26th March, 1973

SERVICE DEPARTMENT TECHNICAL INFORMATION NO.5.
MODEL XC407 MASTER CLOCK
DRAWING NOS. 2306, 2306/1, 2306/2, A12344
MATERIAL LISTS A11979 - A11958 (LARGE P.C.B.) - A11959 - (SMALL P.C.B.)

The Model XC407 is now in full production but since its introduction a number of modifications have been necessary and these are detailed on pages 12, 13, and 14.

Modifications may be necessary when replacement printed circuit boards are used but the serial numbers and printed circuit boards already in use must be checked to determine the method of modification necessary.
Your attention is specifically drawn to the item regarding resistor R.27 (attached to the time dial contacts) when printed circuit boards are replaced on earlier clocks.
Particular attention should also be paid to the pulling-up voltage of the "S" type time dial movement since this was lowered from 24-volts to 17-volts and any engineer visiting an installation with a Model XC407 should make certain that this setting is correct.

The modifications detailed on pages 13 and 14 are obligatory to all Service Engineers and a check must be made on all Master Clocks to ensure that this modification has been made. Should this not be so, the engineer must carry out modifications as detailed. Again I would draw your attention to the fact that these modifications are only necessary where a Tantulum condenser is fitted and is not applicable to earlier models.

Three circuit drawings have been enclosed to enable you to recognise the various modifications that have been carried out and reference to these drawings will show where the various items have been either omitted or added since the clock wasoriginally produced. Drawings 12344/1, /2 and /3 give setting details of the two electro-mechanical movement. Drawing A1234/3 detailing the current production Model of the 404 movement with the modification referred to pn page 12. Drawing D2306/2/G shows the general wiring of the current production model.

Enclosed also is the standard instruction booklet supplied with each Master Clock for instructions to the user.

JA/JB

P.T.O. FOR INDEX.

MODEL XC407 MASTER CLOCK

TECHNICAL AND SERVICE INSTRUCTIONS

MODEL XC407 MASTER CLOCK

DRAWINGS.	MLA 11979	Material list.
	2306/1	Physical Layout Drg.
	2306/2	Theoretical Circuit Diagram.
SPECIFICATION.	ACCURACY	:- ± 15 Secs/Month (When correctly
	OUTPUT	:- regulated) Polarised pulses of 24-volts for 1 second every minute or 1 sec, every 2 secs. for advancing. Max. clock load for a standard system 800 milliamps or 100 standard 3,000 ohm clock movements.
	POWER SUPPLY :-	Transformer/rectifier operated from Mains voltage of 100-125v or 200-250v and sealed nickel cadmium batteries for use during mains failure.
	AVAILABLE STANDBY PERIOD OF BATTERIES :-	6 hours minimum with batts. fully charged.

OPERATION OF MASTER CLOCK.

Briefly the operation of the clock may be described as follows - The pendulum is in an electromagnetically self maintaining circuit using an integrated circuit amplifier in a feedback loop, the frequency of which is controlled by the pendulum itself. Pulses from the feedback loop are fed to a C404 movement at $\frac{1}{2}$ sec. intervals. This motor makes a pair of contacts at 1 min. intervals which in turn cause two relays RL1 and RL2 to pull up at alternate minutes - dependant upon the position of change-over contacts on the pilot dial movement. These Relays control the polarised sub circuit. In the event of mains failure sealed Nickel-cadmium cells take over the systems operation and will continue to drive it for at least 6 hrs. after which they will automatically cut off to save being over discharged. Facilities are also included with the master clock to advance the clocks by means of an astable multivibrator controlling the relays RL1 and RL2 and by cutting off the impulses driving the stepping motor the clocks may be retarded.

Refer to Drgs. 2306/1 and 2306/2.

POWER SUPPLY

Under normal conditions power to operate all but the pendulum drive circuit is obtained from the transformer/rectifier circuitry, the pendulum drive circuit and contact movement drive circuit however are always fed from the sealed Nickel Cadmium battery, which is trickle charged from the transformer/rectifier circuit, to ensure a stable voltage to these importand circuits. With the battery in a fully charged condition an ammeter connected across the battery fuse clips should read 5 mA charge rate.

contd/.....

Now referring to drg. 2306/2, it will be seen that batt. -ve feeding to the small P.C.B. via SK2 Pin 13 is commoned to the rectifier -ve (i.e. D13 & D14) which are fed from the transformer via SK2 Pins 14 and 15. The following description will therefore refer to the system -ve rather than separate batt. or trans. -ve as they are common. The batt +ve is fed via the Fuse F2, 1.5 amp, to SK2 pin 16 and thence to the small P.C.B., through P.N.P. transistor VT8, which may be considered as conducting permanently under normal conditions, to solder pin C on the Small P.C.B. This then feeds to solder pin C on Large P.C.B. and thence to the collector of N.P.N. transistor VT1. This acts as a voltage regulator circuit feeding a constant 12-volts to the integrated circuit I.C.1. driving the pendulum.

SLAVE CLOCK DRIVE.

The contacts on the C404 movement pick up a +ve from the transformer and rectifier D11 and D12 via relay RL3, solder pins E between boards and SK1 pin 4. The other circuit feeds via SK1 pin 7 to the base of transistor VT7. This transistor passes current via SK1 pin 5 to the centre of the Change-over contacts on the 'S' Type Pilot Dial movement. The two outer contacts then alternately pass the current from VT7 via SK1 pins 6 and 8, solder pins D & F between P.C.Bs to relay coils RL1 and RL2.

Now the centre contacts on relays RL1 and RL2 are fed via solder pins Q & R, and A & B to SK1 pins 9 & 10. These then feed the coil of the Pilot Dials 'S' type movment and the slave clocks. The back contacts on both relays are connected to -ve and the front contacts via contacts on RL3 to the transformer/diode +ve. Hence when both relays are de-energised both slave clock terminals P & N are connected to -ve but when either RL1 or RL2 pulls up, as they will do when the contact on the 1 min. contact movement make, either the P or N lead goes to +ve and hence the slave clocks and pilot dial advance one impulse.

Now as the 'S' type movement does not advance until the driving impulse is removed, the C/O contacts on the 'S' type pilot Dial Movement will not change over until all the slave clocks have advanced and the driving impulse has been removed. The change over of these contacts will then prime the circuit to the other Relay (either RL1 or RL2 dependant upon which last pulled up) and the next time VT7 is switched on the appropriate relay will be energised.

