.O. 5906/42
IV.—A.F.O. 5650/41	A.F.O. 6151/42	A.F.O. 6141/42
A.F.O. 2034/42	A.F.O. 362/43	A.F.O. 6149/42
A.F.O. 2506/42	A.F.O. 1066/43	A.F.O. 6150/42
A.F.O. 5003/42		A.F.O. 6406/42
A.F.O. 6401/42	VII.—Nil.	A.F.O. 147/43
		A.F.O. 588/43
V.—A.F.O. 645/42	VIII.—A.F.O. 5279/42	
A.F.O. 1538/42	A.F.O. 5653/42	
A.F.O. 3512/42	A.F.O. 6140/42	
A.F.O. 4628/42	A.F.O. 937/43	

The following Orders are also cancelled because they are sufficiently covered by this Order, or by the handbook, or for other reasons:—

A.F.O. *4484/40	C.A.F.O. * 320/41
A.F.O. *3045/41	C.A.F.O. * 769/41
A.F.O. *3816/41	C.A.F.O. *1083/41
A.F.O. *4281/41	C.A.F.O. *1378/41
A.F.O. *5522/41	C.A.F.O. 195/42
A.F.O. 1539/42	C.A.F.O. 517/42

* Not in annual volume.

