

RADAR FITTING AND MAINTENANCE NOTESTYPE 242.AERIAL OUTFITS.

Confusion sometimes occurs between the various aerial outfits used with Type 242 when fitted with Types 271/2/3/6/7 and Type 293. The following statement is intended to clarify the present position.

Two aerial units are used - Patt. W5250, often called the "hayfork" and Patt. 53896 referred to as the "chandelier". The latter has a wider frequency coverage than the former but also has a slightly greater beam width. The "chandelier" was originally introduced for use in Types 276/7 and Type 293 applications of Type 242, but as it was not available in time the "hayfork" was fitted with the first sets. Now stocks of the "hayfork" are almost exhausted, and the "chandelier" will be fitted in future in all Types 271/2/3/6/7 and Type 293 applications. Both units fit the same pedestals.

Three pedestals are used for Type 242 aerials. Pedestal 19S fits on top of the Type 271 lantern. Pedestal 19TM and 19W are fitted on a bracket on the mast. 19W is similar to 19TM except that it is provided with sliprings which carry the aerial feeder connection to permit continuous rotation of the aerial. The lanterns of Types 272/3 were not considered strong enough to bear the weight of 19S so that this is used for Type 271 only.

Two types of switch are used for the remote control of 242 aerials. Follow up switches Patt. W6605 (110 v.) or Patt. W6357 (220 V.) are used with Types 272/3 and are mounted on the bulkhead in the office. With Types 276/7 and 293 a new follow up switch (Patt. W7844) was introduced. This is supplied as part of the control table of the Radar set.

The combination of these units gives the following outfits :-

Aerial Outfit.	Aerial Unit.	Pedestal	Aerial Control	Radar set	Remarks
ASB	Hayfork	19S 19TM	Mechanical W6357/6605.	271 272/3	AQP supersedes ASB in all
AQP	Chandelier	19S 19W	Mechanical W6357/6605	271 272/3	New fittings (CFO 2500/44).
ASR	Hayfork	19W	W7844 Part of Aerial Control Table.	276/7 293	ASS replaced ASR in all cases (CFO 440/44).
ASS	Chandelier	19W		276/7 293	

RADAR TYPE 272.EXTRACT FROM H.M. SHIP'S REPORT ON MODIFICATIONS CARRIED OUT.

Since the 1st January, 1944, the following modifications to Radar Type 272 fitted in H.M.S. have been carried out.

- (a) P.P.I. fitted in Radar office.
- (b) Strutless lantern fitted.
- (c) Junction boxes fitted to telcothene cables in aerial lantern.

The P.P.I.

The P.P.I. has now worked continuously for two operational trips without any major defects. Initially, certain gyro and flexible drive faults were experienced, these were corrected by Ship's staff. H.M.S. and H.M.S. have both experienced faults owing to defective condensers Patt. W6288. This may be caused by over-heating. In H.M.S. slight over-heating has been noticed, which it is intended to remedy by fitting a blower on the side of the P.P.I. (ED. All P.P.I.'s after Serial No. 1010 will be ventilated to avoid over-heating).

Operationally, the P.P.I. has been a success. The following are the main outstanding advantages :-

- (a) When used for sweeping, small echoes appear on the P.P.I. before they are visible on the "A" scan.
- (b) Small echoes can be held easily on the P.P.I. by simply sweeping rapidly a small arc 5 degrees either side of the bearing.
- (c) When watching the P.P.I. a faster rate of sweep is possible: 240 degrees per minute having been used successfully. A faster rate is undesirable owing to the extra wear on the telcothene cables.
- (d) When using the P.P.I. it is very easy to identify side echoes.

Strutless Perspex Lantern Patt. 54679.

(a) The Strutless Perspex Lantern is a definite improvement. The maximum range of the set has been increased by approximately 15%. Side echoes have been reduced. From a saturation echo at 3000 yards side echoes now appear at definite bearings approximately 35 degrees (Size 3X) and 65 degrees (Size IX) either side of the main echo; previously side echoes had appeared continuously 70 degrees either side of the main echoes .

(b) With the old type lantern it had been noticed that the Local Oscillator tuning varied as the aerials were trained; careful tuning of the transmitter reduced the effect. This effect has not been observed since the strutless lantern was fitted.

(c) The original plywood deck fitted inside the lantern was found to be too small and has been extended to cover the whole deck.

(d) When fitting the lantern it is very important that the cable clamp on the deck and the bearing repeater motor on the pedestal be fitted on the same relative bearing. In one ship the clamp and motor have been fitted on bearing Red 140; no jamming of cables has been experienced.

(e) At sea the new Lantern has been found very convenient for carrying out maintenance to the transmitter etc., in even the roughest weather it has been found possible to work inside the lantern.

Junction Boxes A.P. 55575.