As a matter of interest the diodes D7 and D8 are used for suppression of transient voltages from the slave clocks, so protecting the contacts of RL1 and RL2 against burning due to arcing.

PENDULUM DRIVE

Two permanent rod magnets are associated with the pendulum rod, these being mounted on a brass block secured to the pendulum rod by means of a dowel pin. These are positioned to enter two coils (71-31-8 on 2306/2) mounted to each side of the pendulum rod. The Left-hand Coil or Pick up coil is used to sense the direction of movement of the pendulum and the Right-hand coil to drive the pendulum as follows -

With the pendulum at rest or moving to the left the drive coil has a small current fed through it from I.C.1. Pin 10 and R6 (this current is in the order of 100 microamps). The current produces a magnetic field around the drive coil which is of the same magnetic polarity as that of the interacting end of the Right-hand rod magnet. The pendulum is therefore repelled towards the Left.

Having reached the left-hand extremity of its arc the pendulum will then start to move towards the right which causes a voltage to be induced into the Pick up coil by the Left-hand permanent magnet. This will then cause the integrated circuit to switch off and hence the drive and magnetic field collapses and the pendulum moves freely from left to right. On starting its movement to the left again the drive coil repells the pendulum and the whole cycleis repeated.

Once the pendulum has been given a slight push to start it, the whole procedure will be self maintaining and the pendulum will continue to swing as long as the voltage is applied to the circuit.

In addition to controlling the current passing through the drive coil, the integrated circuit is also used to control the circuit consisting of transistors VT2, VT3 and VT4 which drive the 1 minute contact movement. Regarding this circuit, it will suffice to say that it is used to provide pulses of alternate polarity at $\frac{1}{2}$ second intervals to the movement, these pulses being of approximately 24v maximum amplitude and are derived from the charging and discharging of capacitor C3 through the 1 minute contact movement. This movement is in fact a $\frac{1}{2}$ minute C404 movement with the hour pipe removed, leaving just the minute spindle. To this is fitted a tufnol wheel with a silver pin screwed into it. This silver pin makes contact for one second between two finger springs at one minute intervals (i.e.) at each revolution of the minute spindle.

ADVANCE/RETARD OPERATION.

Having dealt with the main circuitry used to control the clock system during normal mains operation the only remaining part of the circuit left is that for advancing and retarding of the clock system. These operations are undertaken with the aid of the adv./ret. switch and the circuitry associated with transistors VT5 and VT6.

To retard the clock system the adv./ret. switch is moved from normal to retard which reverse biases the base of transistor VT2. This will stop any further pulses being generated to drive the 1 min. contact movement and hence no further output pulses to the slave clocks will occur until the switch is returned to its normal position, whereupon the movement restarts.

To advance the system the adv./ret. switch is moved through the retard position to the advance position. This in fact stops the 1 min. contact movement as for retard and also switches the astable multivibrator circuit VT5 and VT6 on to the base of VT7. This caused the relays RL1 and RL2 to pull up alternately for 1 sec. every 2 secs. as if the 1 min. contact movement contacts were being made for 1 sec. every 2 secs. This rapid advance will continue untill the switch is returned to the retard of normal positions.

It should be noted that the +ve feed for the multi-vibrator circuit is only obtainable via R12, solder pins G, and the rectifier diodes D11 & D12 on the small P.C.B. hence if there is a mains failure the clocks cannot be advanced until the mains is restored. This ensures that the battery is not repidly discharged by advancing the clocks for long periods.

MAINS FAILURE OPERATION.

The description above is of the operation of the basic system during normal mains operation. If however the mains should fail the system will operate as follows:-

When the mains is switched off no change will be noted in the operation of the master clock for at least 6 hrs. The supply to drive all the mains circuits is obtained from the built-in Nickel Cadmium 24v Battery.

As previously discussed the pendulum and 1 min. contact movement drive circuits are fed from the battery via transistor VT8. This is usually conducting but under conditions of mains failure this will not alter. However, relay RL3 will become de-energised as its coil is fed directly from the transformer secondary. The change-over of RL3 also feed Batter +ve VT8 to the contacts on the 1 min. contact movement and also to the relays RL1 & RL2. The contacts of relays RL1 & RL2, which feed the load, pick up their +ve direct from the battery +ve terminal via SK2 pin 16. Hence the system will continue operating satisfactorily so long as VT8 continues to conduct.

contd/...

The base of VT8 is in fact fed with current to make it conduct by transistors VT9 & VT10 which are arranged in a voltage sensitive circuit that effectively senses the battery voltage and switches off when the battery reaches a potential of 22-volts. Once this circuit has switched off and VT8 is switched off, it cannot re-start itself until the mains is re-applied as Vt8 switches on VT9/10 circuit and vice-versa. Only a voltage pulse from the mains can re-start the circuit and hence remove any danger of over discharging the battery and so causing damage to individual cells.

The switching off of VT8 will in fact cause the pendulum to cease swinging - although it will take several hours for the oscillation to completely die away. The 1 minute contact movement will fail to operate and the relays will fail to pull up. Hence no power will be supplied to the clock until mains is restored.

With regard to the battery, this consists as stated previously of sealed cadmium cells arranged in 2 - batteries of 10 cells each. They have a capacity when fully charged of 500 milliamp hours which is adequate to operate the system for at least 6 hours under conditions of mains failure. The cells are normally being trickle charged at a rate of 5 milliamps by the highest voltage tapping on the transformer (i.e.) SK2 pin 11 D9, R23, SK2 pin 16 and thence to the +ve terminal of the battery.

POSSIBLE FAULTS WITHIN THE XC407 MASTER CLOCK

The faults within the master clock can be divided fairly easily into four categories as follows:-

1.) ELECTRICAL where a fuse may have blown, the transformer or the batteries may be damaged.

2.) ELECTRO-MECHANICAL where the contacts on the above movements have become worn or relays RL1 & RL2 have worn out and require replacing or a plug to one of the P.C.Bs has become damaged.

3.) ELECTRONIC where a fault has developed with one of the circuits on the printed circuit boards.

4.) MECHANICAL where for example the C404 type 1 minute contact movement or the 'S' type pilot dial movement have become worn or damaged and fail to operate satisfactorily

The following information is intended to assist service engineers in deciding which part of the master clock is at fault and therefore enabling them to either replace or repair the offending item on site.

