INSTRUCTION BOOK No. 80213R

SKYRANGER H. F. TRANSCEIVER

HC-5 SERIES

MANUFACTURER'S REFERENCE 1N80213

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

47 YORK STREET, SYDNEY

150562

SKYRANGER MODELS

There are two models of the Skyranger H.F. Transceiver — the HC-5-D (direct control) and the HC-5-R (remote control).

This book describes the direct-control model HC-5-D. A supplement will be issued setting forth the differences in the HC-5-R.

The two models are almost identical except for the methods of control.

AMENDMENT RECORD

No.	Date	Reference	Signature
1	18/12/61	Mod. No. 5 Modulator Freq. Response	
2	18/12/61	Mod. No. 6 Receiver Sensitivity	
3	18/12/61	Mod. No. 7 A.G.C. Delay	
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FACTS ABOUT YOUR SKYRANGER

The A.W.A. Skyranger Type HC-5 Series is designed to be fitted to your aircraft for communication on high frequencies.

It contains a powerful transmitter and a sensitive receiver, which can provide communication over hundreds of miles.

The receiver provides sufficient audio output to operate a loud-speaker. An efficient noise limiter is fitted to give protection against ignition noise; however, the best results will be obtained only if your ignition system is properly shielded.

LICENCING

In Australia, before using the Skyranger it is necessary to obtain a station licence from the Postmaster-General's Department. A.W.A. will be pleased to help in obtaining this licence. Any person who is to operate the equipment must obtain an operator's licence from the Department of Civil Aviation.

SERVICING

The Skyranger is designed to give long service without failure. If it should be necessary to remove the transceiver, operation of two fasteners at the rear will allow the unit to be removed from the case without disconnecting any wires.

If servicing should be necessary, it is recommended that it be done by the nearest A.W.A. Aviation Service Depot or by a radio technician approved by the Department of Civil Aviation.

OPERATING THE SKYRANGER

1. CHECK that the battery switch is on, and turn the VOLUME knob on the Skyranger clockwise.

2. WAIT about half a minute for the transceiver to warm up. When it has, receiver noise will be heard when the VOLUME knob is turned fully clockwise.

3. TURN the FREQUENCY knob to the required frequency.

4. TURN the loading coil switch to the corresponding channel when using a fixed aerial and manual loading coil.

5. PRESS the push-to-talk switch on the microphone. The R.F. OUTPUT lamp on the transceiver will light.

6. SPEAK into the microphone clearly, distinctly and in a regulated tone. HOLD the microphone close enough to the lips so that the MODULATION indicator flashes frequently, on the louder speech tones, but not continuously. The R.F. OUTPUT lamp will fluctuate correspondingly. Adjust the VOLUME control to a comfortable listening level.

7. When using a trailing aerial proceed as above, but, instead of (4), reel out the trailing aerial (in flight), with the microphone switch pressed, to the first point of maximum brilliance of the R.F. OUTPUT indicator. Do not forget to reel in the aerial before landing.

8. If both fixed and trailing aerials are fitted, set the aerial selector switch to TRAIL before using the trailing aerial.

9. When changing to another frequency, turn the FREQUENCY knob to the required frequency and proceed as in (4) or (7) above.

10. A headset should always be used for reception of weak signals, but for strong signals a loudspeaker will be satisfactory. To avoid possible damage to the headphones and for maximum receiver volume when using a loudspeaker, it is recommended that the headphones be disconnected from the transceiver either by unplugging them or by the use of a Speaker/Phone Switch.

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1.—TECHNICAL INFORMATION

Input Voltages

An aircraft power supply comprises a battery which is charged by an engine-driven generator. The battery may be either 12 or 24 volts (nominal). With the aircraft in flight the battery voltage rises, and is kept at approximately 14 volts for a 12-volt system, and 28 volts for a 24-volt system, by a voltage regulator. Throughout this book the input voltages are referred to as 14 or 28 volts respectively.

To allow for some voltage drop in the L.T. wiring, and to provide some tolerance on the adjustment, the specified test voltages are 13.5 and 27.5 volts respectively. All performance figures are based on operation at one of these test voltages (as applicable), unless otherwise stated. However, during ground testing or in emergency the transceiver will operate on 11 or 22 volts as applicable, though with somewhat degraded performance.

1.1 Receiver Performance

Number of Channels:	Five (crystal controlled).
Frequency Range:	2 to 13.5 Mc/s.
Sensitivity:	Less than 5μV of a 30% modulated signal produces a 10 db. signal-to-noise ratio and not less than 50 mW output.
Selectivity:	(a) Bandwidth at 6 db points is not less than 9 kc/s. (b) Bandwidth at 60 db points is not more than 68 kc/s.
Stability:	The resonant frequency of the receiver will not deviate by more than 0.01% over the temperature range of −20 to +55°C. Other climatic and long term effects will not produce deviations greater than 0.01%.
Audio Power Output:	3 watts.
Output Impedance:	(a) 600 ohms for phones. (b) 3 ohms for speaker.
Input Impedance:	Nominally 50 ohms.
A.G.C.:	The output will not vary more than 6 db for input variations from 10μV to 100mV.
Distortion:	Less than 15% for 3 watts output.
Frequency Response: (300 to 3000 c/s)	Within 6 db total variation.

1.2 Transmitter Performance

Number of Channels:	Five (crystal controlled).
Frequency Range:	2 to 13.5 Mc/s.
Power Output:	20 to 25 watts, unmodulated, into 50-ohm resistive load. Minimum test power 18 watts.
Modulation Capability:	Not less than 90%.
Frequency Stability:	± 0.01% from −20° to 55°C.
Microphone:	Carbon type.

Output Impedance:	Nominally 50 ohms.
Spurious Radiation:	At least 40 db down on the carrier level.
Frequency Response: (300 to 3000 c/s)	Within 10 db total variation.

1.3 Power Consumption (Approximate)

	Receive	Transmit
14 volt input	4 amp.	10 amp.
28 volt input	2 amp.	5 amp.

1.4 Valve, Semiconductor and Crystal Complement

1.4.1 Receiver

Two 12BA6 valves
One 12BE6 valve
One 6T8 valve
One 6AQ5 valve

Crystals: Number as required up to five; type D, code HCF; tolerance 0.01%, −20° to +70°C; 30pF shunt capacitance. Crystal frequency equals Receive frequency + 455 kc/s.

1.4.2 Transmitter

One 6AM5 valve
Two 6883 valves

Crystals: Number as required up to five; type D, code HCF; tolerance 0.01%, −20° to +70°C; 30pF shunt capacitance. Crystal frequency equals output frequency.

1.4.3 Power Supply

Transistors: Two type 2N277 (14V equipment).
Two type 2N174 (28V equipment).

Rectifiers: Two type OA211 silicon diodes.

1.5 Dimensions

Width: 6¼ inches.
Height: 5¼ inches.
Depth: 13 inches.

1.6 Weight

9.5lb.

1.7 Accessories

The following accessories are required for operation of the Skyranger. Suggested types are shown in brackets, but suitable equivalents may be used.

1. Microphone, carbon (T-17).
2. Headphones, 600 ohms impedance (HS-33).
3. Loudspeaker, 3.2 ohms impedance.

NOTE: The loudspeaker is optional. Headphones should always be used when the received signal is weak.

4. Phone jack (JK-34A).
5. Microphone jack (JK-33A).

   NOTE: Items 4 and 5 are required only when it is not convenient to use the jacks on the front panel of the Skyranger.

6. Aerial loading coil kit type MLK-5 Stock Code A422710 (for fixed aerial) comprising:
   (a) Loading coil (Stock Code A215961).
   (b) Switch (Stock Code A857315).
   (c) Knob (Stock Code A423157).
   (d) Plate (Stock Code A574102).
   (e) Clips (5 off) (Stock Code A211562).
7. Fixed aerial (refer Sub-Section 3.3.2 and drawings 80213C2 and 80213C4).
8. Trailing aerial kit, Stock Code A422662 (alternative or additional to fixed aerial) comprising:
   Reel and wire (AS-1749).
   Fairlead.
   Insulator.
   Drogue (Stock Code A297910).
9. Electric trailing aerial kit, comprising Electric Winch Type RL-41 (14-volt) or RL-42 (28-volt), fairlead and control unit or switch.

2.—BRIEF DESCRIPTION

2.1 General

The Skyranger HC-5-D is a lightweight H.F. transceiver which can be set-up on any five frequencies in the range 2-13.5 Mc/s. Both receiver and transmitter are crystal controlled, and channel changing is by a single five-position front panel knob. The only other adjustments available to the operator are the combined power ON-OFF switch and receiver volume control, and the transmitter press-to-talk button on the microphone.

The equipment is used in conjunction with an external aerial loading coil when the aircraft is fitted with a fixed aerial. This loading coil is set-up with an associated switch to the required inductance for a given frequency.

Alternatively, a trailing type aerial may be fitted. No external loading device is required with this aerial.

Full details of aerial arrangements are given in Section 3—Installation.

2.2 Receiver

The receiver is a single conversion superheterodyne with crystal control of the H.F. oscillator. Five valves are used in the receiver and perform the following functions:

Valve	Function	Type
V1	Tuned R.F. amplifier.	12BA6
V2	Mixer oscillator.	12BE6
V3	Tuned I.F. amplifier.	12BA6
V4	Signal and A.G.C. detector, noise limiter and A.F. amplifier.	6T8
V5	Power output.	6AQ5

2.3 Transmitter

The transmitter is crystal controlled and uses high-level modulation of the power amplifier. Three valves are used in the transmitter and their purposes are as follows:

Valve	Function	Type
V6	Crystal oscillator and tuned buffer amplifier.	6AM5
V7	Power modulator.	6883
V8	Modulated R.F. power amplifier.	6883

Lamps on the front panel provide a good indication of the correct functioning of the transmitter. These lamps are:

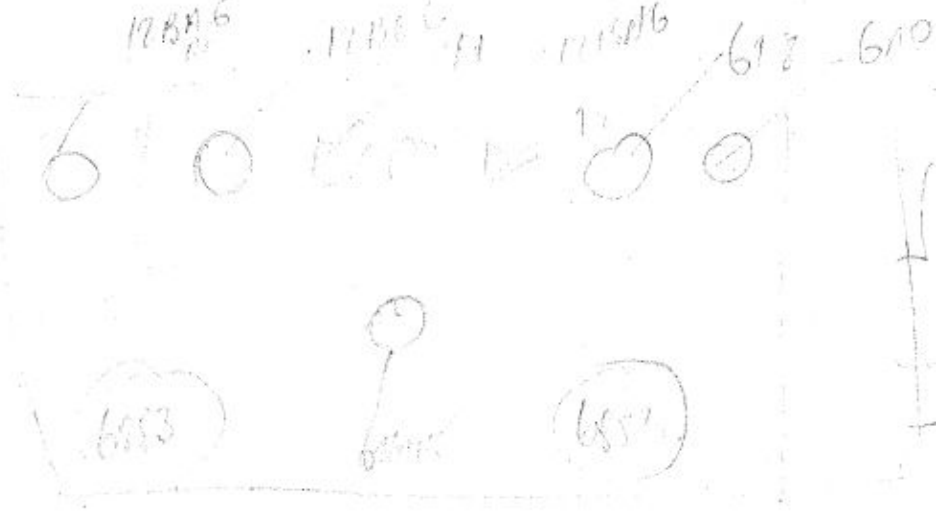
(a) R.F. OUTPUT—showing presence of R.F. power at the aerial terminal.

(b) MODULATION—showing peaks of modulation as "flashes" on a neon lamp.

2.4 Power Supply

High tension voltages for both receiver and transmitter are derived from a D.C. to D.C. converter using germanium transistors and silicon rectifiers. 14 or 28 volt operation can be obtained by fitting appropriate converters, making valve heater changes on a readily accessible jumper terminal board, and changing the supply wiring to the change-over relays.

Changing from one source of input supply becomes a simple operation which can be performed in a few minutes.



3.—INSTALLATION

3.1 Mounting the Transceiver

3.1.1 Removal of unit from Case.

Unscrew the two knurled captive screws* at the rear. Carefully withdraw the unit from its case. It is not necessary to disconnect any cabling to do this since all connections are made by plug SKA which mates with a case-mounted socket.

3.1.2 Mounting the Case in the Aircraft.

The case is designed to fit standard instrument panel radio-mounting cut-outs. Minor variations in cut-out size will necessitate enlargement or the use of packing strips to provide a snug fit without distortion of the case. A distorted case can prevent correct mating of the rear connector and make insertion and withdrawal of the unit difficult.

Where instrument panel mounting is chosen, additional support should be provided towards the rear of the case.

Since the transceiver dissipates a considerable amount of heat, sufficient space should be allowed around it to permit free movement of air.

Ensure that case mounting screws do not foul the unit when it is inserted. If necessary dimple the case and use countersunk-head screws. Paint in the vicinity of all mounting screws must be removed from the case, instrument panel and airframe mounting brackets to provide a good electrical bond of case to airframe. Check all instrument panel bonding straps to ensure that they are effective and in good condition.

Whilst the Skyranger is designed to withstand shocks and vibration encountered when it is fastened rigidly to the airframe, its trouble-free life (like that of any other electronic equipment) will be longer if it is possible to shockmount it. Shockmounting must be done in an approved manner. This applies to such details as the type and rating of the shockmounts, the method of attachment, and the provision of efficient bonding straps between case and airframe.

3.1.3 Replacing Unit.

Insert the unit in its case, pushing it fully home. Turn clockwise tightly the two knurled captive screws*.

NOTE: *—Early production models are fitted with "Oddie" quick-release fasteners.

3.2 Wiring

(Refer drawing 80213C4.)

3.2.1 General.

The interwiring cable is supplied already wired to the connector on the transceiver case, and the wires are labelled. If any wire is not used it should be cut off, insulated and tied back.

The wires conform to a specification approved for aircraft interwiring. Wire gauges required and lengths of cable supplied are as listed below. Cable lengths are not critical and may be altered to suit the particular aircraft installation.

Lead Function	Wire Gauge	Length	Connector Pin No's.
LT +	AN14	8 feet	1 and 2
LT −	AN14	8 feet	9 and 10
Phones	AN20 or 22	8 feet	6
Mic P.T.T.	AN20 or 22	8 feet	16
Mic audio	AN20 or 22 shielded	8 feet	5
Speaker	AN20 or 22	12 feet	7
Aerial	RG58A/U coaxial	10 feet	8

3.2.2 L.T. Supply

The L.T. positive wire from pins 1 and 2 of the case socket should be connected via a fuse or circuit breaker to the aircraft positive supply controlled by the battery master switch, so that voltage will be removed from the equipment wiring when the battery master switch is "off."

The fuse or circuit breaker should be 15 amperes for 14 volt equipment or 10 amperes for 28 volt equipment.

The L.T. negative wire from pins 9 and 10 of the case socket should be terminated in a solder lug and this then connected to a well-bonded airframe member, preferably adjacent to the transceiver mounting position. Remove all paint and grease, and bolt securely to provide good electrical connection. Alternatively, it may be connected to the negative bus-bar.

CAUTION: Application of reverse polarity, even momentarily, will permanently damage the power supply. Double check for correct leads before making connections.

3.2.3 Microphone, Headphones and Speaker.

A speaker, in addition to headphones, may be fitted if desired. Microphone and headphones may be plugged directly into the front panel jacks, or separate jacks, conveniently mounted in the cabin and connected via the interwiring cable to the unit rear connector, may be installed.