These are an improvement; the time taken to change a defective cable has been reduced to half an hour instead of the previous four hours.

All modifications have helped to increase the efficiency of Radar Type 272P.

(ED. This report is most encouraging and it is hoped that most ships fitted with Type 272 will be able to carry out these modifications in the near future).

RADAR TYPES 276/293.

Reports have been received from sea of leakage of oil in the 19U pedestal on to the M-type transmitter and the lining-up switch. Experiments are still being carried out to find a satisfactory oil seal. The oil used in these pedestals is D.T.D.44C and is a very light one especially suitable for use under Arctic conditions. To decrease the possibility of oil leakage, ships fitted with Type 276/293 sets and not working under Arctic conditions, should replace this oil by a heavier one. Light Torpoyl is a suitable replacement. Reports of other weaknesses of these sets are receiving attention and in particular the following action has been taken.

(i) Air Conditioning Unit. This has been redesigned and the new units are now coming into production.

(ii) Pedestals. 19U₁ with mica spiders fitted will shortly be available.

(iii) Waveguides. Every effort is being made to improve the finish of waveguide elbows and flanges. A new 45° elbow has been designed which should ease fitting and it is anticipated that these will soon be in production. Jigs are being designed to facilitate waveguide fitting and these will be supplied to bases and large ships.

(iv) Type 242 follow-up switch in the control table is being replaced by the 242 switch used with 272 sets.

(v) A new control table using a servo-selsyn drive will shortly be coming into production and will replace the units now used with Types 276/293.

(vi) The gear necessary for fitting remote hand drive to these sets is now available and should be fitted. Fitting instructions are given in the new 276/293 Fitting-Out Specification B.393/44.

Other points are receiving attention but reports from sea on this set will be most useful and are awaited.

TYPE 276.

It has been decided to remove the perspex fronts from the MJJ reflectors. Seals are being constructed for the waveguide flares and will be supplied to ships as soon as available.

The perspex fronts should not be removed until the seals are available.

WAVEMETER G82A.

It has been reported that Wavemeter G82A, A.P.W. 3129A, is frequently unstable in service. The trouble is evidenced by flickering of the magic eye tuning indicator over the whole frequency range. It is suspected that this trouble is confined to early models of wavemeters bearing the letters BD before the serial number.

This effect is due to a badly fitting oscillator screening box and can be corrected by taking the following action :-

The inside edges of the screening box should be thoroughly cleaned, taking care to remove all traces of paint and dirt.

In cases where the screening box does not fit tightly on the casting the edges of the box should be bent to effect a tight fit.

HOW TO CHANGE A MAGNETRON IN HALF AN HOUR.

The information contained in H546 on magnetron tuning is not complete and further notes with an amended tuning procedure are being issued as an amendment to H546. In particular it is not generally realised that the complete tuning procedure need not be carried out when rapid changing of CV.76 is necessary. By adopting the procedure outlined in the following notes it should be possible to change CV.76 and have the set back on the air working at 90% or greater efficiency in less than $\frac{1}{2}$ hour.

Procedure :-

- (a) Always keep hardened a spare CV.76 of the same frequency group as the CV.76 in the set. This hardening is done by running it at full power for several hours once every two or three weeks. The valve should be given a final hardening before leaving harbour, then even if the period at sea exceeds three weeks, the valve should still be more efficient than one taken straight from the store.
- (b) When the set CV.76 fails, replace it by the spare in the office. Do not alter the waveguide plunger setting.
- (c) Switch on CV.76 filament.
- (d) Screw the new CV.76 fully into the waveguide using the capstan bar.
- (e) Adjust the magnet to bring the valve into the centre of the pole pieces.
- (f) Turn variac up to the stop, switching off CV.76 filament when current pulse is 3 mm. high.
- (g) Allow valve to run for 1 min. and retune Local Oscillator.
- (h) Examine echoes for frequency spectrum and instability. To do this :-
 - (1) Tune L.O. two turns either side of maximum echo point. Note whether there are any subsidiary maxima of signal and whether they are greater in amplitude than $\frac{1}{10}$ the amplitude of the signal when L.O. tuned for maximum echo amplitude.or
 - (2) Note whether echoes are "ghosting" (bare line under echoes as obtained on frequency break in 271P).
- (i) If no frequency instability is found and if spectrum is single, the CV.76 tuning need not be altered.
- (j) If frequency instability or multiple spectra are found, screw in waveguide one turn at a time until frequency is stable and single.

The CV.76 tuning may now be **left at** this point and final tuning carried out when there is an opportunity.

The receiver should now be tuned using G821 or echoes.

The mechanical changing of the CV.76 will be considerably speeded up by practise in valve changing, which will be obtained if instruction (a) is followed. With two tools ready to hand -

RANGE CALIBRATION OF INDICATORS AND P.P.I's.