To service a master clock it will be necessary for the engineer to understand the foregoing description of the circuit operation and to be able to interpret any meter reading etc. he may obtain on site, with reference to the circuit diagram 2306/2.

VOLTAGE READINGS & OTHER TESTS WITHIN THE MASTER CLOCK:-

Loss of A.C. sec supply/discharged battery

1.) These are with both mains and the internal battery connected into the system.

Battery Voltage - measure at terminal block at R.H. top of backboard - 28-volts
N.B. check battery fuse is O.K.

Transformer Secondary - measure between fuse on top of transformer and SK2 pin 14 24-volts AC
SK2 pin 11 35-volts AC
N.B. check fuse is O.K.

Having checked the two power supply units are O.K. the appropriate voltages on the P.C.B. assembly may be measured.

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Firstly connect the V/M -ve to solder pin H and check that this is in fact carring the system common -ve by firstly probing to Battery +ve and then the transformer secondary fuse - in each case the V/M should read 24-30 volts if so lead H is OK. and this point may be used as a negative common for V/M measurements.

a) V/M -ve to H +ve to G reading should be 24volts D.C. If no voltage is present check if RL3 is attracted, if it is diodes on P.C.B. are faulty - Replace P.C.Bs. If RL3 is de-energised check continuity of SK2 particularly Pins 14 & 15 - recheck transformer secondary fuse.

b) V/M -ve to H +ve to E V/M reading 24volts D.C. If a) was OK. and RL3 is energised check for dirty contacts on RL3.

c) V/M -ve to H +ve to C V/M reading 27volts D.C. If no reading check voltage with +ve of V/M to emitter to VT8 in small P.C.B. - this should be 28volts if not check continuity from battery +ve to pin 16 SK2 on small P.C.B. If VT8 emitter reads 28volts but no voltage appears at C with the mains connected to the Master Clock then a fault lies within the Master Clock voltage sensing circuit - Replace P.C.B. Assembly.

2) Loss of time dial and Slave Circuit.

d) V/M +ve to E -ve to D Remove Slave Clock fuse. Make contacts on C404 movement (with screwdriver tip of other metallic instrument) and either the first or second impulse should give a V/M reading of 24volts D.C. transfer V/M -ve to F and next impulse should register on this pulse, the following pulse should not.

If no impulses are obtained on either pin ensure that a good contact is being made to the finger springs, that +24-volts is being fed to one of them (V/M -ve on H) check continuity of SK1 pins 4, 5, 6, 7, 8, check 'S' type Movement Change-over contacts - ensure they are not worn away, pitted, dirty or otherwise open circuit - if necessary reset them. If all is OK. suspect VT7 on P.C.B. and change P.C.B. Assembly.

If impulses at only -ve pin are present suspect the 'S' Type Movement or the Spring pressures.

If impulsing is erratic with pulses to both pins D & F simultaneously - suspect the 'S' Type Change-over contacts and replace if necessary.

N.B. It should be noted that when a voltage is present at D, RL2 should energise and when present at F, RL1 should energise. If they do not, then the relays should be examined for posible failure - replace if necessary.

contd/....

e) V/M -ve to H +ve to A should give a reading of 24volts every other time the contacts on the 1 minute movement are made, a similar reading should be obtained on B on the alternate impulses. If readings are not obtained, but relays RL1 and RL2 are energising alternately then the contacts on at least one of the relays have become worn or pitted and should if necessary be replaced.

With a V/M connected between A and B alternate polarity pulses should be read on the V/M the successive operations of the contacts on the 1 minute movement.

f) Check operation of the "Advancing" circuit. Put the switch into the advance position and ensure that polarised impulses of approximately 1 second duration, every 2 seconds appear at the slave clock terminals but only when the mains is switched on. If no rapid pulses occur check the Adv./Ret. switch is not dirty or faulty and if this is OK. replace P.C.B. Assembly.

Having discussed the sections of the Master Clock that may be considered as the slave clock circuitry we now come to that part which is responsible for the time keeping of the system i.e. the pendulum drive circuit and the Stepping Motor (C404) drive circuit.

Whereas the possible faults on the foregoing section made it difficult to list possible faults and cures, this is rather easier for this part of the circuit and details are given as follows:-

PENDULUM STOPPING.

1) Pendulum will not maintain itself in motion.

Check that the permanent magnets are not catching on the coils as they enter and leave them. Check that there are no other obstructions to the pendulum assembly and that the suspension spring is in good condition. If all is mechanically sound check that voltage is available at solder pin C as in C) above if so then check that the screws and nuts holding the solder tags from the pick-up and driver coils are firmly screwed home, tighten if necessary. If all the above fails to find the cause of the problem take off one lead of the Pick-up and Drive Coils and measure their resistance - this should be about 5000 - 6000 ohms - replace coil if necessary. If the fault is still not found, change the P.C.B. Assembly as it is likely to be a component fault.

2) Pendulum is maintained but not(C404) Stepping Motor.

If this movement fails to operate, the three possible faults are,

a) Movement itself,
b) Interconnection plug or lead between P.C.B. and Movement,
c) P.C.B. Circuitry.