A permanent magnet speaker (3.2 ohms voice-coil impedance) may be conveniently mounted in the cabin. One lug of the speaker voice coil connects to pin 7 of the transceiver socket and the other lug should be connected directly to the metal airframe adjacent to the speaker or, via an AN-22 wire, back to the point where the negative L.T. lead from the transceiver connects to airframe.

CAUTION: Speakers contain strong permanent magnets which may seriously affect magnetic compass calibration. Speakers must not be located closer to the magnetic compass than the specified compass-safe-distance for the particular speaker used. For loudspeakers type 525 MA3 or 6 MA3 the compass safe distance is 24 inches.

3.2.4 Aerial Connections.

The RG58A/U coaxial lead from the transceiver case connector (pin 8) should be cut to the required length and connected to the aerial loading coil switch, or, in the installations using trailing aerial only, to the trailing aerial fair-lead. The outer braid of this cable (connected to pins 9 and 10 of the transceiver case connector) must also be efficiently bonded to the airframe as close as possible to the loading coil switch or the trailing

aerials. When only one aerial is fitted, all reference to the other aerial and its connections should be ignored.

For installations using both fixed and trailing aerials, an additional length of RG58A/U connects between the loading coil switch and the aerial fairlead. Both ends of the outer braid of this cable must also be efficiently bonded to airframe.
Efficient bonding of all coaxial braid terminations is essential, otherwise power loss and detuning will result.

3.3 Aerial Arrangements

3.3.1 General Notes.

The aerial used with the Skyranger may be either fixed or trailing. It is also possible to fit both types, with a suitable changeover switch. Some typical arrangements are shown in Drawing No. 80213C2.

Choice of the aerial type depends upon a number of factors, such as the frequencies to be used, the maximum range required, the size of the aircraft (which determines the maximum practicable length of a fixed aerial), and whether operation is required on the ground.

In most cases a fixed aerial is the most satisfactory type. It is cheaper to install and maintain, less susceptible to damage, and allows operation on the ground. It can be used at all frequencies, but is more efficient at the higher frequencies (i.e. above about 4 Mc/s., depending on the length of the aerial).

The trailing aerial is more expensive to install and maintain, is much more susceptible to damage (it is very easy to forget to reel it in before landing), and cannot be used on the ground. A trailing aerial is recommended only when maximum range is required on frequencies below 4 Mc/s.

3.3.2 Trailing Aerial.

No loading coil is necessary with a trailing aerial since the length can be adjusted to represent a quarter wavelength at the frequency in use. Correct length is indicated by maximum brilliance of the R.F. indicator light, on the front panel of the transceiver, when transmitting.

The trailing aerial may use either a manual or an electric reel. The manual reel is simpler and cheaper, but since the reel must be near the fairlead (aerial lead-in) it can be used only where the fairlead can be fitted near the pilot. Where this is not possible, an electric reel and winch must be used.

With an electric reel and winch some means of controlling the winch must be provided. This may consist of a three-position switch (OUT - OFF - IN) or a special control unit. The control unit contains a counter which may be connected to the reel by a flexible drive shaft to count the turns of the reel as the aerial wire is let out. A warning light is fitted to indicate when the aerial is extended.

With a trailing aerial a drogue is fitted to the end of the aerial. This provides sufficient drag at flying speed to extend the aerial when it is released. The drogue is in the form of a truncated cone, and is usually made of rubber.

3.3.3 Fixed Aerial.

When a fixed aerial is used, a loading coil is required mounted as close as practicable to the lead-in. A selector switch mounted adjacent to the coil must be readily accessible to the pilot in flight. The length of wire from lead-in insulator to load coil should not exceed 12 inches. Leads from selector switches to coil must also be of minimum length.

Voltages on all these leads can reach a high value, and the wires should be well insulated, unshielded, and preferably spaced at least one inch from the airframe or other grounded structure.

The most satisfactory fixed aerial length depends upon the operating frequencies required. To enable the load coil to resonate the aerial at any frequency, the electrical length of the aerial must be less than one quarter wavelength at that frequency.

Generally speaking, if frequencies above 8.0 Mc/s. are not to be fitted, the aerial should be cut to just less than one quarter wavelength **at the highest frequency to be fitted.** The aerial loading coil will then resonate the aerial at this and all lower transmitter frequencies.

Where frequencies above 8.0 Mc/s. are required, an aerial cut to one quarter wavelength at the highest frequency may not provide satisfactory operation on the lower frequencies (i.e. 2 to 4 Mc/s.) because the aerial is too short. In this case, a more satisfactory system is to lengthen the aerial to provide satisfactory operation in the lower frequency range.

It is then necessary to use a series capacitor of appropriate value and rating on all frequencies above that at which the aerial is physically one quarter wavelength. This capacitor, mounted adjacent to and connected in series by the selector switch of the fixed aerial loading kit, electrically shortens the aerial to enable it to be tuned by the load coil. A 1.0 megohm resistor should be connected across the series capacitor to provide a static leak. A typical capacitor value is 50 pF.

On small aircraft where the distance from lead-in to tail fin is less than the required aerial length, the aerial may be continued out towards the wingtip.

3.3.4 Fixed and Trailing Aerial.

By fitting both fixed and trailing aerials the advantages of both can be realised.

The loading coil switch in this case has a sixth position marked "TRAIL" which connects the transceiver to the trailing aerial, disconnecting the loading coil and fixed aerial.

3.4 Equipment check prior to installation

3.4.1 Where possible the equipment should be given a brief bench check before being installed to ensure that no damage has occurred in transit.

3.4.2 If facilities are not available for an operational test on the bench, examine the unit carefully for evidence of mechanical damage, and check that all valves are secure in their sockets. If satisfactory proceed as in 3.5 below.

3.5 Check and Adjustment after Installation

3.5.1 Receiver.

Switch on equipment and allow about 30 seconds warm-up period. Check that background noise is present on all used channels with volume control fully advanced. Check for reception of ground station if practicable.

3.5.2 Transmitter.

(A) Installation using fixed aerial and loading coil.

1. Locate the aerial loading coil, removing the cabin trim if necessary to gain access to coil taps.
2. Connect a d.c. voltmeter (1000 ohms per volt or better), set to read up to 12 volts to the red (+) and white (−) meter jacks on the transceiver front panel.
3. Switch on transceiver and allow it to warm up.
4. Select the channel to be tuned on both transceiver channel selector and loading coil switches. Locate the correct loading coil tap for the channel being tuned and disconnect from coil.
5. Using an insulated screwdriver, hold the tap insulated from coil and ground, operate the press-to-talk switch and observe the reading on the voltmeter. A reading of approximately 4 volts indicates that the transmitter Power Amplifier stage tuning is satisfactory.
6. With the press-to-talk switch operated, and using the insulated screwdriver, move the tap along the loading coil, commencing at minimum inductance, until maximum brilliance of the R.F. indicator lamp on the transceiver front panel is obtained. Alternatively, locate the approximate tap position by listening to the receiver noise, which will rise to a maximum at the correct point.
7. Observe the meter reading which should be between 8 and 11.5 volts. Vary the position of the tap about the point of maximum brilliance until maximum meter indication is obtained. Connect the tap at this point.
8. Repeat steps (4) to (7) inclusive for each channel to be tuned.
9. On completion of tuning, check that all taps are tight on the coil and not bent over and liable to short out adjacent turns.
10. Replace the cabin trim, ensuring that the coil is not fouled or the taps disturbed. Ensure also that any metal trim or metal trim-stiffener is well spaced from the coil, switch and leads.
11. Recheck tuning of each channel by observing the brilliance of the R.F. indicator and the test meter reading. The meter should read between 8 and 11.5 volts, which corresponds to a P.A. cathode current of 80 to 115 mA. Check modulation by speaking into the microphone and noting that the MODULATION indicator lamp on the front panel flashes. The R.F. indicator brilliance should also fluctuate with the speech modulation.
12. Turn the volume control fully clockwise and listen for receiver noise on each channel.
13. Operationally test the transceiver by making a two-way test on as many used channels as practicable. Where possible, use distant stations to check the range of the transmitter and the sensitivity of the receiver.

(B) Installation using trailing aerial.

1. The equipment must be flight tested.
2. Select each channel in turn and with the microphone press-to-talk switch operated reel out the trailing aerial to the first point of maximum brilliance of the R.F. output indicator. Alternatively, reel out the aerial, without pressing the microphone button, to the first position of maximum receiver noise. Press the microphone button and adjust the aerial length for maximum brilliance of the R.F. indicator. This procedure restricts transmission to a minimum and reduces the possibility of interference.
3. If practicable, check the P.A. cathode current on each channel using the meter, connected as in (A2) above, which should read 8 to 11.5 volts.
4. Check modulation as in (A11) above.
5. Where a trailing aerial reel counter is fitted, note and record the number of turns of the reel for each channel.
6. Make a two-way test on each channel (if practicable), preferably with stations distant at least one hundred miles.

NOTES: (1) For ease of carrying out the above adjustments, it is convenient if the meter reads about half scale corresponding to 10 volts. The normal 10 volt or 50 volt meter scales produce full scale or very small indications respectively. If a 10 volt range 1000 ohms per volt meter is available, insertion of a 10k ohms resistor in series with the meter will produce about a half-scale reading.

(2) During transmitter tuning and testing listen to the receiver for other stations, and reduce transmissions to a minimum, so as avoid interference.

(3) In order to make a more accurate check on transmitter output on a particular installation a thermocouple ammeter reading 0.1 amp. can be connected in series with the lead-in wire to the aerial.

Readings will vary considerably from one type of aerial installation to another and for different frequencies.

However typical aerial currents will vary from 0.4A to over 1A into a fixed aerial and approximately 0.6A for trailing aerial.

Where any doubt exists as to whether power is actually going into the aerial, this check is recommended. With experience a log of typical aerial currents to be expected for various aerial installations at the various frequencies will soon be accumulated.

4.—TECHNICAL DESCRIPTION

4.1 Receiver.

The aerial is connected via the contacts of relay RLB and capacitor C2 to inductors L1 to L5. Capacitors C2 and C3 constitute an impedance matching network providing an input of approximately 50 ohms impedance. Switch SWA/1R is used to select a particular inductor, the rest of which is shorted out by SWA/1F. These inductors are slug tuned and C3 and C4 complete the resonate circuit to the grid of valve V1 (12BA6).

Output from V1 is capacitively coupled to the input grid of V2 (12BE6), which is tuned by R.F. inductor L6 to L10 (whichever is selected by SWA/2R). All inductors not in circuit are shorted out by SWA/2F. The oscillator section of V2 is crystal controlled by XL1 to XL5 (whichever is selected by SWA/2R).

Each crystal controlled circuit is 455 kc/s above its corresponding signal frequency and the resulting intermediate frequency signal is transformer coupled via TR1 to the intermediate frequency amplifier V3 (12BA6).

Transformer TR2 couples V3 to the second detector V4 (6T8). The first diode of V4 (pin 1) provides signal detection; the second diode (pin 6) provides delayed A.G.C. The detected signal at the junction of C49 and R45 is then conducted normally through the separate diode section of V4 (pins 2 and 3), which acts as an effective series type impulse noise limiter providing protection against ignition type noise.

The bias on this diode is derived from the rectified carrier through the filter network R26 and C42. The output of the noise diode is fed via C43 to the triode audio amplifier section of V4. Output from this amplifier is coupled to the power output stage V5 (6AQ5). This stage delivers about 3 watts maximum output into a 3 ohms load for loudspeaker or a 600 ohms load for headphones.

Volume control is obtained from a bias control (RV1) in the R.F. mixer and I.F. stages.

4.2 Transmitter.

The transmitter consists of a crystal oscillator and buffer amplifier (V6) which is a pentode type 6AM5. The crystal oscillator is of the earthed anode type with crystals between grid and earth in a 30pF Colpits circuit. The crystal output is electron coupled to the anode buffer circuit (L11 to L15 and C50). These tuned circuits provide a high R.F. drive level to V8 (type 6883). Switch SWA/3R selects the required crystals and SWA/4R selects the appropriate buffer output circuits.

Valve V8 is an anode and screen modulated class "C" R.F. amplifier in which the output is coupled to the 50 ohms aerial line by simple "pi" networks. These output circuits are five in number, one for each frequency. The components of these tuned circuits are fitted according to the table given in sub-section 5.9. The tuned circuits comprise inductors L16 to L20, capacitors C68, C69 and C71 to C73, with common capacitor C75.

In addition harmonic traps consisting of inductors L24 to L28 and capacitors C95 to C99 form series tuned circuits resonant to the second harmonics. These filters are selected to give an output in which all harmonics are at least 40 db. down. Channel switching is performed

by SWA/4R in the buffer-drive circuit. SWA/6R and SWA/7R select the appropriate "pi" networks.

Valve V7 (type 6883) is the modulator which is a class "A" amplifier driven by the microphone through microphone transformer TR4. The output of this anode and screen modulates V8 through modulation transformer TR5. Microphone current is obtained from the cathode circuit of V7 from the voltage drop across R48.

Press-to-talk switching is achieved by keying the minor H.T. to the screen of V7 and anode and screen of V6 via p.t.t. relay contact RLA2. Contact RLA1 controls application of H.T. to V8.

Relay contacts RLB1 and RLB2 in parallel control application of aerial to receiver or transmitter.

4.3 Power Supply.

The power converter consists of a free-running oscillator employing transistors VT1 and VT2 and a toroidal transformer TR1 operating at aproximately 1000 c/s. The circuit is a common collector type with separate base feedback windings on the transformer. Voltage developed across resistors R1 and R2 is applied as bias in the transistor base circuits.

The A.C. waveform produced is a square wave with negligible overshoot.

A half wave circuit consisting of the secondary winding of TR1, capacitor C4 and silicon diode MR2 (type OA211) supplies the receiver or transmitter oscillator V6 with minor H.T. Voltage doubling by both C3 and C4, and MR1 and MR2 supplies main H.T. to the transmitter.

A fuse is fitted to the power supply and is in series with the D.C. positive input. The purpose of this fuse is to protect the transformer against possible failure of either transistor.

4.4 Switch ON-OFF.

ON-OFF switch SWB is coupled to the volume control potentiometer RV1 on the front panel.

4.5 Change-over Relays.

Relays for the minor H.T. and aerial change-over are the same type and have low capacitance contacts.

4.6 Microphones and Headphones.

Jacks on the front panel are provided for microphones and headphones.

4.7 R.F. Modulation Indicators.

Indication of R.F. OUTPUT is given on the front panel by a filament type lamp LP2 receiving its current through toroidal R.F. transformer TR6, consisting of two turns of p.v.c. insulated wire around two ferrite rings, the primary of which is in series with the aerial lead.

MODULATION indication is given by a neon light on the front panel (LP1). This lamp operates on audio voltage on the modulation transformer and flashes when modulation exceeds approximately 80%.

4.8 Test Meter.

Terminal points marked METER, red (positive), white (negative), are placed on the front panel to enable readings of the transmitter power amplifier cathode current to be taken.

4.9 14 Volt Operation.

On a 14 volt supply, Power Unit 1H80214 is fitted with a power transformer type 2LH61553 and transistors type 2N277. The filaments of the transceiver are connected so that the shorting links on the specially fitted terminal board TSA bridge terminals 1 to 7, 2 to 8, 3 to 9, 4 to 10 and 5 to 11. The relays RLA and RLB are in parallel.