Arrangements are being made for the provision of Oscillators G41 with special adaptors known as "Signal - Inversion Units", in order to enable precise setting of the range-calibrator frequency to be carried out on the indicators and P.P.I's of various WS and WC sets. Until these items can be supplied, it is suggested that the following improvement of the present methods of setting the calibrator frequency may be found convenient where the necessary apparatus is available.

2. The suggested method depends essentially on checking the frequency of the indicator's internal calibration - oscillator against a wavemeter G56, Patt. 8834K (which is supplied to many ships and bases for W/T purposes). The sensitivity of a G56 by itself, however, is insufficient to enable this method to be used accurately; the necessary extra gain can conveniently be obtained by the use of the amplifiers included in a Cossor double-beam oscilloscope (Patt. W3336/A), as follows.

3. Connect the "Output to Wavemeter" point on the indicator or P.P.I., via a 50 pF condenser if available, to the A1 terminal on the Cossor double-beam oscilloscope. Set the selector switch on the oscilloscope to the position marked 2HFY1. Connect terminal Y1 on the oscilloscope to the input terminal on the wavemeter G56. Adjust the gain controls of the oscilloscope until a reasonable reading can be obtained on the meter of the G56. Finally set the calibrator frequency to the correct value as described in the relevant handbook.

4. The method given above can be applied to the calibration of the following indicators and P.P.I's :-

<u>Indicators.</u>	<u>Sets</u>	<u>Handbooks.</u>
Cathode Ray Unit Des. "C")	271X/2X/3X	
" " " " "D")	271/2/3	H.374A
" " " " "H")	271P/2P/3P	
" " " " "H")	271Q/3Q	CB.4321
" " " " "J")	271PR/2PR/3PR	H.374A
" " " " "N")	276/7, 293	H.546
" " " " "P")		
" " " " "P")	277S/T	H.525
(improved)		
" " " " Des. "L")	291	CB.4232
" " " " "21")	267W	-
<u>P.P.I's</u>		<u>Handbooks.</u>
Display Unit Design "B" (Patt. W7067)		CB(R)4298.

TYPE 281/B MAINTENANCE NOTES.Transmitter.

For satisfactory operation it is important that the modulator and transmitter valves are at the correct voltages. It is advisable to check these voltages occasionally with a good avometer to make sure the meters are reading correctly.

Electrolytic condensers in trigger units are the most usual cause of trouble and as, in the early models, these are not pattern articles, the following pattern numbers for replacements should be noted :-

<u>Item No.</u>	<u>Replacement.</u>
56	W.9381 or two X1140.
57	do do
58	W6809 *

* It should be noted that X1140 cannot be used as a replacement in this case as its outer case is connected to negative.

If, owing to losses, the sync pulses in the receiving office are not sufficiently large this may be easily increased by disconnecting resistance 24 in the modulator.

If inability is experienced in tuning a type 281B to the correct frequency this may be due to the length of the lines between the transmitter and the "Jews Harp". Altering these lines by about $\frac{1}{4}$ wave length should be tried.

Receiver.

If it is necessary to alter the phasing when fitting a Type 243 to Type 281, care should be taken to see that the beam switch is not thereby put out of phase.

It should be noted that the repetition rate of the calibrator is nearer to 150 cycles per second than the 50 cycles per second stated in the handbook.

Aerial System.

The frequent checking of the flexible feeders for continuity is an essential part of the Type 281 maintenance.

When operating in arctic climates remember to rotate the aerials for short intervals at least once a watch, or more frequently according to weather conditions. The beam switch should also be operated.

Performance Tests.

The performance meter described in appendix F, Part II of the new handbook (C.B.4310(A)) will be available shortly, but the test aerial therein described has been considerably modified.

The performance of the Type 281 transmitter can be tested without using the lamp load, as follows :-

- (a) Train the transmitting and receiving aerials face to face.
- (b) Disconnect the receiving aerial feeder from the receiver.
- (c) Connect the receiving aerials to the thermo couple and radiation meter used in Type 273 to measure power output.

If desired the radiation meter can be installed in the transmitting office by using the key line, thus simplifying the final tuning of the transmitter.

HAVE THE FOLLOWING MODIFICATIONS BEEN CARRIED
OUT ON YOUR TYPE 281 ?

- (i) The choke in H.T. lead of transmitter. A.F.O.4023/42.
- (ii) New resistances in modulator. A.F.O.4894/42.
- (iii) Thyatron blower disconnected. A.F.O.5043/42.
- (iv) Chokes in transmitter grid. C.A.F.O.123/43.
- (v) Switch in Thyatron meter circuit. A.F.O.1830/43.
- (vi) Modification to Receiver to assist in Height Finding. C.A.F.O.2045/43.
- (vii) Calibrations by reference to F.P.I. C.A.F.O.662/44.
- (viii) Modifications to long pulse length, for use with P.P.I. and Skiatron. C.A.F.O.782/44.