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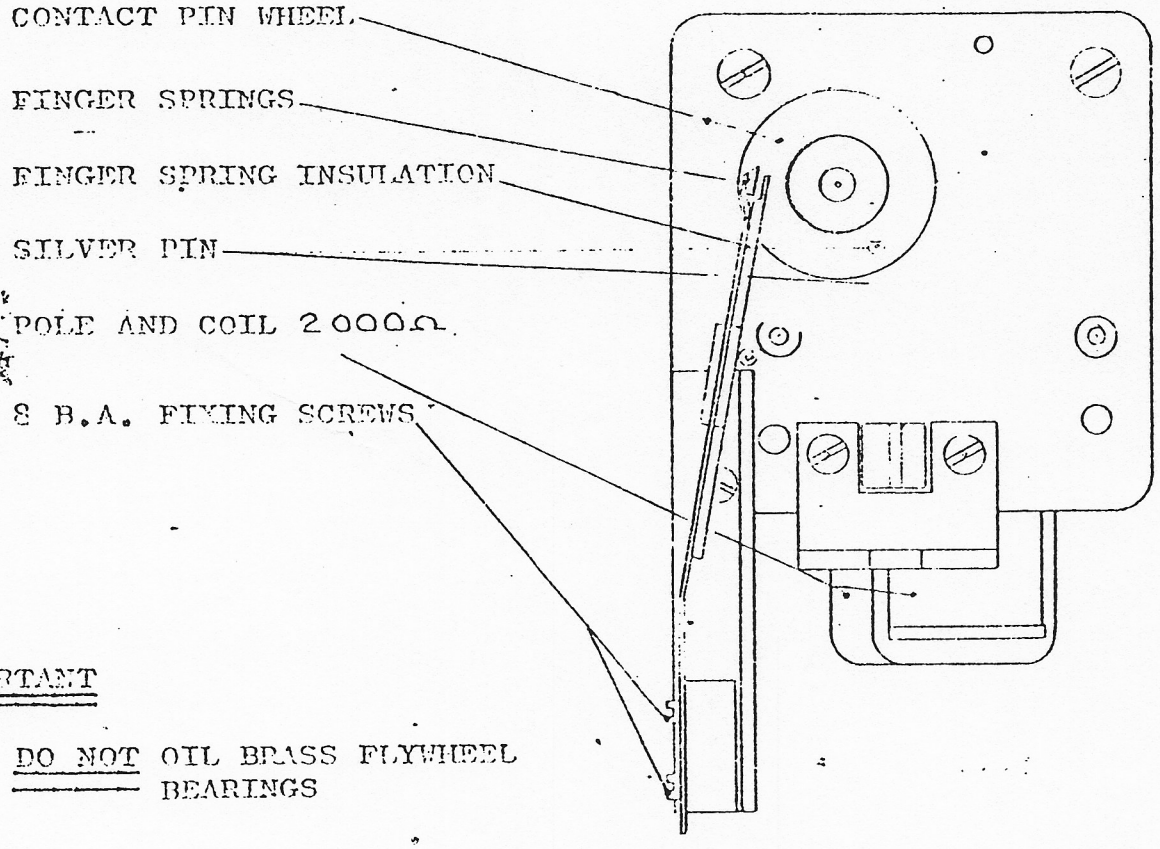


IMPORTANT

DO NOT OIL BRASS FLYWHEEL BEARINGS

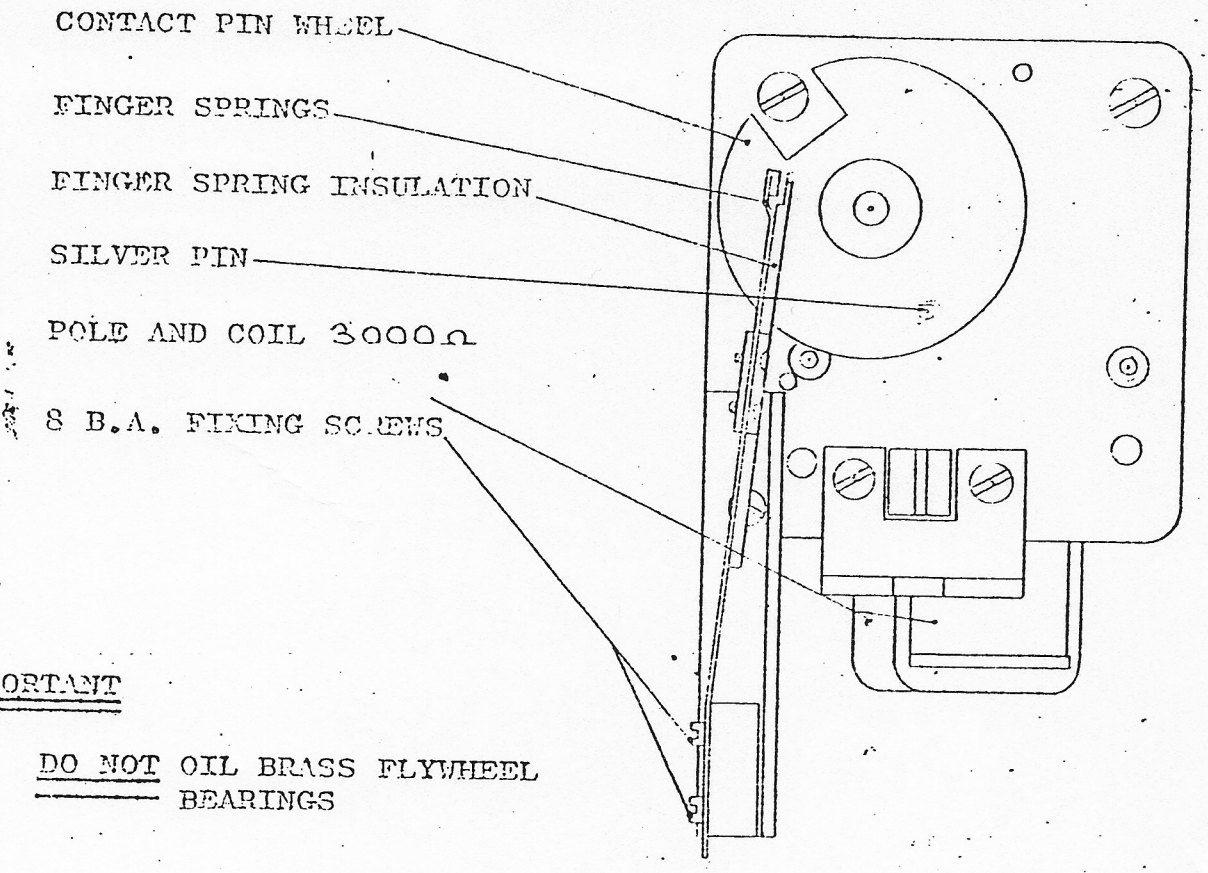
1) Align contact finger springs by the 8 BA fixing screws. These should make and break simultaneously and be clear of each other and the contact pin wheel.

2) Set contact pin wheel by means of grub screw. It should not be possible on the impulse prior to contact, for the silver pin to jamb between finger spring and insulation. Ensure that finger spring insulation sits firmly on silver pin, but drops cleanly off insulation on contact impulse.

3) Set finger spring tension to give sufficient tension to return springs to steady pin without undue bounce. This gives contact pressure of approximately 3-4 grams. DO NOT OVER TENSION.

4) Re-check settings 1 and 2.

NB DETAILS OF MOD. XC407 1 MIN. CONTACT MOVT. AFTER SERIAL Nº 2228



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4) Re-check settings 1 and 2.

NB 11 DETAILS OF MOD. XC407 IMIN. CONTACT MOVT. BEFORE SERIAL No 2228.