4.10 28 Volt Operation.

With a 28 volt supply, the Power Unit 2H80214 is fitted with a transformer type 1LH61601 and transistors type 2N174. The shorting links on the terminal board TSA bridge only terminals 2 to 3 and 4 to 5; all other shorting links are removed. The relays RLA and RLB are in series.

4.11 Crystal Holders.

The crystals are held firmly in their sockets by the clear perspex retainer which shows the correct location for each crystal, i.e., receiver oscillator crystals towards the front panel, channel 1 to 5 starting from the top, and the transmitter oscillator crystals similarly positioned in the second set of holders.

5.—MAINTENANCE

5.1 Introduction.

The Skyranger has been designed to give trouble-free operation over long periods, but, like other electronic equipment, its performance may deteriorate slowly, or it may even fail suddenly upon occasion. Regular maintenance can discover and arrest slow deteriorations, and can frequently correct conditions which would lead to sudden failure.

The recommended inspection system for the Skyranger comprises the following:

(a) **Before First Flight Inspection.**
To be done before the first flight each day.

(b) **Maintenance Release Inspection.**
To be done immediately before the issue or renewal of the Maintenance Release. The period of validity of the Maintenance Release is based either upon flying hours or elapsed time.

(c) **Major Inspection.**
To be done at regular intervals, of about 12 months, which may coincide with the renewal of the Certification of Airworthiness. It is supplementary to the Maintenance Release Inspection, which should be done at the same time.

These inspections are described below.

5.2 Before First Flight Inspection.

(a) Inspect, from the ground, the fixed aerial masts and fittings, to see that they are in place and apparently free from damage.

(b) If a trailing aerial is fitted, check that the drogue is attached and the aerial free to reel out and in.

(c) Check that the transceiver is fully home and secure in its case.

(d) Check that all visible cables are undamaged and clear of all aircraft flying controls.

(e) Switch on the transceiver, allow approximately one half minute warm up, then test for reception and/or satisfactory noise level on each used channel.

(f) Check operation of the volume control.

(g) Operate the press-to-talk switch on the pilot's microphone, and test the operation of the transmitter by observing the R.F. OUTPUT indicator lamp (see note 1).

(h) Check modulation by speaking into the microphone, with press-to-talk switch operated, and observing the MODULATION indicator lamp in the front panel. When speaking at the correct level the neon lamp should flash on peaks of speech intensity. Continuous flashing indicates too much modulation, and that speech level should be reduced.

(i) If practicable, select the appropriate frequency and establish communication with a ground station, preferably at least 100 miles distant.

(j) Reset the frequency selector to the frequency required for the next contact. Switch off the transceiver.

NOTE 1: If the aircraft is fitted with a trailing aerial only, transmitter tests will not be possible.

NOTE 2: During tests of the transmitter, care should be taken to avoid interfering with other stations.

5.3 Maintenance Release Inspection.

Before commencing, investigate and clear all reported faults.

(a) Carefully examine aerial masts and fittings for condition and security of attachment. If necessary clean dirt from insulators.

(b) If a trailing aerial is fitted, reel out to its fullest extent and examine for kinks or other damage. Check condition and attachment of fairlead. Check attachment of wire to reel and drogue to wire. Reel in carefully.

(c) If easily accessible, check aerial loading coil, switch and associated leads for condition and absence of any signs of arcing or burning. Check for adequate clearance of all aerial leads from any metal airframe parts.

(d) Examine transceiver case and all accessible cables for condition, attachment, and adequate clearance from all aircraft flying controls.

(e) Examine all bonding straps for condition and security of attachment.

(f) Check microphone and headphones for signs of damage, especially to cord and plug.

(g) If an external fuse is fitted, check that it is of correct type and rating. Check that the correct spare fuse is carried.

(h) Carry out the checks detailed in (e) and (j) inclusive of the Before First Flight Inspection, sub-section 5.2 above.

5.4 Major Inspection.

(a) The transceiver and removable ancillaries should be removed to workshop for bench performance tests as detailed in 5.5 below.

(b) Examine, as far as practicable, all cables normally concealed behind cabin trim, metal covers or other permanent parts of the aircraft structure. Cables should be free from damage and adequately supported to prevent chafing.

(c) Expose the fixed aerial load coil and switch and examine all components and associated wiring for good connection and freedom from abrasion, arcing or burning. Ensure that all components and leads are spaced at least one inch from any metallic airframe part.

(d) Check the termination of all aerial leads, ensuring that the earth braids of the co-axial cable(s) are efficiently bonded to airframe at each end.

(e) Check any external jacks or jackboxes for condition, attachment and contact cleanliness.

(f) Check speaker (if fitted) for condition and attachment.

(g) If an external fuse is fitted, check that the fuse is tight in its holder, makes good contact, and is correctly designated.

(h) Replace the transceiver and check the aerial tuning.

(i) Replace cabin trim, ensuring that the fixed aerial tuning coil, switch, leads, etc., are not fouled by any soundproofing or trim. Ensure also that any metallic parts of the trim are spaced at least one inch from coil, switch or leads, to obviate any risk of arcing.

(j) Carry out the operational test of the equipment as detailed in sub-section 5.2 (e) to (j) inclusive.

(k) Ensure that the installation is in a clean and neat condition.

5.5 Equipment Overhaul.

5.5.1 General.

When the transceiver is removed at a major inspection, or at any other time that overhaul is necessary, certain inspection and tests should be made to ensure that the transceiver is in good mechanical and electrical condition.
These are as follows:

Mechanical Inspection	Paragraph	5.5.3
Receiver Sensitivity	„	5.5.4
Receiver Bandwidth	„	5.5.5
Receiver A.G.C. Characteristic	„	5.5.6
Receiver Audio Response and Power Output	„	5.5.7
Transmitter Power Output	„	5.5.8
Transmitter Modulation Capability	„	5.5.9
Transmitter Modulator Frequency Response	„	5.5.10

In addition to the above tests, this section of the instruction book gives complete alignment instructions, and other tests as an aid to fault location. However, if the unit is in good mechanical condition and meets all electrical tests listed above, no further work is necessary. If the transceiver does not meet all tests, further work such as re-alignment or replacement of valves or other components will be necessary to bring the transceiver to the required standard.

NOTE: Unless otherwise stated, standard L.T. input for these tests shall be 13.5V for 14 volt equipment and 27.5V for 28 volt equipment.

5.5.2 Test Equipment Required.

(a) Signal Generator, 455 kc/s to 13.5 Mc/s (AWA R7231 or equivalent).
(b) Audio Frequency Oscillator (AWA R7077 or equivalent).
(c) Audio Output Meter (AWA M8832 or equivalent).
(d) Cathode Ray Oscilloscope.
(e) R.F. Power Meter (50 ohms, reading to 25W.).
(f) Voltohmyst (AWA A56010 or equivalent).
(g) Multimeter (1000 ohms per volt or better).

Accessories.

(a) Source of L.T. power, capable of supplying sufficient current at 13.5V or 27.5V, as appropriate.
(b) Test harness comprising connector PLA (McMurdo type RSD. 16) wired as required. Refer Drawing 80213C4 for connections. Insert appropriate fuse or circuit breaker in positive L.T. lead, together with a D.C. Ammeter to read 0.-10A.
(c) Carbon microphone (T-17 or equivalent).
(d) Loudspeaker (3.2 ohms impedance).
(e) Resistors and capacitors as required.

5.5.3 Mechanical Inspection.

General.

Thoroughly examine the transceiver visually for signs of dirt, corrosion and overheating of components. Check that all compon-

ents are secure, and that all attachment screws are tight. Take care not to move any adjusting screws.

Check valves for correct seating in their sockets. Check telephone jack, microphone jack and plug SKA on rear of set for signs of damage and correct seating of contact surfaces.

Crystals should be examined to see that they are making good contact in the sockets. Control knobs should be checked for security of attachment.

CAUTION: A large quantity of the wire used in the transceiver has an insulating coating of Polyvinyl Chloride (P.V.C.), a thermo-plastic which must not be subject to excessive heat. When servicing, therefore, take care against a hot soldering iron coming into contact with or being placed near the wiring forms.

(b) Band Change Switch.

Wafer switches should be cleaned when the transceiver is examined or when noisy and intermittent operation is evident. Care should be exercised when cleaning not to bend or otherwise damage the contacts. Attempts to straighten or re-align contacts of this type of switch are not usually successful and the preferred action when damaged contacts are discovered is to replace the whole wafer.

Solutions used in cleaning should not be allowed to fall on wiring or other parts of equipment.

Clean and lubricate by applying sparingly, with a soft brush, a suitable switch cleaning fluid such as "Servisol."

(c) Relays.

RLA and RLB are high grade relays with gold-plated contacts and are lightly loaded. Maintenance should be confined to examining the contacts for pitting and only burnishing the contacts as required. On no account must an abrasive tool be used.

(d) MODULATION and R.F. Lamps.

The MODULATION neon pilot light type NE51 has a life expectancy of approximately 10,000 hours. When the lamp fails to glow at the appropriate time check that the circuit is complete to the terminals of the lamp holder.

If there is evidence that the neon is faulty, replace with a new lamp. The bezel has a right-hand thread and can be unscrewed from the front of the panel, after which the lamp itself can be removed by pressing it in and twisting to the left.

The R.F. OUTPUT lamp is a type GE44.

Take care not to interchange the lamps: the NE51 neon lamp goes in the upper holder marked MODULATION. If the lamps are accidently transposed, neither will light.

5.5.4 Receiver Sensitivity.

(a) Connect the transceiver to the test harness, apply the appropriate L.T. voltage and adjust to 13.5 or 27.5V as applicable. Connect the audio output meter, set to 600 ohms impedance, to the 600 ohm output (pins 6 and 9 of the rear connector).

(b) Switch the unit on and set volume control fully clockwise. After the few seconds the L.T. current will be steady at approximately 4A (for 14 volt equipment) or 2A (for 28 volt equipment). Check that the receiver H.T. voltage, as measured at pin 6 of V5 (6AQ5), is approximately 200V.

WARNING: For all receiver tests remove the microphone from unit front panel jack since accidental operation of microphone press-to-talk switch can permanently damage the signal generator.

(c) Connect the signal generator, modulated 30% at 1000 c/s to the aerial lead. Tune the signal generator accurately to the frequency of the channel under test.

NOTE: The impedance of the signal generator should be matched to the input impedance of the receiver (50 ohms) in this and in all similar cases. For example, if the output impedance of the signal generator is 10 ohms (a common value), a non-inductive resistor of 40 ohms should be inserted in the lead to the receiver.

The voltage input figures quoted refer to the signal generator settings, although the actual receiver input, in the example quoted, will be less.

(d) The signal input required to produce 50 milliwatts output at a signal-plus-noise-to-noise ratio of better than 10 db should not exceed 5.0 μV on any frequency.

Repeat this test on all used channels.

5.5.5 Receiver Bandwidth.

With the equipment connected as for overall sensitivity in paragraph 5.5.4 above, measure the overall bandwidth at the frequency fitted which is closest to 3.0 Mc/s.

The bandwidth at 6 db shall not be less than 9 kc/s.

The bandwidth at 60 db shall not be greater than 68 kc/s.

5.5.6 Receiver A.G.C. Characteristic.

With the equipment set up as in 5.5.5 above measure the A.G.C. voltage (using a Voltohmyst) at pin 6 of TR1 as the input is varied from 10 μV to 100mV. The A.G.C. voltage should increase smoothly from –1V to at least -10V and the audio output should not increase by more than 6 db.

5.5.7 Receiver Audio Response and Power Output.

(a) With the equipment set up as in 5.5.5 above, modulate the signal generator at 1000 c/s from the audio oscillator to a depth of 30%.

(b) Set the signal generator output to 1 mV and adjust the receiver volume control for 50 milliwatts output.

(c) Vary the audio frequency, keeping the modulation depth constant at 30% and the R.F. signal level at 1 millivolt. Note the variation in receiver audio output, which should not exceed 6 db over an audio frequency range of 300 to 3000 cycles per second.

(d) Reset the modulation to 30% at 1000 cycles, increase the R.F. signal input and check that at least 3.0 watts output is obtainable.

(e) Connect the C.R.O. across the output meter and observe the waveform which should show no noticeable distortion at 3 watts output.

5.5.8 Transmitter Drive and Power Output.

Disconnect the signal generator **before** plugging in the microphone for transmitter tests.

(a) Connect the 50 ohm R.F. power meter to the aerial coaxial cable.

(b) Select the lowest frequency channel, operate the microphone press-to-talk and measure the main and minor H.T. voltages (no modulation applied).

Main H.T. measured at one end of L22: 400V. minimum.

Minor H.T. measured at pin 3 of V7: 200 V. ± 10% minimum.

(c) With the press-to-talk switch operated, measure the P.A. grid drive, P.A. cathode current, and R.F. power output on each used channel.

P.A. grid drive, measured at grid (pin 5) of V8, using the Voltohymst with a 47K resistor in series with the test prod, should be 50 to 65 volts negative with respect to chassis.

P.A. Cathode Current, measured with 0-15V D.C. meter (sensitivity 1000 ohm/volt or better) connected to the meter jacks on the transceiver front panel, should be 100 to 120 milliamperes (10 to 12 volts on the meter).

Power Output shall be not less than 18 watts.

NOTE: If the transmitter fails to pass this test, check alignment as detailed in para. 5.6.2.

5.5.9 Transmitter Modulation Capability.

(a) Loosely couple the vertical plates of the cathode ray oscilloscope to the output circuit of the transmitter, and adjust the coupling so that the carrier envelope is displayed on the tube.

(b) Remove the microphone from the jack on the front panel and connect the audio oscillator via a shorting plug as in figure 5.1 below, which is so arranged that when inserted in microphone jack it short-circuits the press-to-talk line to ground, as well as injects the audio frequency voltage into the microphone circuit.

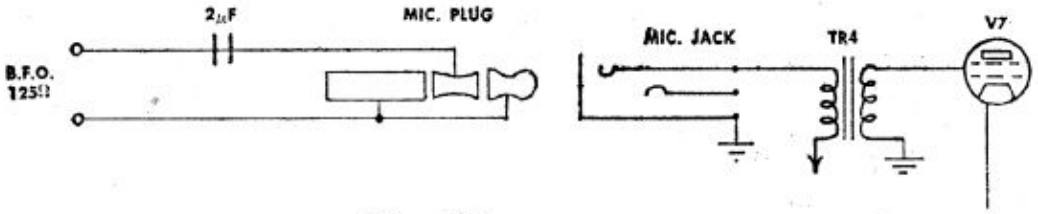


Fig. 5.1

Wiring of Microphone Plug for Modulation Test.

(c) Set the B.F.O. to 1000 c/s, adjust the B.F.O. output until the C.R.O. indicates approximately 90% modulation and observe the voltage input as measured on the A.C. voltmeter. The audio voltage should be 0.5V r.m.s. approx.

During the above test, observe the MODULATION indicator lamp which should glow at approx. 80% modulation and above.

5.5.10 Transmitter Modulator Frequency Response.

Note the exact input voltage required to produce 90% modulation as in 5.5.9 (c) above.

Vary the modulating frequency between the limits of 300 and 3000 c/s, continuously adjusting the B.F.O. output to maintain a constant 90% modulation and observe the variation in input voltage as indicated on the 0-5V A.C. meter. The input voltage variation shall not exceed 10 db.