ARE YOU CARRYING OUT THE MAINTENANCE WORK DESCRIBED
IN APPENDIX H, TO C.B.4310(A) ?

TYPES 282/3/4/5.

BEAM SWITCH

News has been received from one of the manufacturers of the "Improved Type" Switch, Rotary Capacity, Pattern 3896B. The first two to be made at these works were put on test, running continuously during working hours. One has now broken down after a life of 2,051 hours; the other is still running!

Make sure of getting the best out of your set by fitting this "improved type" switch. C.A.F.O.664/44 gives full instructions for obtaining these switches.

REFITS

The Radar gear in ships refitting must have proper maintenance if the sets are to be in working order at the end of a refit. This applies particularly to Types 282/3/4/5 where the policy in the past seems to have been to shut down the A.C. supplies for the whole period. Reports have been received of aerial arrays which have received no attention during a four-month refit and have suffered severely from dockyard air. Weekly maintenance of aeriails should be carried out and A.C. supplies should be run up frequently so that the electrical working of each set may be checked.

TYPES 282/3/4/5.

A number of modifications to Panel L24 have been agreed upon, the details of which will be promulgated shortly in A.F.O's.

The improvements have been made to meet the following complaints which have been received from sea :-

- (a) the coarse range tube scan is too cramped;
- (b) difficulty is experienced in seeing small echoes;
- (c) the "well" of the fine range tube is not liked as a ranging index;
- (d) excessive length of strobe on the coarse range tube.

Briefly the modifications consist of :-

- (i) Fitting lenses to both coarse and fine range tubes, to improve "seeability" of small echoes. Both will be "Use Optional".
- (ii) Turning the coarse range tube 90° and applying the signal to what were the X plates, thus increasing the vertical sensitivity to counter (b) above.
- (iii) Making the calibration pips on the coarse range tube optional, controlled by a toggle switch. This should help to clean up the scan.
- (iv) Removing the "well" and replacing it with a "black mark" ranging index on a straight trace.
- (v) Altering the time base to give a 25 thousand yard scan for all L.24's except those associated with main armament radar in cruisers and above, when the scan is increased to 40 thousand yards. This should help to overcome (a) and (b) above.
- (vi) Shortening the strobe on the coarse range tube. When the echo is being correctly ranged on, the strobe will appear to the left on the coarse range tube.
- (vii) Improving amplification on the fine range tube.

These alterations to the original design have not been made without some small sacrifices.

- A. The ranging accuracy is not expected to be quite so high with the "blackmark" as it was with the "well", but it is still of the order of \pm 25 yards.
- B. The strobe on the bearing tubes will now appear as a brightening pulse on the echo, gradually diminishing in intensity to the right for several thousand yards.
- C. The new "spotting tube" Design 4 will now have "wells" as originally intended. Spotting will be carried out about a small centre pip, corresponding to the ranging index, with two other pips, one each side, a thousand yards from the centre pip. The distance of the splash from the target echo will be measured by a paper scale or by interpolation between the pips.

- D. An improved drill for checking the groundwave position regularly must be carried out while the calibration pips are switched off when searching for small echoes.

All these modifications can be carried out by ship's staffs.

TYPE 253.

The maintenance of battery power supplies in ships has always been a source of trouble. It has therefore been decided to fit a rectifier unit working from 180 v. 500 cycles to supply Type 253 in future fittings. The output of the rectifier is carefully smoothed (less than 1% ripple) to avoid firing the set on variations in the power supply. (Unsmoothed rectifiers are not suitable for use with Type 253).

Two types of rectifiers will be used, Patt. W9823A and Patt. 56584. They differ only in using different smoothing condensers. Each rectifier is 16 $\frac{1}{2}$ " wide, 12" deep and 21" high, and each requires a supply of about 300 watts.

The various supplies which may be used for Type 253 are listed below :-

- (1) Battery Outfit BBh. The standard fitting to date.
- (2) Battery Outfit BBm. An alternative to BBh.
- (3) Battery Outfit BBq. Fitted in certain destroyers sloops etc., for Type 60EQR and used as a common battery.
- (4) Rectifier Patt. 9823A. For ships where an adequate 180 v. supply is available.
NOTE :- DUK supplying 2710/242 is not adequate to supply W9823A.
- (5) Rectifier Patt. 56584. Alternative to W9823A.
- (6) Battery Outfit BBj. For ships with no charging facilities.
- (7) Ship's Batteries. In coastal craft a common 24 v. supply is available.

It should be noted that ships L.P. supply is not suitable for Type 253.