Firstly check the movement by operating the rotor assembly by hand (as for advancing or retarding a standard C404 movement) - Check that the movement is not tight or binding or dirty. If the movement seems satisfactory, withdraw socket SK2 from the pins on the P.C.B. and check the resistance of the coil (i.e. between Pins 1 and 2 on the socket) this should be 3000 ohms approximately prior to serial number 2227 and after this number 2000 ohms. If this is O.K. examine the socket to ensure it is making good contact with the pins on the P.C.B. and when satisfied, replace the socket. If the movement still fails to operate put V/M probes into the top of SK2 pins 1 and 2 when pulses of alternate polarity at $\frac{1}{2}$ second intervals should be noted. It will not be possible however to read the full voltage deflection on a volt meter since the volt meter will not attain full scale deflection due to the short period of the pulse. If the movement still fails to operate the P.C.B. assembly should be changed.

C404 MOVEMENT

As stated previously the C404 movement is propelled by the charging and discharging of condenser C3 which provides a polarity reversal pulse to the movement coil. The movement should drive and lift the contacts springs at a minimum of 15 volts. The air gaps between armature and pole face are set during manufacture - under no circumstances must these be altered. The only adjustment provided on this movement is to vary the back-lash between worm and worm wheel by the two magnet fixing screws. This adjustment should give the minimum amount of back-lash possible, without causing stiffness, since excessive back-lash can cause the contacts of the C404 movemen to re-make after breaking, and as a consequence the S type movement and clock circuit will gain.

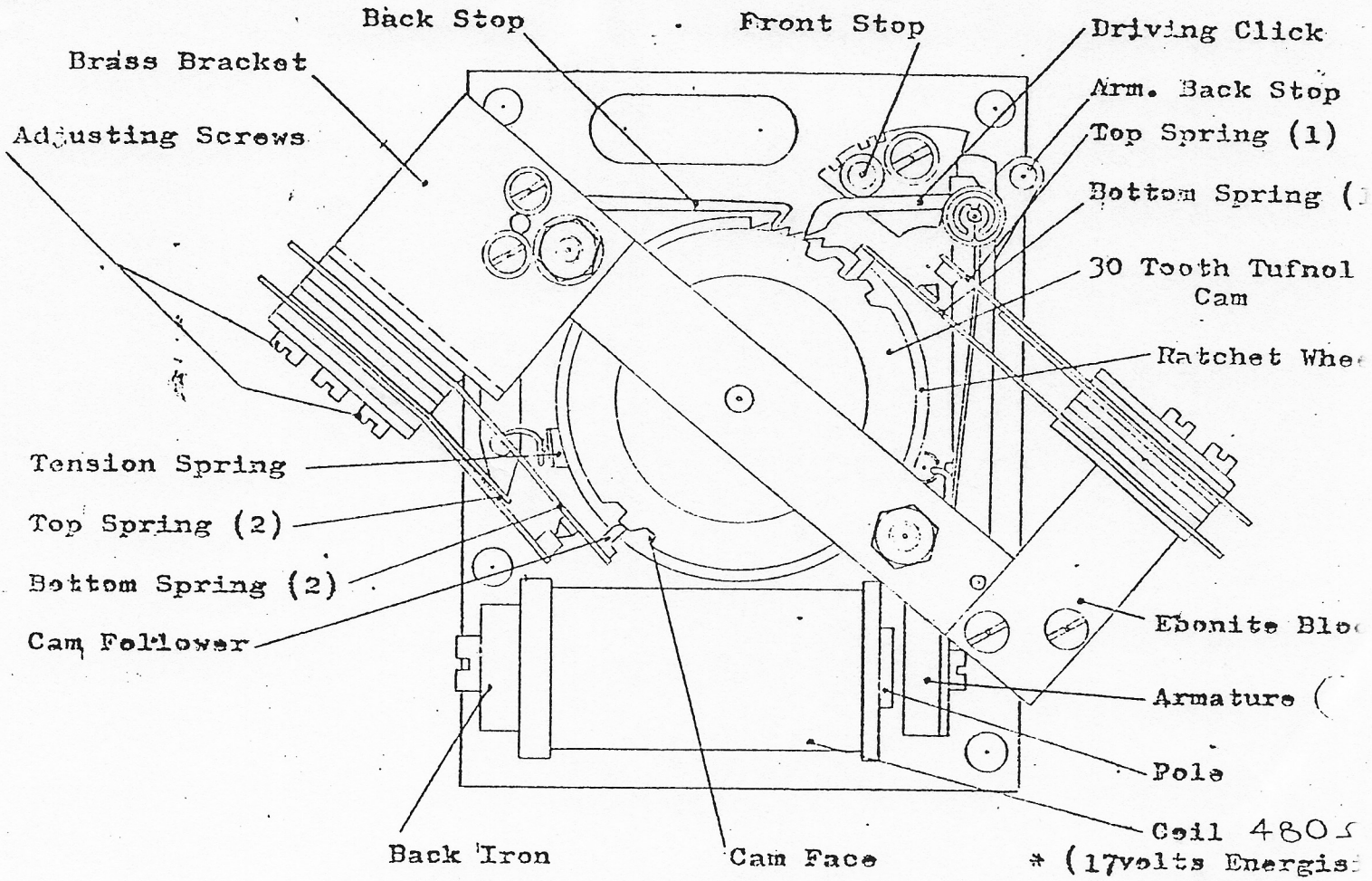
It is also important that the fly wheel is kept free since this absorbs flutter from the armature and dampens the back-lash. On no account should oil be applied to the fly wheel bearing since this will eventually coagulate and cause friction.

Should it be necessary to check the movement, remove the two magnet fixing screws and withdraw the worm from the spigot spindle. Check the fly wheel for freedom, clean and re-oil the spigot and nylon worm bearing using a spot of light oil only and re-assemble bearing in mind the above remarks on back-lash.

Check contact settings as per drawing A.12344/2.

The above remarks also apply to the slave clock movements should they also require servicing, since these movements are similar in construction. In the case of a slave dial movement a 12 to 1 gear is fitted to operate the hour hand, the

contd/.....



Ebonite Block Contact (Fixed)

1) Set Bottom spring (1) with sufficient tension to return spring to bottom of Tufnol wheel tooth only.

DO NOT OVER TENSION

2) Set Top Spring (1) to 20 grm measured at contact Set contact gap at .010" - .015" (10 - 15 Thou).