5.6 Alignment Procedures.

5.6.1 Receiver Alignment.

(A) I.F. Stages.

Re-alignment of the I.F. stages of the receiver will not normally be required unless the receiver fails to pass the overall sensitivity test of para. 5.5.4, or some component affecting the alignment has been changed.

(1) I.F. Alignment.

The I.F. system operates at 455 kc/s and uses two over-coupled transformers TR1 and TR2. Alignment of these overcoupled circuits involved a special "damp" alignment process as follows:

Connect a 455 kc/s signal (±0.1%) modulated 30% at 1000 c/s to the grid of V2 (pin 7) via a 0.01μF capacitor.

Set the channel selector to the lowest frequency channel.

Attach a 10,000 ohms 1/4 watt resistor to two small alligator clips, and attach clips to terminals 4 and 6 of TR2.

Increase the signal input until a readable output is obtained, say 50mW. Adjust the primary winding iron core of TR2 for maximum output. The primary core is accessible from underneath the chassis. Reduce the input as necessary.

Connect the resistor to terminals 1 and 3 of TR2 and peak the iron core in the secondary of TR2.

Repeat the above procedure for the alignment of transformer TR1.

(2) I.F. Sensitivity.

Disconnect one end of capacitor C16 and feed a 455 kc/s signal, modulated 30% at 1000 c/s, to pin 7. Measure the signal required to produce 50 mW output. Typical I.F. sensitivity is 200 μV, or 12 mV input at 455 kc/s to the grid of V3.

(3) I.F. Bandwidth.

With the signal fed as in (2) measure the total bandwidth at 6 db, 30 db and 60 db point. The results should be as below:

6 db: not less than 9 kc/s.

30 db: equal to 25 kc/s ± 5 kc/s.

60 db: not greater than 68 kc/s.

(B) R.F. Adjustments:

R.F. circuits require readjustment only if the receiver fails to pass the overall sensitivity test of para. 5.5.4 above or in the event of a frequency change or addition.

(1) R.F. alignment merely involves adjusting the iron cores of aerial coils (L1 to L5) and R.F. coils (L6 to L10) to resonance as indicated by maximum output with an appropriate input signal applied to the aerial terminal.

5.6.2 Transmitter Alignment.

Alignment of the transmitter circuits is necessary if the unit fails to pass the Transmitter Drive and Power Output tests of para. 5.5.8, or if a frequency change or addition has been made.

(A) Preliminary Alignment of L11 to L15.

1. Switch the transceiver OFF.
2. Disconnect the screen (pin 3) of V8 from R61, R42 and R43.

3. Apply the D.C. probe of the Voltohmyst to grid (pin 5) of V8 through a 47k ohms resistor. Set the Voltohymyst to the 150V range (negative input).
4. Switch the transceiver ON. Insert the microphone plug into its jack on the front panel of the unit. Tune L11-L15 for maximum reading on the Voltohmyst, switching to the appropriate channel and operating the press-to-talk switch. The reading of the Voltohmyst should be at least –50V.

(B) Alignment of L16 to L20.

1. Switch the transceiver OFF. Reconnect the screen of V8 as per circuit diagram, but leave the Voltohmyst connected as in (A). Terminate the aerial in the 50 ohms load.
2. Connect a voltmeter, on the 15V range, to the front panel test points marked METER. Switch the transceiver ON; operate the press-to-talk switch and tune L16 to L20 for minimum indication on the voltmeter.

(C) Final Adjustment of L11 to L15.

1. With the transmitter ON, observe the indication of the Voltohmyst, the power meter and the voltmeter connected to the front panel terminals.
2. The Voltohmyst indicates the drive to the P.A. valve V8, and the voltmeter the P.A. cathode current (10 volts corresponding to 100 mA). The drive should produce an indication of 50 to 65V D.C. (negative). Excessive drive will reduce the cathode current of V8, and also the R.F. power output. L11 to L15 must be detuned by turning the slug clockwise to stabilise the crystal oscillator and, if necessary, to reduce the drive below 65V negative. At the completion of this adjustment, operate the press-to-talk switch several times to ensure that the oscillator is stable. Measure the P.A. grid drive which should be between the limits of 50 to 65 volts, the cathode currents which should not exceed 120 milliamperes, and the R.F. power output which should be greater than 18 watts.

   NOTE: A cathode current in excess of 120mA will reduce the modulation level and will also overload the power supply; if prolonged, it will cause overheating and failure of the power supply.

(D) Tuning of Second Harmonic Trap (L24-L28).

Couple a receiver (capable of tuning to the second harmonic of any frequency set up on the transmitter) loosely to the transmitter output.

Operate the transmitter, tune the receiver to the second harmonic of the transmitter frequency and adjust the appropriate trap for minimum R.F. level in the receiver, which can be measured by metering the voltage on the receiver A.G.C. line.

Alternatively, with 1000 c/s modulation fed to the transmitter as in test 5.5.9 the trap can be adjusted for minimum audio output from the receiver. Keep the receiver R.F. gain control retarded to prevent operation of the A.G.C.

5.7 Typical Operating Voltages.

Typical operating voltages are given in the Table below:

TABLE 5.1

H.F. Transceiver HC-5-D (Skyranger) IN80213

Valve Socket Voltages Measured with V.T.V.M. (Voltohmyst).

Valve	Anode	Screen	Cathode	Remarks
V1	80	45	0.2	Gain Control at maximum c.w.
V2	130	60	1.3	Gain control at maximum c.w.
V3	140	70	1.3	Gain control at maximum c.w.
V4	95	—	1.3	Triode Section.
V4	0	—	1.0	Limiter Diode Section.
V5	200	200	10	
V6	200	145	0.16	In Transmit condition without modulation.
V7	400	200	30	
V8	410	175	10	

NOTE: Oscillator drive levels measured with Voltohmyst. To ensure that the probe does not cause any detuning of the R.F. circuits, connect a 47k ohms BTS resistor or equivalent in series with probe tip and keep the resistor leads no longer than 1/2 inch.

Receiver oscillator—V2 pin 1 –4 to –5 volts (receiver gain at maximum).

Transmitter oscillator—V6 pin 1 –20 to –35 volts.

Transmitter P.A. grid—V8 pin 5 –50 to –65 volts.

WARNING—HIGH VOLTAGE.

Take care in handling the transceiver since 450 volts to the transmitter section is supplied **at all times** to valves V7 and V8 with the power turned on.

5.8 Power Supply.

The power supply normally requires no maintenance other than possible fuse replacement due to fuse fatigue. Where the performance and efficiency of the power supply are in doubt (i.e. where the output voltages are too low or the input current too high), the unit can be checked as follows:

(i) Remove the unit from the transceiver by unfastening the four retaining screws and nuts and disconnecting the four wires.

(ii) Connect the major H.T. output (junction of C3 and MR1) and earth to a 2000 ohms load capable of dissipating 100 watts.

(iii) With 12.5 or 25 volts input, as applicable, the output across the resistor should be not less than 400 volts and the input current approximately 8.5 amperes or 4.25 amperes.

(iv) Check the overall efficiency, i.e. $\frac{\text{power output}}{\text{power input}} \times 100$.

This should be not less than 80%. Lower efficiencies could indicate a faulty transformer or transistors.

(v) Check the output voltage at the minor H.T. point under the above conditions. This should be approximately 200 volts.

NOTE: The oscillating frequency of the unit is approximately 1000 c/s.

5.9 Changing Frequencies.

5.9.1 General.

When the frequency of any channel is to be changed, it is first necessary to obtain new crystals of the correct frequency. Refer to sub-section 1.4 for the crystal specifications. Remove the old crystals and replace them by the new ones, taking care that transmitter and receiver crystals are placed in their correct sockets.

Check by inspection that the correct coils and/or capacitors are fitted to cover the new frequency. If not, replace coils and/or capacitors as necessary. The tuning ranges of the different types of coil and coil/capacitor combinations are given in paragraphs 5.9.2 and 5.9.3.

Align the transmitter as described in sub-section 5.6.

Replace the frequency designator plate as described in paragraph 5.9.5.

5.9.2 Receiver Aerial and R.F. Circuits; Transmitter Oscillator.

Coils for all three positions are identical for a given signal frequency range.

Frequency Range (Mc/s)	Coil Type
2.0 - 2.5	12V57963
2.5 - 3.3	11V57963
3.3 - 4.2	10V57963
4.2 - 5.4	6V57963
5.4 - 7.0	9V57963
7.0 - 8.6	8V57963
8.6 - 11.0	5V57963
11.0 - 14.0	13V57963

5.9.3 Transmitter Output Coils and Capacitors.

Frequency Range (Mc/s)	Input Capacitor (C68 to C73)	Output Capacitor (C74, 76, 77, 78, 79)	Coil Type
2.00 - 2.35	470pF	2200pF	19V57963
2.35 - 2.7	330pF	1500pF	19V57963
2.7 - 2.9	250pF	1200pF	19V57963
2.9 - 3.2	220pF	1000pF	18V57963
3.2 - 3.5	180pF	820pF	18V57963
3.5 - 3.85	120pF	680pF	18V57963
3.85 - 4.25	100pF	470pF	18V57963
4.25 - 4.65	100pF	470pF	17V57963
4.65 - 5.1	68pF	330pF	17V57963
5.1 - 6.0	82pF	470pF	16V57963
6.0 - 7.2	47pF	220pF	16V57963
7.2 - 8.2	22pF	100pF	16V57963
8.2 - 10.0	none*	100pF	15V57963
10.0 - 12.4	none*	none*	15V57963
12.4 - 14.0	none*	none*	14V57963

*The capacitors specified above for input and output are effectively connected in parallel with capacitors C57 (68pF) and C75 (470pF) used in equipment.

Input Capacitor Specification (C68 to C73 inclusive).

Ducon disc ceramic, ± 5% tolerance, CDH, 1500V D.C. wkg.

Range	Type	Style
15pF to 39pF	NPO	C
39pF to 75pF	NPO	D
75pF to 110pF	N470	D
110pF to 180pF	N470	E
180pF to 240pF	N750	D
240pF to 300pF	N750	E
300pF to 510pF	N2200	D

Output Capacitor Specification (C74 to C79 inclusive)

Ducon ± 5% tolerance, 500V D.C. wkg.

up to 100pF	NPO disc ceramic
100pF to 1500pF	Simplex foil mica type PT
above 1500pF	Simplex foil mica type SM

Alternatively, Simplex PT or SM stacked foil can be used for all output capacitors.

5.9.4 Harmonic Suppression Traps.

Frequency Range Mc/s	Coil Type (L24-L28)		Capacitor (C95-C99)
2.0 - 2.5	5V57963	330pF	Simplex PT, Silver Mica, ± 5%, 500V
2.5 - 3.1	5V57963	220pF	
2.9 - 3.7	5V57963	150pF	
3.6 - 4.5	5V57963	100pF	
4.3 - 5.5	5V57963	68pF	
5.2 - 6.5	5V57963	47pF	Simplex NPO, Disc Ceramic, ± 5%
6.0 - 8.0	5V57963	33pF	
7.5 - 9.8	5V57963	22pF	
9.0 - 11.0	13V57963	33pF	
10.5 - 13.7	13V57963	22pF	

NOTE: To simplify identification of coil types used, ranging from 5V57963 to 19V57963, the standard R.M.A. colour code has been adopted and each coil is marked by a colour dot(s) according to its prefix type number. Transceivers after serial No. 31 will also have the coils stencilled numerically by prefix number.

The coil to be identified should be positioned so that the colour dot(s) is at the top and the core adjusting screw is at the bottom. If there is more than one dot, read from left to right, i.e., brown dot first then the second dot. This will give the prefix number to coils V57963.

Standard R.M.A. colour code is:

Colour	Numeral
Black	Zero
Brown	One
Red	Two
Orange	Three
Yellow	Four
Green	Five
Blue	Six
Violet	Seven
Grey	Eight
White	Nine

5.9.5 Frequency Designator Plates

A sheet of Metal-Cal frequency designator plates is stapled to the back cover of this book. When a new frequency is to be fitted proceed as follows:

(a) Using sharp scissors, carefully cut the required frequency designation plate from the sheet.

(b) Remove the old frequency plate from the front panel of the transceiver by lifting one corner with a sharp knife or razor blade and peeling it off.

(c) Clean the exposed surface using a solvent such as X55 so that no grease or foreign matter adheres to it.

(d) Lay the Metal-Cal face down on a firm surface. Pierce the paper backing horizontally close to the corner with a large pin or scriber, lift the corner and peel off.

(e) Take the frequency plate between the thumb and finger on the edge endeavouring not to place the fingers on the adhesive. Place the plate on the receiving surface, smooth along firmly with the fingers, then roll down hard with a wooden roller or similar implement.

(f) If the new frequency is not on the sheet, print the frequency neatly on the exposed surface, using Indian ink.

5.10 Fault Finding.

5.10.1 General.

In common with most electronic equipment, fault finding makes use of certain items of test equipment. The most likely faults will require those items listed in paragraph 5.5.2, although other specialised items such as a field strength meter can be used to advantage.

Before removing the Skyranger to the workshop it is always best to ascertain if the fault is located in the aircraft installation. Therefore, carefully check the aircraft for faulty interwiring, aerial, aerial loading coil and switch, microphones, headphones, jacks and L.T. supply.

When investigating a stage to which a fault has been isolated, a check of the supply voltages to that stage should be made. Typical operating voltages are given in sub-section 5.7, table 5.1 of this book. Where the associated valve is suspected as faulty it should be replaced with a known serviceable spare.

The following is produced as a guide to assist servicing the general faults likely to be encountered in the Skyranger equipment.

5.10.2 Malfunctions—Receiver.

1. No Sound from Headphones or Speaker.

(a) Open connections in battery supply.

(b) Blown fuse, or circuit breaker open.

(c) Insufficient battery voltage (flat battery).

(d) Defective valves or components.

(e) Faulty ON/OFF switch.

(f) Dirty contacts in relay RLA.

(g) No receiver H.T. voltage.

(h) Open circuit speaker coil.

(i) Broken lead to headset.

2. **No reception on all channels.**
   (a) Aerial or aerial loading coil open circuit.
   (b) Dirty contacts in relay RLB.
   (c) Defective valves or components.

3. **No reception on an individual channel.**
   (a) Defective crystal.
   (b) Dirty contact on switch assembly SWA.
   (c) Misalignment of receiver R.F. or Aerial stages.
   (d) Poor connection on aerial load coil or switch.

4. **Poor Reception.**
   (a) Insufficient battery or H.T. voltage.
   (b) Defective valves or components.
   (c) Misalignment of R.F., mixer, or I.F. stages.
   (d) Interference from ignition or electrical apparatus, e.g. generator, regulator, electrical tachos and gyros.
   (e) Excessive background noise in cockpit.

5. **Low Audio Level.**
   (a) Defective speaker or headphones.
   (b) Defective valves or components.

6. **Intermittent Operation.**
   (a) Poor connection in connector SKA.
   (b) Poor connection in aerial loading coil circuit.
   (c) Poor connection at phone jack.
   (d) Shorted valve elements or components.
   (e) Dirty contacts on switch SWA or relays.
   (f) Faulty crystal.

5.10.3 Malfunctions—Transmitter.

1. **No Power Output—All Channels.**
   (a) Open aerial connections.
   (b) Faulty or dirty contacts on relays RLA or RLB.
   (c) Faulty valves or components.
   (d) Low or nil transmitter H.T.