3) Adjust 30 tooth cam by the grub screws

4) Ensure that cam follower falls cleanly to bottom of Tufnol wheel tooth but does not touch cam face when back lash is taken up.

Check that cam follower does not ride up tooth face and reduce contact gap.

Brass Bracket Contact

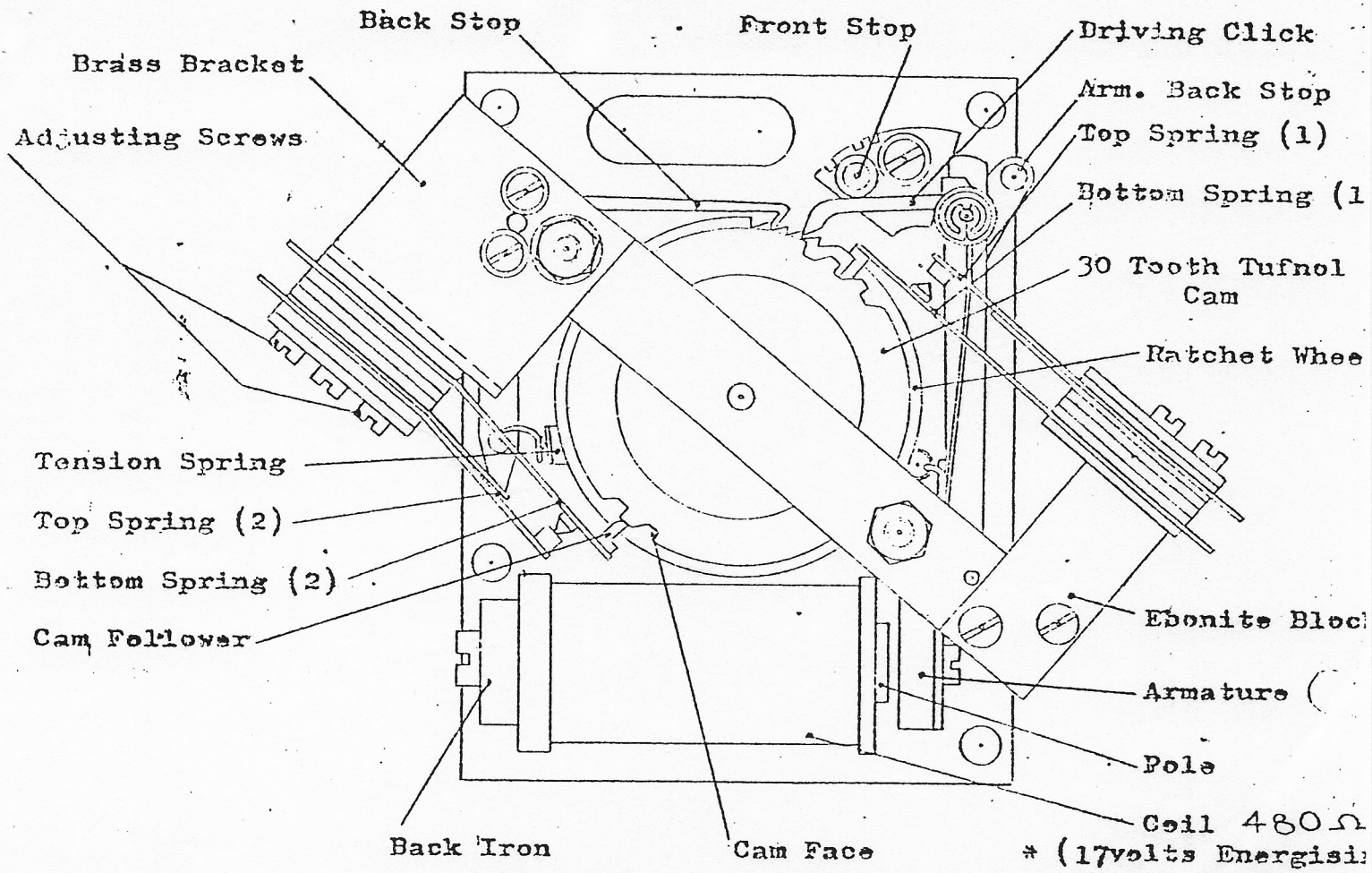
5) Set as for Ebonite Contact excluding item 3 but with contacts made when Ebonite Block Contacts are broken. Use contact block adjusting screws for lateral adjustment

6) Check that both followers do not touch ratchet wheel.

* Amended 15.11.72 17-volts was 20.

DETAILS OF MOD. XC407 'S' TYPE MOVEMENT AFTER SERIAL No 2020

A12344 1



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3) Adjust 30 tooth cam by the grub screws

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Check that cam follower does not ride up tooth face and reduce contact gap.

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5) Set as for Ebonite Contact excluding item 3 but with contacts made when Ebonite Block Contacts are broken. Use contact block adjusting screws for lateral adjustment

6) Check that both followers do not touch ratchet wheel.

* Amended 15.11.72 17-volts was 20.

DETAILS OF MOD. XC407 'S' TYPE MOVEMENT AFTER SERIAL No 2020

A12344 1

coil resistance being 3000 ohms, and the movement will drive down to a voltage of 12 volts. In this case the flywheel bearing will require oiling (Sparingly).

S TYPE TIME DIAL MOVEMENT

This movement is impulsed from relays RL.1 and RL.2 at minute intervals. Erratic operation of this movement will cause indifferent time-keeping of the clock circuit since it is used to provide polarity reversal pulses to the external clocks. The movement armature should energise at 17 volts and when set correctly this figure will provide sufficient drive to lift the contact springs.

Should dis-arrangement have taken place, check the movement as follows: Firstly check for minimum back-lash between the back stop click and the ratchet wheel. This can be adjusted by the driving click front stop (see drawing A.12344/1), so that the back stop just drops in the tooth on each impulse. Check this setting round the whole of the ratchet wheel before tightening the front stop securing screw. Set the armature back stop to enable the driving click to take 1.1/3 teeth on impulse. The armature should mate with the pole and back iron faces simultaneously with the armature touching the armature back stop. To effect this adjustment remove the pole fixing screw and slide the back iron after slackening off the two fixing screws under the movement coil. It should be impossible to rock the armature after this adjustment has been correctly carried out neither should the armature touch the pole and back iron faces first and then rock on to the armature back stop.