2. **No Power Output on Individual Channel.**
   (a) Faulty connection on aerial load coil or switch.
   (b) Faulty switch assembly SWA.
   (c) Misalignment of oscillator or power amplifier stages.
   (d) Faulty crystal.

3. **Low Power Output.**
   (a) Misalignment of transmitter stages.
   (b) Low gain valves.
   (c) Insufficient transmitter H.T. or battery voltage.

4. **Intermittent Output.**
   (a) Loose connection on aerial loading coil or switch.
   (b) Faulty connection in plug SKA.
   (c) Faulty connection in mic. jack.

(d) Relays not operating properly.
(e) Unstable oscillator due to misalignment.
(f) Dirty contacts on switch SWA or relays.
(g) Shorted valve elements or components.
(h) Faulty crystal.

5. **No Modulation or Poor Modulation.**
(a) Faulty microphone.
(b) Open connection in mic. jack or microphone.
(c) Faulty valves or component.
(d) Dirty mic. plug or jack.
(e) Improper microphone technique (speak closer and more directly into the microphone).
(f) Overloaded transmitter (too much power amplifier anode current).
(g) Excessive background noise in cockpit.

6.—COMPONENT SCHEDULE

When ordering replacement parts, please quote ALL details given below for a particular component.

The component supplied against the order may not be identical with the original item in the equipment, but will be a satisfactory replacement differing in only minor mechanical or electrical details; such differences will not impair the operation of the equipment.

Circ. Ref. No.		Description	Manufacturer's Reference
(a) Capacitors.			
C1		Not used.	
C2	250pF	±5%, 500VW, silver mica.	Simplex SS
C3	510pF	±5%, 500VW, silver mica.	Simplex SS
C4	47pF	±5%, 500VW, cer. tub., ins.	Ducon CTR. NPO
C5		Not used.	
C6		Not used.	
C7		Not used.	
C8		Not used.	
C9		Not used.	
C10		Not used.	
C11	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C12	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C13	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C14	68pF	±5%, 500VW, cer. tub., ins.	Ducon CTR.NPO
C15		Not used.	
C16	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C17	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C18	15pF	±1μμF, 500VW, cer. disc	Ducon CDS.NPO
C19	100pF	Part of TR1, ±5%, 500VW, silver mica.	Simplex SM
C20		Not used.	
C21	100pF	Part of TR1, ±5%, 500VW, silver mica.	Simplex SM
C22	39pF	±5%, 500VW, cer. tub., ins.	Ducon CTR.NPO
C23		Not used.	
C24		Not used.	
C25		Not used.	
C26		Not used.	
C27		Not used.	
C28	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C29	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C30	0.1μF	±10%, 125VW, polyester, tub.	Philips C296AA/A
C31	100pF	±5%, 500VW, cer. tub., ins.	Ducon CTR.N750
C32	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C33	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C34	100pF	Part of TR2, ±5%, 500VW, silver mica.	Simplex SM
C35		Not used.	

Circ. Ref. No.		Description	Manufacturer's Reference
C36	100pF	Part of TR2, ±5%, 500VW, silver mica.	Simplex SM
C37	100pF	±20%, 500VW, cer. bead.	Ducon CBA.K1000
C38	100pF	±20%, 500VW, cer. bead.	Ducon CBA.K1000
C39	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C40	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C41	22pF	±5%, 500VW, cer. disc.	Ducon CDS.N750
C42	0.1μF	±10%, 125VW, polyester, tub.	Philips C296AA/A100K
C43	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C44	1000pF	±10%, 400VW, polyester, tub.	Philips C296AC/A
C45		Not used.	
C46	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C47	10μF	25VW, electro, tub. met. case.	Ducon ES2503
C48	2200pF	±10%, 400VW, polyester, tub.	Philips C296AC/A
C49	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C50	33pF	±5%, 500VW, cer. tub., ins.	Ducon CTR.NPO
C51	10μF	25VW, electro, tub. met. case.	Ducon ES2503
C52	1500pF	±20%, 2000VW, cer. tub., ins.	Ducon CDS.K2000
C53	15μμF	±1μμF, 500VW, cer. disc	Ducon CDS.NPO
C54	100pF	±5%, 500VW, cer. tub., ins.	Ducon CTR.N750
C55		Not used.	
C56	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C57	68pF	±5%, 500VW, cer. disc.	Ducon CDS.NPO
C58	100pF	±5%, 500VW, cer. tub.	Ducon CTR.NPO
C59		Not used.	
C60		Not used.	
C61	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C62	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C63	0.01μF	–0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C64	1500pF	±20%, 2000VW, cer. disc.	Ducon CDH style C
C65		Not used.	
C66	0.01μF	–0+100%, 1000VW, cer. disc.	Ducon CDH style E
C67	1500pF	±20%, 2000VW, cer. disc.	Ducon CDH style C
C68		Refer to Sub-Section 5.9.	
C69		Refer to Sub-Section 5.9.	
C70		Not used.	
C71		Refer to Sub-Section 5.9.	
C72		Refer to Sub-Section 5.9.	
C73		Not used.	
C74		Refer to Sub-Section 5.9.	
C75	470pF	±10%, 500VW, mica.	Simplex PT
C76		Refer to Sub-Section 5.9.	
C77		Refer to Sub-Section 5.9.	
C78		Refer to Sub-Section 5.9.	
C79		Refer to Sub-Section 5.9.	
C80		Not used.	

Circ Ref. No.		Description	Manufacturer's Reference
C81		Not used.	
C82		Not used.	
C83		Not used.	
C84		Not used.	
C85	8μF	−20+50%, 450VW, electro, tub. met. case.	Ducon ET
C86	1000pF	±10%, 400VW, polyester, tub.	Philips C296AC/A
C87	8μF	−20+50%, 450VW, electro, tub. met. case.	Ducon ET
C88	50μF	−20+50%, 125VW, electro, tub. met. case.	Ducon ET
C89	3300pF	±10%, 400VW, polyester, tub.	Philips C296AC/A
C90		Not used.	
C91	50μF	−20+100%, 250VW, electro, tub. met. case.	Ducon ET
C92	0.1μF	±10%, 125VW, polyester, tub.	Philips C296AA/A
C93	0.01μF	−0+100%, 500VW, cer. tub.	Ducon CTR.K6000
C94		Not used.	
C95		Refer to Sub-Section 5.9.	
C96		Refer to Sub-Section 5.9.	
C97		Refer to Sub-Section 5.9.	
C98		Refer to Sub-Section 5.9.	
C99		Refer to Sub-Section 5.9.	
C100		Not used.	
C101	0.01μF	−0+100%, 1000VW, cer. disc.	Ducon CDH style E

(b) Inductors.

L1 to L20	Refer to Sub-Section 5.9.	
L21		AWA Pt. No. 40117
L22		AWA 184V57970
L23	Not used.	
L24 to L28	Refer to sub-Section 5.9.	

(c) Resistors.

NOTE: Resistors described as "Composition Grade 1" and "Composition Grade 2" are made up by various manufacturers to R.S.C. standards. "Vitreous enamelled" resistors are completely identified by the "RWV" type number given, and are also produced by several manufacturers to a common specification. Acceptable manufacturers of these resistors are listed below.

Wattage ratings are quoted at 71°C.

Composition Grade 1	Manufacturer and Type .
1/8W. insulated	Erie 109
1/4W. insulated.	Erie 108
1/4W. non-insulated	I.R.C. type DCC Welwyn C21 Painton 72

1/2W. insulated	Erie 100
3/4W. non-insulated	I.R.C. type DCE Welwyn C23 Painton 74
1W. non-insulated	I.R.C. type DCG Welwyn C24 Painton 75

Composition Grade 2

1/4W. insulated	I.R.C. type BTS
1/2W. insulated	I.R.C. type BTA
1/2W. non-insulated	Morganite T
1W. insulated	I.R.C. type BTB
1W. non-insulated	Morganite R

R1	22kΩ	±10%, 1/2W, comp., grade 2, ins.
R2	470kΩ	±10%, 1/2W, comp., grade 2, ins.
R3	68Ω	±10%, 1/2W, comp., grade 2, ins.
R4	100kΩ	±10%, 1/2W, comp., grade 2, ins.
R5	10kΩ	±10%, 1/2W, comp., grade 2, ins.
R6	100kΩ	±10%, 1/2W, comp., grade 2, ins.
R7	22kΩ	±10%, 1/2W, comp., grade 2, ins.
R8	1kΩ	±10%, 1/2W, comp., grade 2, ins.
R9	270Ω	±10%, 1/4W, comp., grade 2, ins.
R10		Not used.
R11	22kΩ	±10%, 1/2W, comp., grade 2, ins.
R12	22kΩ	±10%, 1/2W, comp., grade 2, ins.
R13	270Ω	±10%, 1/4W, comp., grade 2, ins.
R14	47kΩ	±10%, 1/2W, comp., grade 2, ins.
R15		Not used.
R16	470kΩ	±10%, 1/4W, comp., grade 2, ins.
R17	100kΩ	±10%, 1/4W, comp., grade 2, ins.
R18	1MΩ	±10%, 1/4W, comp., grade 2, ins.
R19	100kΩ	±10%, 1/4W, comp., grade 2, ins.
R20	100kΩ	±10%, 1/4W, comp., grade 2, ins.
R21	390kΩ	±10%, 1/4W, comp., grade 2, ins.
R22	680Ω	±10%, 1/4W, comp., grade 2, ins.
R23	1kΩ	±10%, 1/2W, comp., grade 2, ins.
R24	100kΩ	±10%, 1W, comp., grade 2, ins.
R25	100kΩ	±10%, 1W, comp., grade 2, ins.
R26	470kΩ	±10%, 1/4W, comp., grade 2, ins.
R27	10MΩ	±10%, 1/4W, comp., grade 2, ins.
R28	470kΩ	±10%, 1/4W, comp., grade 2, ins.
R29		Not used.
R30		Not used.
R31	100kΩ	±10%, 1/2W, comp., grade 2, ins.
R32	22kΩ	±10%, 1/2W, comp., grade 2, ins.
R33	220kΩ	±10%, 1/2W, comp., grade 2, ins.
R34	4.7kΩ	±5%, 4.5W, w-w, vitr. enam. wire term. RWV4-K
R35		Not used.

R36	330Ω	±10%, 1/2W, comp., grade 2, ins.	
R37	100kΩ	±10%, 1/2W, comp., grade 2, ins.	
R38	27kΩ	±10%, 1W, comp., grade 2, ins.	
R39	33kΩ	±10%, 1/2W, comp., grade 2, ins.	
R40		Not used.	
R41	100Ω	±5%, 3W, w-w, vitr. enam., wire term.	RWV4-J
R42	47kΩ	±5%, 8W, tin oxide, ins.	Welwyn F34
R43		Not used.	
R44		Not used.	
R45	470kΩ	±10%, 1/4W, comp., grade 2, ins.	
R46	100kΩ	±10%, 1/4W, comp., grade 2, ins.	
R47	330Ω	±5%, 4.5W, w-w, vitr. enam. wire term.	RWV4-K
R48	150Ω	±5%, 1.5W, w-w, vitr. enam., wire term.	RWV3-J
R49	470Ω	±10%, 3W, w-w, vitr. enam., wire term.	RWV4-J
R50		Not used.	
R51	1MΩ	±10%, 1/4W, comp., grade 2, ins.	
R52	4.7kΩ	±10%, 1W, comp., grade 2, ins.	
R53		Not used.	
R54		Not used.	
R55		Not used.	
R56		Not used.	
R57		Not used.	
R58		Not used.	
R59		Not used.	
R60		Not used.	
R61	10kΩ	±10%, 1W, comp., grade 2, ins.	
R62	100kΩ	±10%, 1/2W, comp., grade 2, ins.	
R63	47kΩ	±10%, 1/4W, comp., grade 2, ins.	
R64	33Ω	±10%, 3W, w-w, vitr. enam., wire term.	RWV4-J
R65		Not used.	
R66	68Ω	±5%, 3W, w-w, vitr. enam., wire term.	RWV4-J
RV1	3kΩ	Variable, carbon, curve H, with switch	Ducon PSS

(d) Sockets.

V1	7 pin, miniature, P.T.F.E.	Clix VH337/702 CPS
V2	7 pin, miniature, P.T.F.E.	Clix VH337/702 CPS
V3	7 pin, miniature, P.T.F.E.	Clix VH337/702 CPS
V4	9 pin, miniature, P.T.F.E.	Clix VH499/902 CPS
V5	7 pin, miniature, P.T.F.E.	Clix VH337/702 CPS
V6	7 pin, miniature, P.T.F.E.	Clix VH337/702 CPS
V7	Octal, mica filled phenolic	Teletron ST38L
V8	Octal, mica filled phenolic	Teletron ST38L
XL1 to XL10	Crystal Holder, 2 pin, miniature.	Teletron SC22

(e) Transformers.

TR1	1st I.F., frequency 455 kc/s	AWA 11V57977
TR2	2nd I.F., frequency 455 kc/s	AWA 12V57977
TR3	Audio output	AWA 1LE61563
TR4	Microphone input	AWA 2XC59207
TR5	Modulation	AWA 1TU61549
TR6	2 Ferramic shell, pt. no. 39117, 2 turns of 7/.0076, P.V.C. insulated wire.	AWA 787540

(f) Miscellaneous.

	Cap, Valve (6883 top cap)	Aegis EHT (large)
	Holder, Lamp, clear bezel	RAFI2010LS5
	Holder, Lamp, red bezel	RAFI2010LS4
JKA	Jack, single circuit	Mallory SC1A
JKB	Jack, two circuit	Mallory SCA/2B
	Knob, volume control	AWA 59043W7
	Knob, channel change	AWA 1S80010
LP1	Neon indicator, B.C.	Gen. Elec. NE51
LP2	Lamp, pilot (R.F. Output)	GE44
TJA	Pin Jack, single point	Oxley
TJB	Pin Jack, single point	Oxley
RLA	Relay, 200Ω coil, 2 c/o	Zoeller AZ-20-42
RLB	Relay, 200Ω coil, 2 c/o	Zoeller AZ-20-42
	Screen, valve, B7G (6AQ5)	AWA 2S56610
	Screen, valve, B7G	AWA 1S56610
	Screen, valve, B9G	AWA 1S55611
SWA	Switch, Oak "H" type. Seven section, five position, sections numbering from the front panel. Section 1, 2, 3 and 5 are bakelite. Section 4, 6 and 7 are ceramic. When any correspondence arises over one particular wafer, these details must be quoted.	AWA 80213V96
SWB	On/off switch, part of RV1	
SKA	16-way, male contacts.	McMurdo PRD16
PLA	16-way, female contacts.	McMurdo PSD16

Power Supply 1H80214 (12/14 Volts).

(a) Capacitors.

C1	1000μF	18VWP, electro, tub. met. case.	UCC ESA
C2	100μF	18VWP, electro, tub. met. case.	UCC EPA20
C3	8μF	−20+50%, 450VW, electro, tub. met. case.	Ducon ET
C4	8μF	−20+50%, 450VW, electro, tub. met. case.	Ducon ET

(b) Resistors.

R1	820Ω	±10%, 1/2W, comp., grade 2, ins.	
R2	10Ω	±10%, 3W, w-w, vitr. enam., wire term.	RWV4-J
R3	100Ω	±10%, comp., grade 2, style RC7-J.	Erie 9

(c) Miscellaneous.

FS1	Fuse, glass cartridge type, loaded 10A.	Belling Lee L1055
L1	Inductor.	AWA 58V57973
MR1	Rectifier, silicon type.	Philips OA211
MR2	Rectifier, silicon type.	Philips OA211
VT1	Transistor, high power germanium	R.C.A. 2N277
VT2	Transistor, high power germanium	R.C.A. 2N277
TR1	Transformer, power.	AWA 2LH61553

Power Supply 2H80214 (24/28 Volts).

(a) Capacitors.

C1	500μF	25VW, electro, sub. met. case ins.	Ducon ET6O
C2	25μF	50VW, electro, sub. met. case ins.	UCC ECE
C3	8μF	−20+50%, 450VW, electro, met. case, ins.	Ducon ET
C4	8μF	−20+50%, 450VW, electro, met. case, ins.	Ducon ET

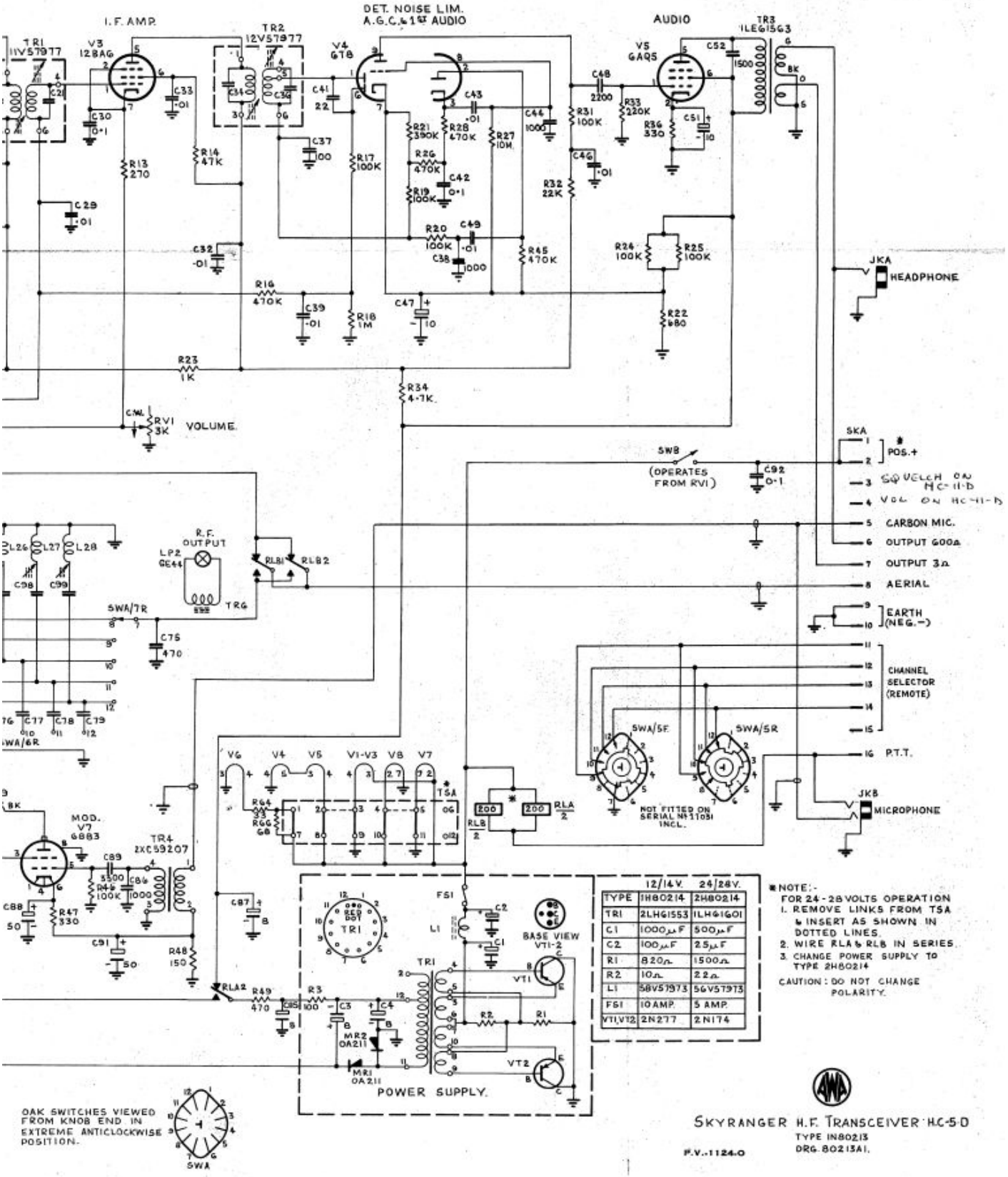
(b) Resistors.

R1	1500Ω	±10%, comp., grade 2, ins.	
R2	22Ω	±10%, 1½W, w-w, vitr. enam.	RWV3-J
R3	100Ω	±10%, comp., grade 2, style RC7-J.	

(c) Miscellaneous.

FS1	Fuse, glass cartridge type, loaded 5A.	Belling Lee L1055
L1	Inductor.	56V57973

MR1	Rectifier, silicon type.	Philips OA211
MR2	Rectifier, silicon type.	Philips OA211
VT1	Transistor, high power germanium.	R.C.A. 2N174
VT2	Transistor, high power germanium.	R.C.A. 2N174
TR1	Transformer, power.	AWA 1LH61601



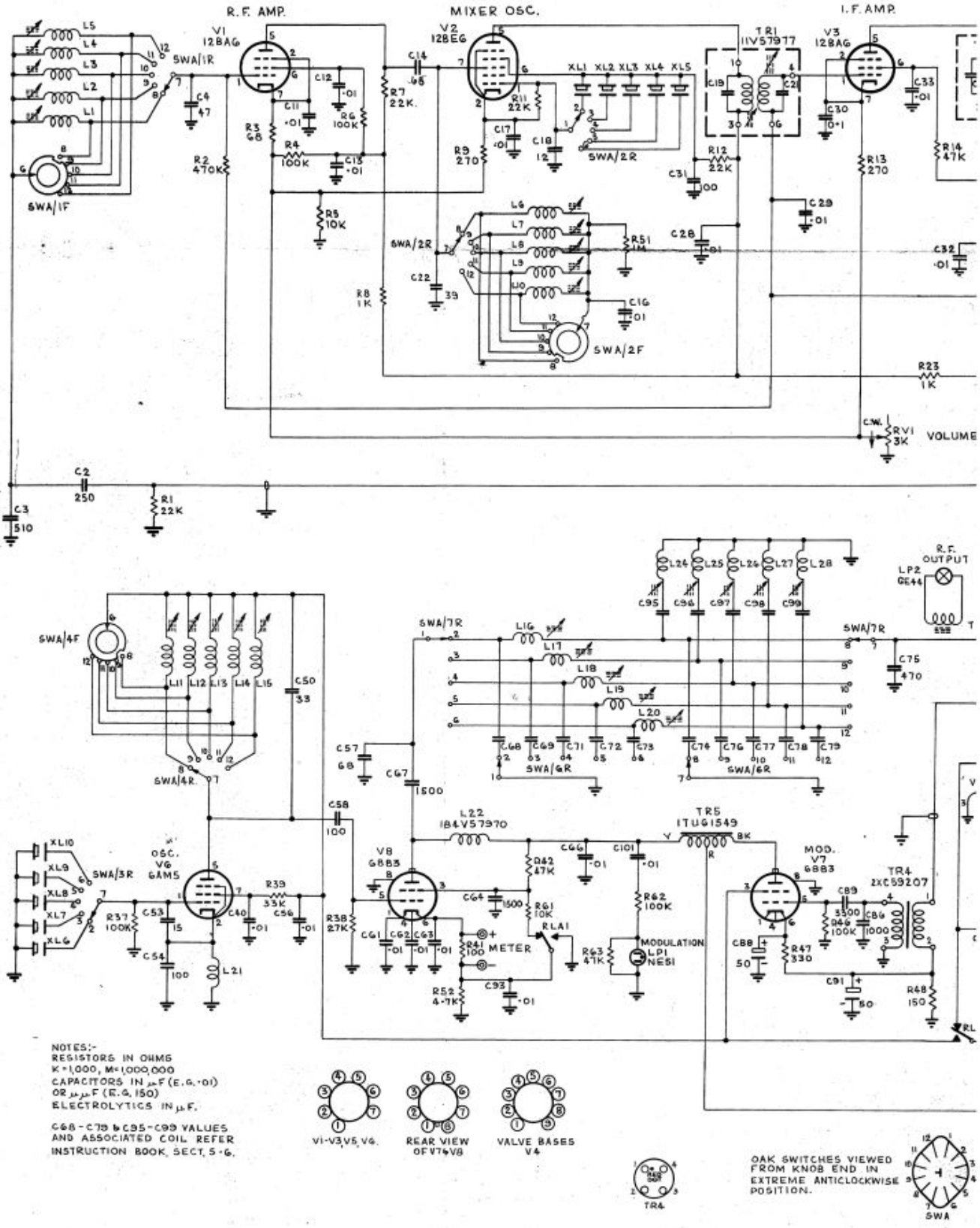
	12/14V.	24/28V.
TYPE	1H80214	2H80214
TR1	2LH61553	1LH61601
C1	1000μF	500μF
C2	100μF	25μF
R1	8.2Ω	15Ω
R2	1Ω	2.2Ω
L1	58V57973	5GV57973
FS1	10 AMP.	5 AMP.
VT1,VT2	2N277	2N174

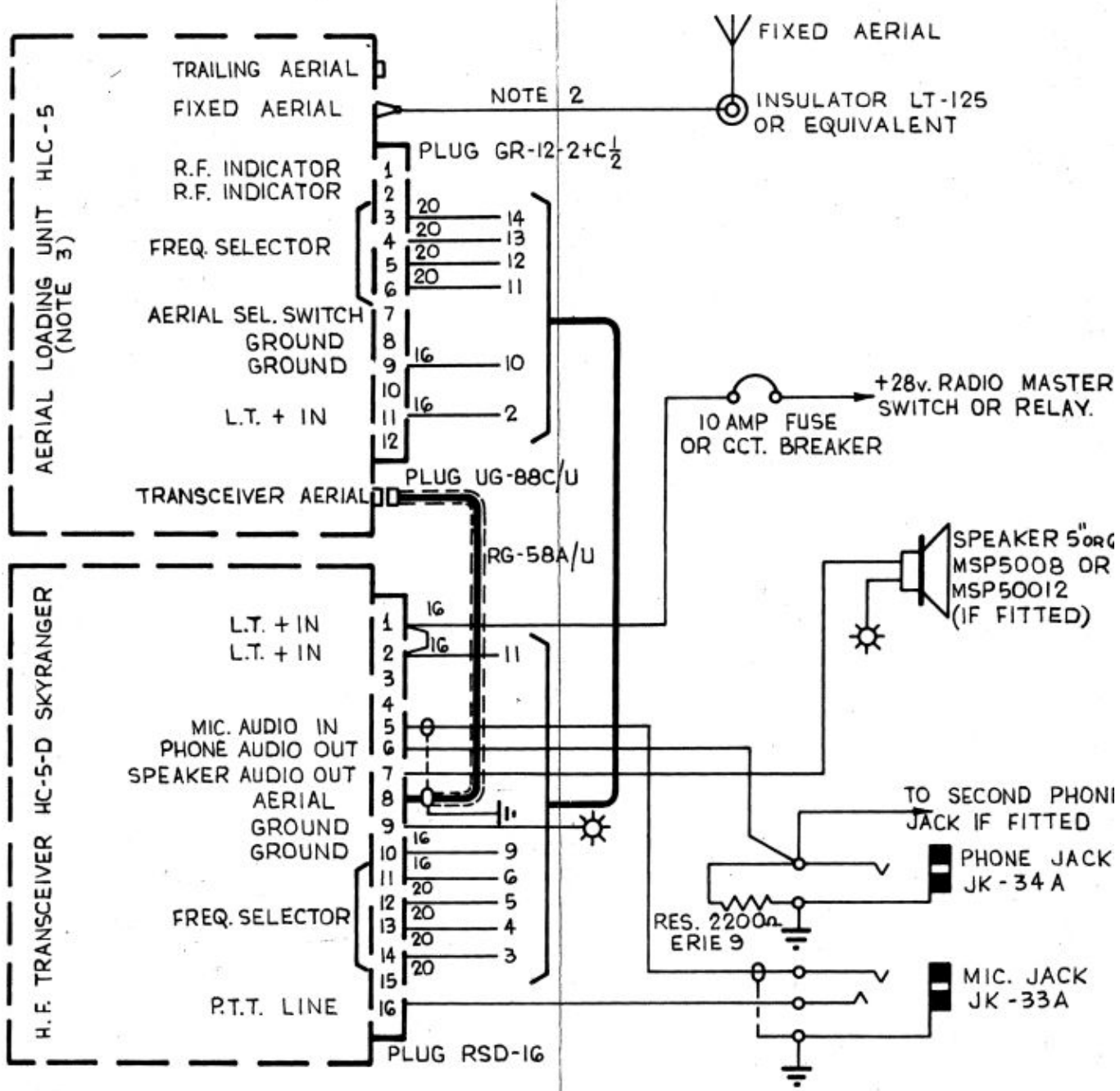
*NOTE:-
FOR 24-28 VOLTS OPERATION
1. REMOVE LINKS FROM TSA & INSERT AS SHOWN IN DOTTED LINES.
2. WIRE RLA & RLB IN SERIES.
3. CHANGE POWER SUPPLY TO TYPE 2H80214

CAUTION: DO NOT CHANGE POLARITY.

SKYRANGER H.F. TRANSCEIVER HC-5D
TYPE IN80213
DRG. 80213A1.