After setting the movement as above the tension spring adjuster should be set so that the movement just energises at 17 volts. (See drawing A.12344/1 for contact arrangement settings). Oil the pivots only with one spot of oil per pivot and on no account apply oil to the ratchet wheel or tufnol cam faces.

STRIPPING THE CLOCK DOWN

Before proceeding with major stripping of any units the mains supply to the clock should be switched off and the internal battery disconnected at the top right hand terminal block.

1), Removing P.C.B. Assembly

a) Remove pendulum by raising slightly and bringing the top part of the rod forward to clear the pendulum mount, then disengage each permanent magnet from its associated coil. On later models a transit bracket has been fitted across the pendulum mount and it will be necessary to move this to remove the pendulum.

b) Remove sockets S.K.1 and S.K.2 at the top of the P.C.B.

c) Unscrew nuts to allow the removal of the leads from the P.C.B. and the pickup and drive coil. - Remove plug in relays.

d) Unscrew the six wood screws securing the P.C.B. Assembly together with the two 4 B.A. Screws fitted behind relays to release the complete assembly from the back-board. N.B. DO NOT Lose the P.C.B. Packing pieces when removing the wood screws.

2) Removing the Pilot Dial and S. Type Movement

a) Remove the bezel from the dial by pulling forward - this is only a push fit.

b) Unscrew the grub screws in the minute hand and pull off.

c) Pull off the hour hand.

d) Unscrew the dial - 8 B.A. screws top and bottom.

e) Unscrew the three screws in the false plate supporting the movement during the unscrewing of the 3rd screw.

The movement will now hang freely on its interconnecting wires, with the false plate held in place by the rubber packing pieces. If the movement is to be completely removed disconnect the S type coil from the terminal block on the back-board, and remove the wires attached to the S type contact assembly.

3) Removing the C404 Movement

a) Having exposed the movement by removing the pilot dial assembly as above, remove the pillar used to support the S type movement.

b) Remove the three fixing screws in the movement corners. Rotating the tufnol wheel to gain access through the cut out.

The movement wired to the socket S.K.1 and the S type movement will now be free and able to be removed from the clock for easier access.

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MODIFICATIONS

Prior to serial number 2019 the S type contact assemblies were mounted on one block forming a change over contact arrangement. After this serial number the assemblies were fitted separately being diametrically opposed as shown on current production drawings. The S type coil was also changed from 880 ohms to 460 ohms to provide increased drive. A Sub P.C.B. was also added at this date (drawing A.12098) shown in the bottom right hand corner of drawing 2306/2/E on the small P.C.B. together with resistor R.27 (attached to the time dial contacts) to limit the base current on transistors V.T.11 and V.T.12.

This sub P.C.B. was fitted to the soldertag connections for the octal base relay on the bottom right hand corner of the small P.C.B. and was added to relieve the S type movement contacts of R.L.1 and R.L.2 relay load current. It was subsequently found to be unnecessary however and was removed after serial number 2221 together with resistor R.27. At this stage diodes D.15 and D.16 were reversed on the octal base wiring and V.T.7 was also changed to a B.F.Y.50 transistor.

Note

When fitting replacement P.C.B.'s always check that resistor R.27 has been removed from the S type contact assembly. Relays R.L.1 and R.L.2 will not operate directly from the S type movement with resistor R.27 in circuit.

To provide increased power to operate the C404 movement the coil resistance was changed from 3000 to 2000 ohms after serial number 2228. The contact pin was also altered to a position nearer the centre of the tufnol wheel to relieve the movement of excessive contact pressure.

From serial number 2266 condenser C.10 will also be fitted to further increase the power to the 404 movement although this change in power is marginal. Minor alterations have also been made to the small P.C.B. with the addition of R.29 to limit the base current of V.T.9 with the addition of Diode D.18 to prevent reverse current through V.T.10 when V.R.1 is inadvertently reduced to zero ohms.

OPERATING AND GENERAL INSTRUCTIONS

These are contained in a separate maintenance and installation Guide Booklet supplied with each unit and contain instructions on the setting up and general operation of the system, for use by the user.

MODIFICATIONS

Faults have recently been discovered on a number of Master Clocks fitted with Tantalum capacitors where transistor VT8 has failed. The Failure can be listed in two categories.

(1) Short circuiting of the base/emitter junction causing over charging of the nickel cadmium cells.

(2) Open circuiting of the collector emitter causing complete failure of the 404 movement.

Item 1

The normal charging rate of 5 mA. is limited by resistor R.23 and diode D9. Should Transistor VT8 go short circuit between base/Emitter a charging current of some 300 milli amps can occur via diode D17, through the base/collector of VT9 in the reverse direction consequently shorting out the current limiting resistor R.23.

This will only occur on P.C.B.'s fitted with Tantalum Capacitor C9 between Serial Numbers 2136 and 2257 since diode D17 was also added at this time without R29 being fitted. It should be noted that this fault can occur in service without being detected until the battery eventually fails.

Item 2

Should the collector/emitter of VT8 go open circuit the 404 movement will immediately stop since the battery circuit from socket pin 16 has been disconnected. Check VT8 by shorting collector/emitter and the 404 movement should again rotate. Both these faults have been attributed to a high voltage appearing at the base of VT8 and as a consequence, on all Models producted after serial number 2257, resistor R29 has been fitted to limit the base voltage of VT8. This resistor (2K2 $\frac{1}{2}$-watt) will of course limit the current through diode D17 should VT8 emitter/base go short circuit and therefore overcomes the two problems previously described.