P.V.-1124-0

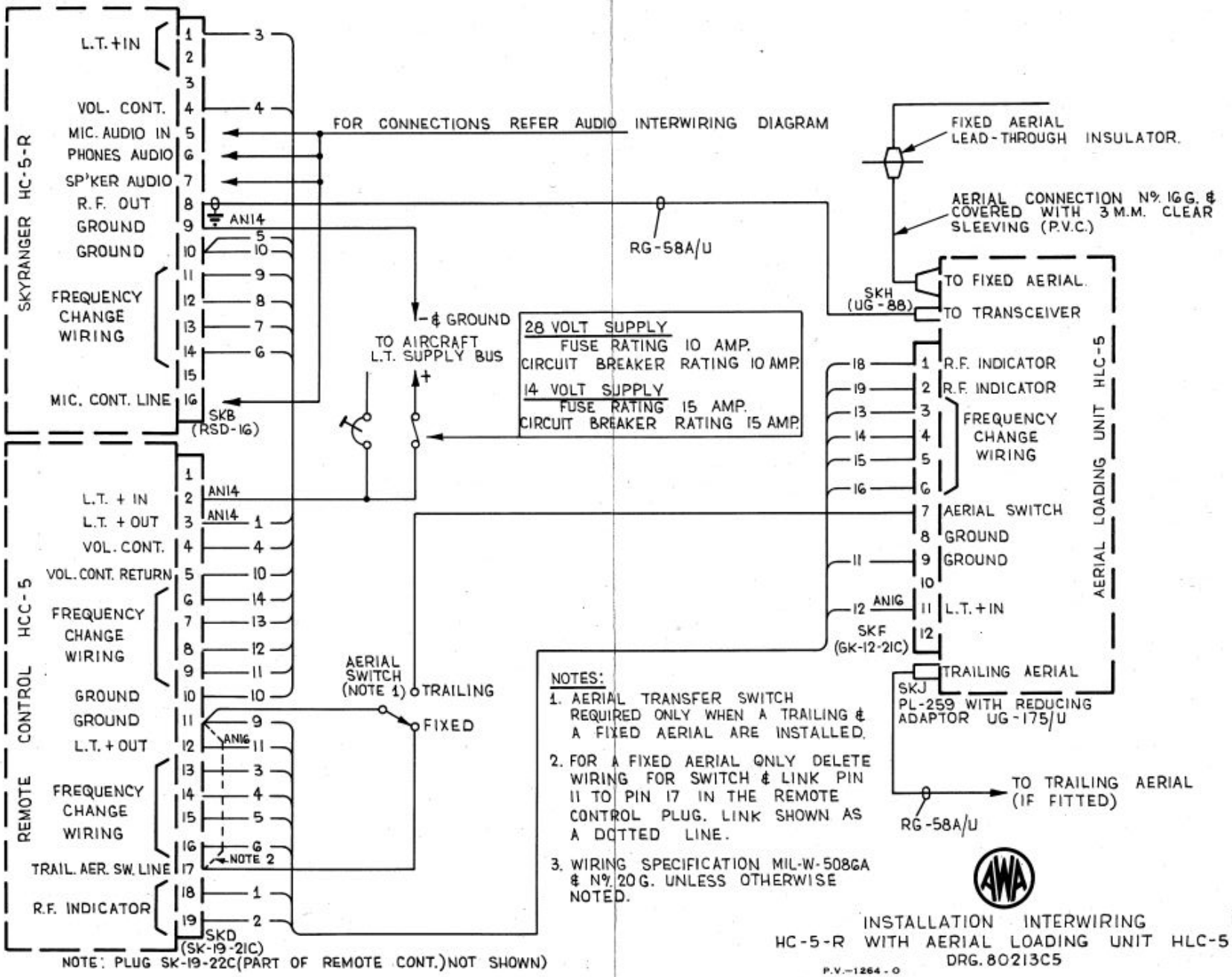

R.F. AMP.
MIXER OSC.
I.F. AMP.
V1 12BA6
V2 12BE6
TR1 IIV57977
V3 12BA6
SWA/1R
SWA/1F
SWA/2R
SWA/2F
SWA/3R
SWA/4F
SWA/4R
SWA/5R
SWA/6R
SWA/7R
R1 22K
R2 470K
R3 68
R4 100K
R5 10K
R6 100K
R7 22K.
R8 1K
R9 270
R11 22K
R12 22K
R13 270
R14 47K
R23 1K
RV1 3K VOLUME
C2 250
C3 510
C4 47
C11 .01
C12 .01
C13 .01
C14 .05
C17 .01
C18 12
C28 .01
C29 .01
C30 .1
C31 100
C32 .01
C33 .01
C22 39
C16 .01
L1 L2 L3 L4 L5
L6 L7 L8 L9 L10
L11 L12 L13 L14 L15
L16 L17 L18 L19 L20
L24 L25 L26 L27 L28
XL1 XL2 XL3 XL4 XL5
XL6 XL7 XL8 XL9 XL10
R.F. OUTPUT
LP2 GE44
C75 470
C50 33
C57 68
C67 1500
C58 100
L22 184V57970
TR5 ITUG1549
V8 6BB5
OSC. V6 6AM5
MOD. V7 6BB3
TR4 2XC59207
R37 100K
R38 27K
R39 33K
R41 100
R42 47K
R43 47K
R46 100K
R47 330
R48 150
R52 4-7K
R61 10K
R62 100K
C53 15
C54 100
C56 .01
C40 .01
C61 .01
C62 .01
C63 .01
C64 1500
C66 .01
C101 .01
C89 3500
C88 50
C91 50
L21
RLA1
METER
MODULATION LP1 NES1
NOTES:-
RESISTORS IN OHMS
K=1,000, M=1,000,000
CAPACITORS IN µF (E.G. .01)
OR µµF (E.G. 150)
ELECTROLYTICS IN µF.
C68-C79 & C95-C99 VALUES AND ASSOCIATED COIL REFER INSTRUCTION BOOK, SECT. 5-G.
V1-V3, V5, V6.
REAR VIEW OF V7 & V8
VALVE BASES V4
TR4
OAK SWITCHES VIEWED FROM KNOB END IN EXTREME ANTICLOCKWISE POSITION.
SWA

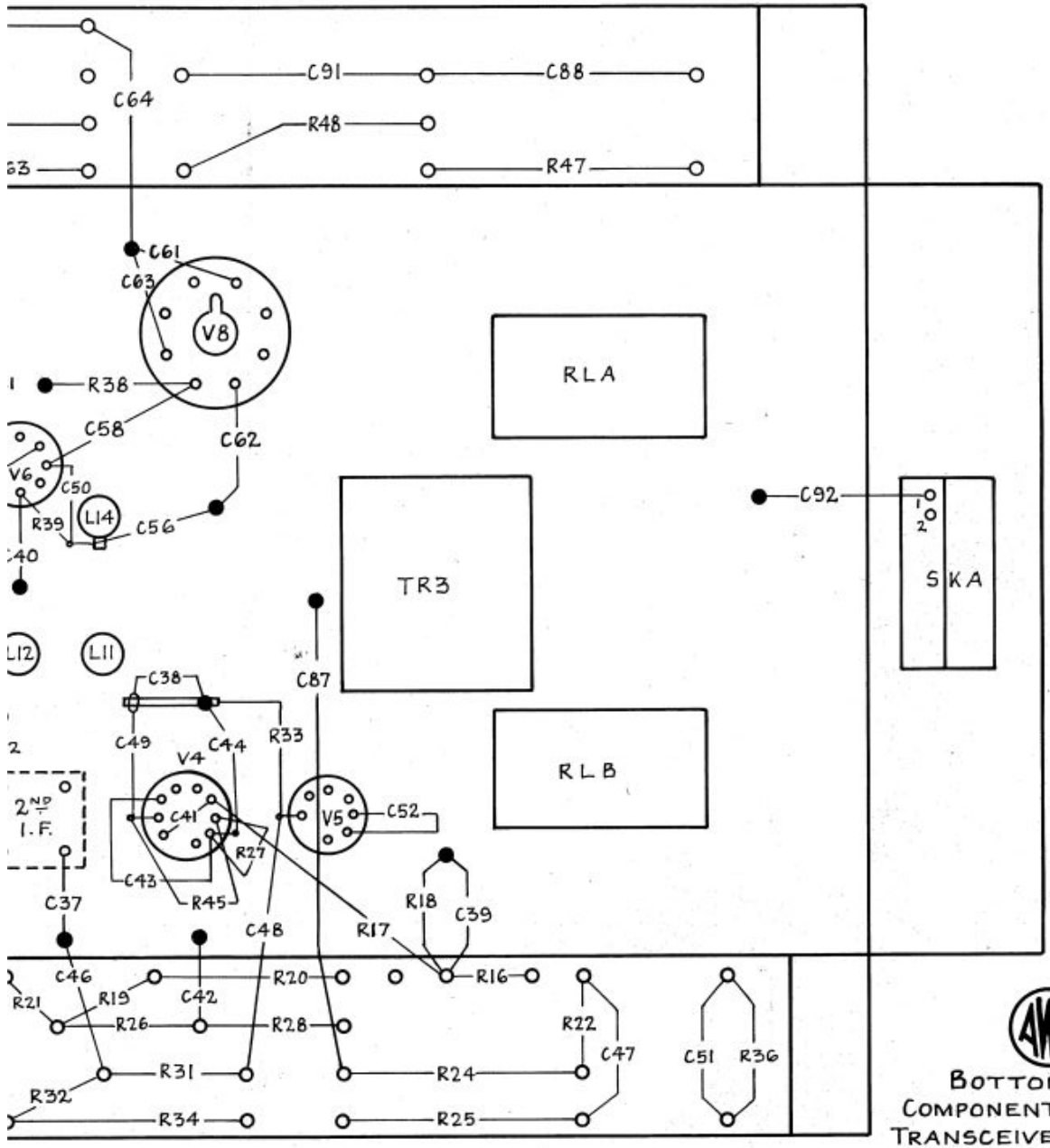


NOTES:

1. ALL WIRING TO MIL-W-5086A & 22 GAUGE UNLESS OTHERWISE STATED.
2. CABLE RG-58A/U WITH BRAID REMOVED & COVERED WITH 4mm CLEAR P.V.C. TUBING.
3. SERIES CAPACITORS MAY BE FITTED IN THIS UNIT WHEN OPERATING FREQ. IS 8Mc/s OR HIGHER.

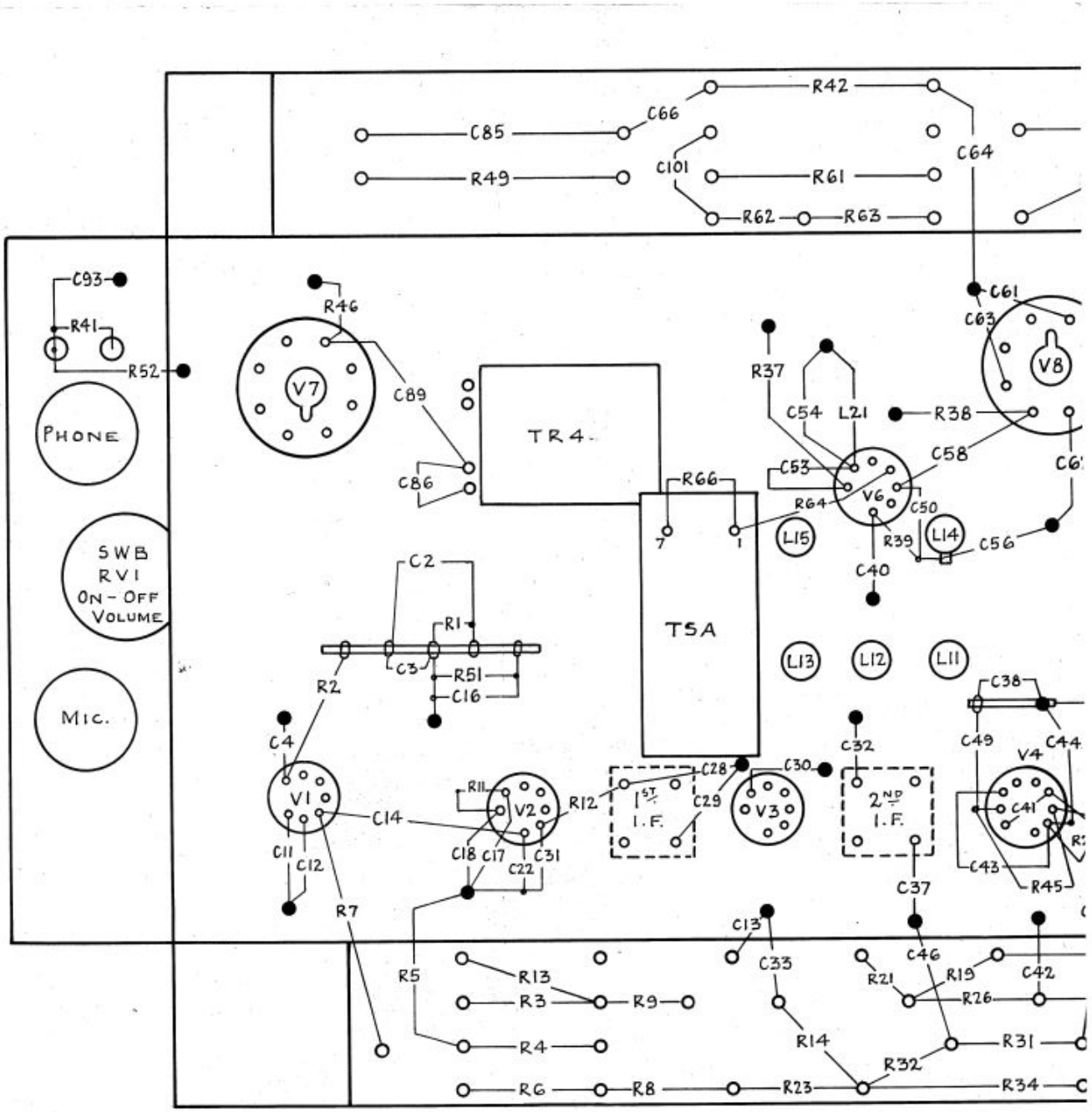
INSTALLATION INTERWIRING
HC-5-D WITH AERIAL LOADING UNIT HLC-5
DRG. 80213D85 P.V.-1262 - O