DRG. Nº

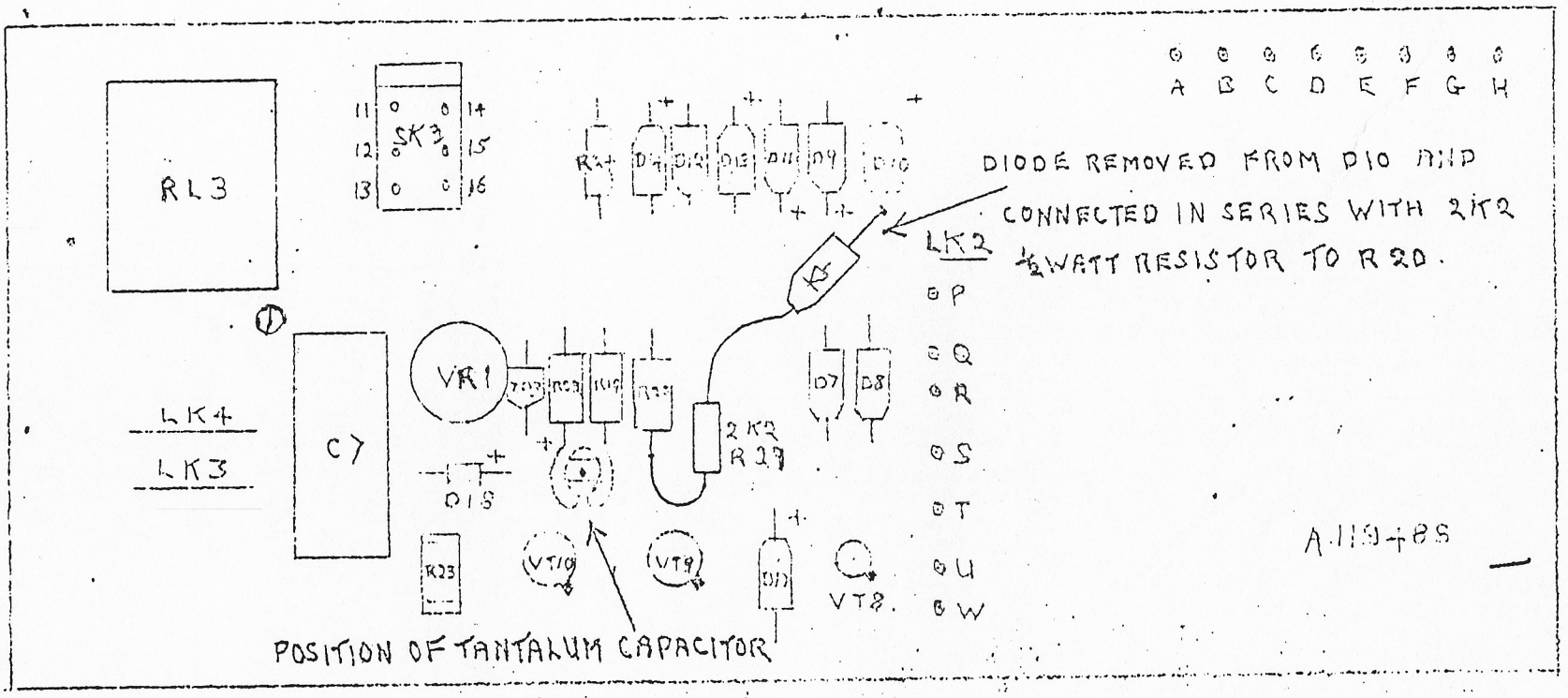
ins 1/2 1½

mm 5 10 15 20 25 30 35 40 45 50

DIMENSIONS IN INCHES
UNLESS OTHERWISE STATED

THIRD ANGLE PROJECTION

IF ANY QUERIES
ASK D.O.



IMPORTANT.

THIS MOD. MUST ONLY BE CARRIED OUT ON CLOCKS BETWEEN SERIAL NO 2136 AND SER. NO 2257. FITTED WITH A TANTALUM CAPACITOR

ISSUE		MATERIAL:-	FINISH:-	ORDER Nº:-	GENTLEC	
		TOLERANCES DEC. ± FRACT. ± ANGULAR± UNLESS OTHERWISE STATED	TITLE:- MODIFICATION TO XC(10) SMALL P.C.B. TO FIT DIODE D17 IN SERIES WITH 2K2 RES	SCALE :-		
DRN.	CHKD.	DATE	USED ON MATERIAL LIST		DRG Nº:- SERV. NO 5/1.	

MODIFICATION FOR THE FITTING OF RESISTOR R29

Firstly check the charging rate by removing Fuse F2 (Located near the nickel cadmium cells) and insert a milliammeter. Under normal charing conditions this should read approximately 5 milli amp. If this is excessive check transistor VT8 for short circuit between the base/emitter junction.

Check to determine if Tantalum Capacitor C9 is fitted, this being the small globular yellow capacitor with a purple band fitted at the bottom left hand of the small P.C.B. between resistors R19 and R22. If this has not been fitted it is unnecessary to carry out any modifications.

After Serial No. 2257 Diode D17 has been fitted together with Resistor R29 between Diode D11 and Resistor R20 across the front of the small P.C.B.

After Serial No. 2270 Diode D17 has again been fitted in the original position of D10 with Resistor R29 across the rear of the small P.C.B. Also from this Serial No. Diode D18 has been fitted at the rear of the small P.C.B. to prevent a high base voltage appearing on VT10 should VR1 be acidentally altered to zero ohms. Also added at this date was Capacitor C10 to give added power to the 404 movement. After Serial No. 2257 no modification is therefore necessary.

Between Serial No's 2136 and 2257 and on some recently supplied P.C.B.'s for replacement purposes where C9 has been fitted, Diode D17 has been fitted in the original position of D10 (now obsolete) at the top right hand of the small P.C.B.

If Resistor R29 has not been fitted, a wire link has usually been fitted across the rear of the P.C.B. to connect Diode D17 to the junction of Resistors R19 and R20. Remove the positive end of Diode D17 from the P.C.B. and fit a 2K2 ½-watt Resistor in series with Diode D17 as shown on Drawing SERV/5/1 across the front of the P.C.B. which will then connect Diode D17 through this Resistor to the bottom of Resistor R20.

After carrying out these modifications a check should be made by disconnecting the main supply when Relay R3 should de-energise.

MODIFICATIONS

It has been found during the past two years that Master Clocks have been despatched over an unknown period with incorrectly set battery cut out potentiometers. In all cases these are set to cut out at too high a voltage.

If this is found in the field the potentiometer on the small P.C.B. may be re-adjusted by disconnecting the slave clock circuit and replacing by a resistor, drawing a current of approximately three quarters of an amp (30 - 35 ohm). This will rapidly discharge the battery since it is of a relatively small ampere hour output and the battery voltage will gradually fall. Set the Master Clock to retard with the silver pins on the 1 minute contact movement made. This will energise the output relay. Turn the potentiometer on the small P.C.B. fully anti-clockwise and switch off mains supply and wait until the battery voltage reads 22-volts. Slowly turn the pot clockwise until the output relay drops off. The potentiometer is then correctly set for the system to cut off at its correct voltage level.

NOTE:

Please add this page to your Service Manual for the XC407 Master Clock.