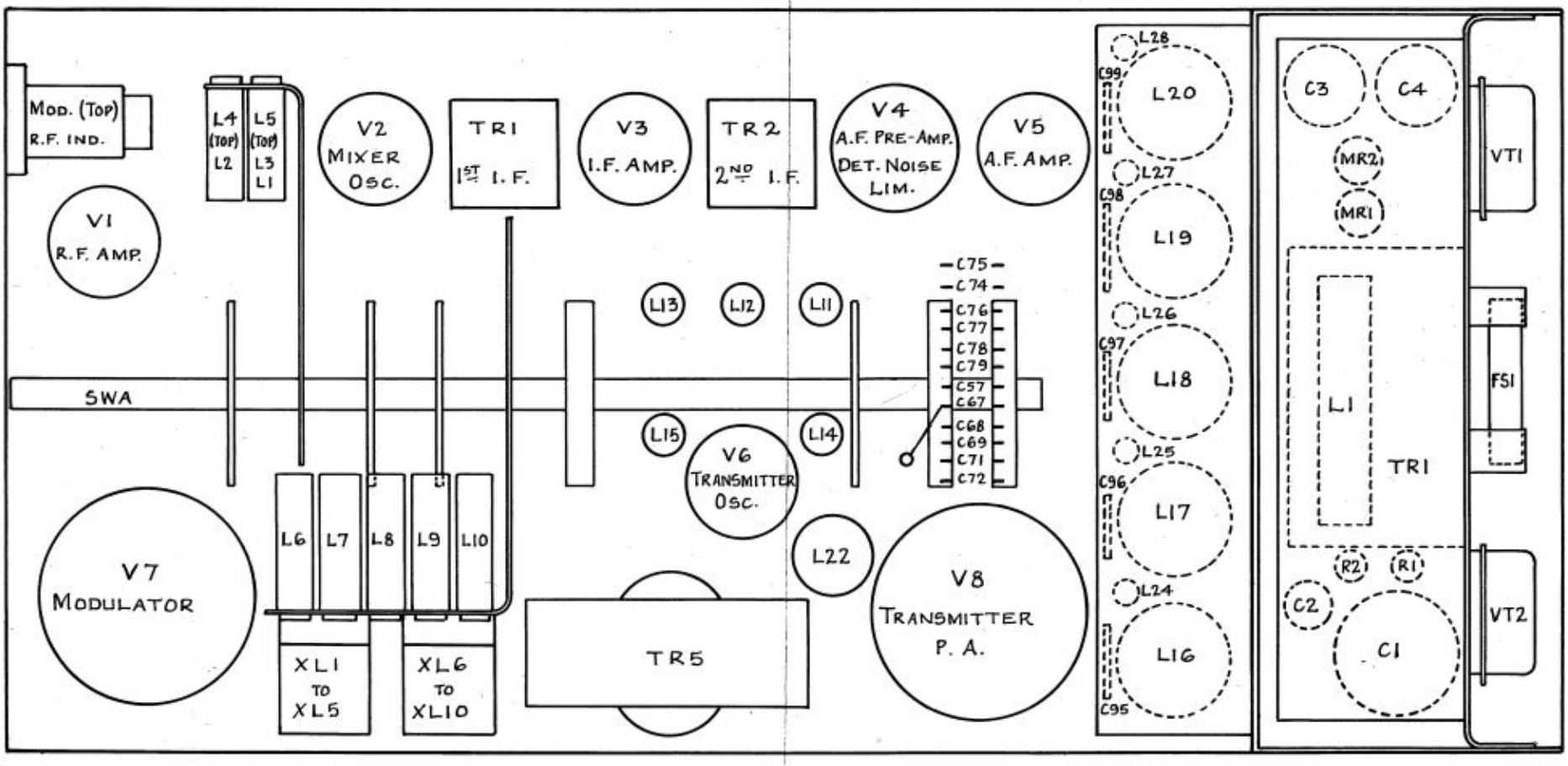

SKYRANGER HC-5-R
L.T. +IN
VOL. CONT.
MIC. AUDIO IN
PHONES AUDIO
SP'KER AUDIO
R.F. OUT
GROUND
GROUND
FREQUENCY CHANGE WIRING
MIC. CONT. LINE
SKB (RSD-16)
AN14
FOR CONNECTIONS REFER AUDIO INTERWIRING DIAGRAM
RG-58A/U
FIXED AERIAL LEAD-THROUGH INSULATOR.
AERIAL CONNECTION N°. 16 G. & COVERED WITH 3 M.M. CLEAR SLEEVING (P.V.C.)
SKH (UG-88)
TO FIXED AERIAL.
TO TRANSCEIVER
- & GROUND
TO AIRCRAFT L.T. SUPPLY BUS
+
28 VOLT SUPPLY
FUSE RATING 10 AMP.
CIRCUIT BREAKER RATING 10 AMP.
14 VOLT SUPPLY
FUSE RATING 15 AMP.
CIRCUIT BREAKER RATING 15 AMP.
AERIAL LOADING UNIT HLC-5
R.F. INDICATOR
R.F. INDICATOR
FREQUENCY CHANGE WIRING
AERIAL SWITCH
GROUND
GROUND
L.T. + IN
SKF (GK-12-21C)
TRAILING AERIAL
SKJ
PL-259 WITH REDUCING ADAPTOR UG-175/U
REMOTE CONTROL HCC-5
L.T. + IN
L.T. + OUT
VOL. CONT.
VOL. CONT. RETURN
FREQUENCY CHANGE WIRING
GROUND
GROUND
L.T. + OUT
FREQUENCY CHANGE WIRING
TRAIL. AER. SW. LINE
R.F. INDICATOR
SKD (SK-19-21C)
AERIAL SWITCH (NOTE 1)
TRAILING
FIXED
AN16
NOTE 2
TO TRAILING AERIAL (IF FITTED)
RG-58A/U
NOTES:
1. AERIAL TRANSFER SWITCH REQUIRED ONLY WHEN A TRAILING & A FIXED AERIAL ARE INSTALLED.
2. FOR A FIXED AERIAL ONLY DELETE WIRING FOR SWITCH & LINK PIN 11 TO PIN 17 IN THE REMOTE CONTROL PLUG. LINK SHOWN AS A DOTTED LINE.
3. WIRING SPECIFICATION MIL-W-5088A & N°. 20 G. UNLESS OTHERWISE NOTED.
NOTE: PLUG SK-19-22C (PART OF REMOTE CONT.) NOT SHOWN)
AWA
INSTALLATION INTERWIRING
HC-5-R WITH AERIAL LOADING UNIT HLC-5
DRG. 80213C5
P.V.-1264-O



P.V.-1123-0

BOTTOM VIEW.
COMPONENT LAYOUT,
TRANSCEIVER IN80213.
DRG. 80213G1.


R42
C66
C85
R49
C101
R61
R62
R63
C64
C93
R41
R52
R46
V7
C89
C86
TR4
PHONE
SWB
RV1
ON - OFF
VOLUME
MIC.
C2
R1
C3
R51
C16
R2
C4
V1
C14
C11
C12
R7
R11
V2
R12
C18
C17
C22
C31
R5
R13
R3
R9
R4
R6
R8
R23
R34
T5A
R66
7
1
R64
C28
C29
1ST I.F.
C30
V3
C13
C33
R14
C37
2ND I.F.
C32
R21
C46
R19
R26
R31
R32
C61
C63
V8
R37
C54
L21
R38
C58
C53
V6
C50
R39
L15
L14
C56
C40
L13
L12
L11
C38
C49
C44
V4
C41
C43
R45
C42

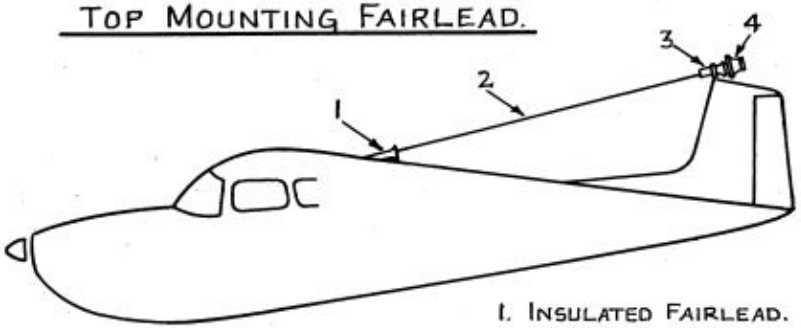


AWA

TOP VIEW
COMPONENT LAYOUT.
TRANSCEIVER IN80213.
DRG. 8021303

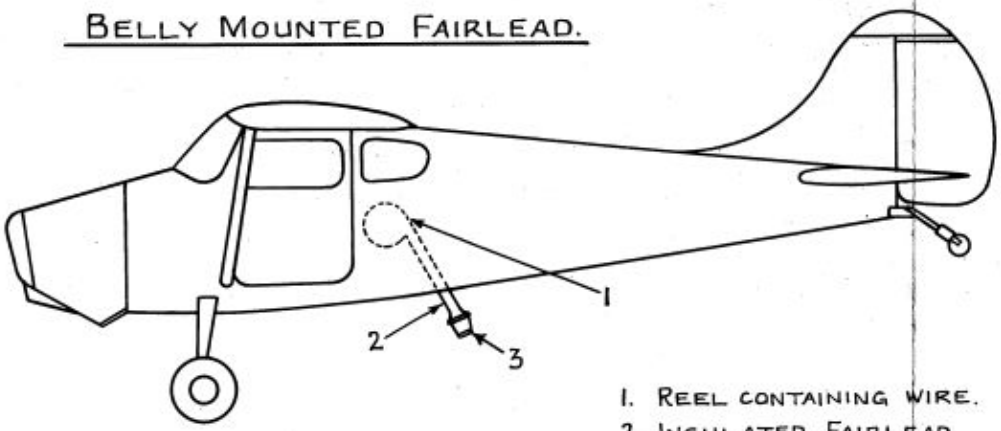
P.V.-1127-0

TOP MOUNTING FAIRLEAD.



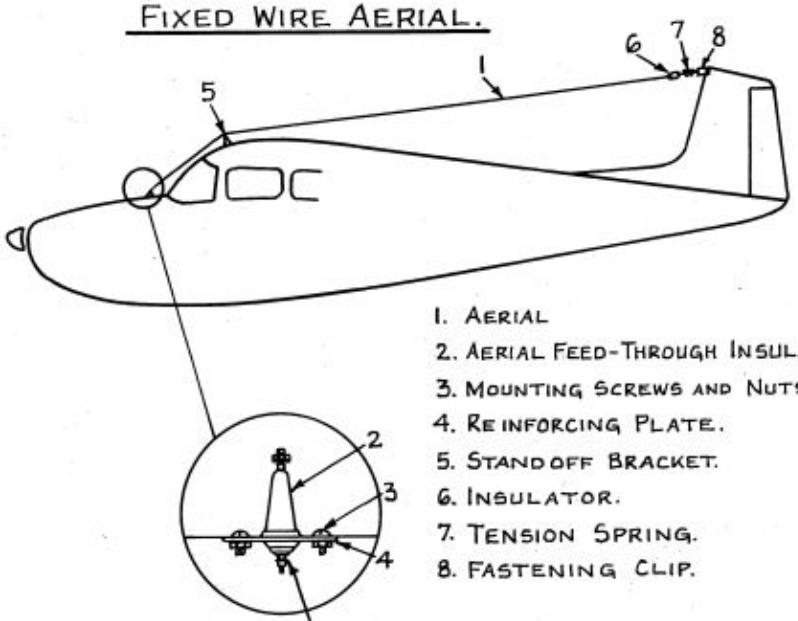
1. INSULATED FAIRLEAD.
2. TRAILING AERIAL WIRE
3. INSULATOR.
4. DROGUE.

BELLY MOUNTED FAIRLEAD.



1. REEL CONTAINING WIRE.
2. INSULATED FAIRLEAD.
3. DROGUE.

FIXED WIRE AERIAL.

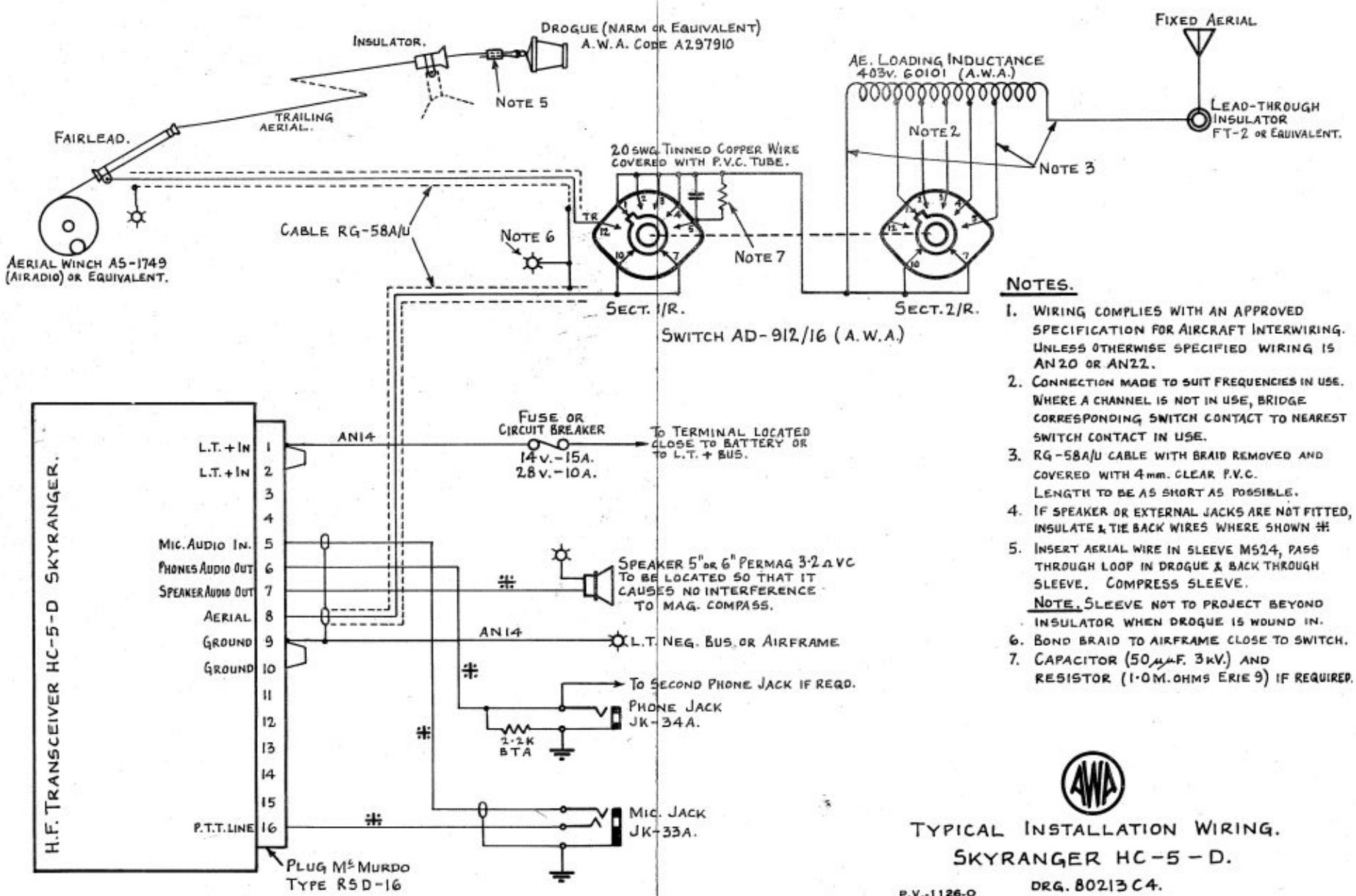


1. AERIAL
2. AERIAL FEED-THROUGH INSULATOR.
3. MOUNTING SCREWS AND NUTS.
4. REINFORCING PLATE.
5. STAND OFF BRACKET.
6. INSULATOR.
7. TENSION SPRING.
8. FASTENING CLIP.

TYPICAL AERIAL INSTALLATION FOR SKYRANGER HC-5-D.

DRG. 80213 C2

P.V.-1128-0



NOTES.

1. WIRING COMPLIES WITH AN APPROVED SPECIFICATION FOR AIRCRAFT INTERWIRING. UNLESS OTHERWISE SPECIFIED WIRING IS AN20 OR AN22.
2. CONNECTION MADE TO SUIT FREQUENCIES IN USE. WHERE A CHANNEL IS NOT IN USE, BRIDGE CORRESPONDING SWITCH CONTACT TO NEAREST SWITCH CONTACT IN USE.
3. RG-58A/U CABLE WITH BRAID REMOVED AND COVERED WITH 4 mm. CLEAR P.V.C. LENGTH TO BE AS SHORT AS POSSIBLE.
4. IF SPEAKER OR EXTERNAL JACKS ARE NOT FITTED, INSULATE & TIE BACK WIRES WHERE SHOWN ⋕
5. INSERT AERIAL WIRE IN SLEEVE MS24, PASS THROUGH LOOP IN DROGUE & BACK THROUGH SLEEVE. COMPRESS SLEEVE.
   NOTE. SLEEVE NOT TO PROJECT BEYOND INSULATOR WHEN DROGUE IS WOUND IN.
6. BOND BRAID TO AIRFRAME CLOSE TO SWITCH.
7. CAPACITOR (50 μF. 3kV.) AND RESISTOR (1·0M. OHMS ERIE 9) IF REQUIRED.

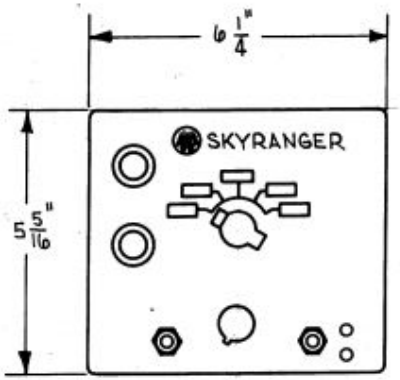
TYPICAL INSTALLATION WIRING.
SKYRANGER HC-5-D.

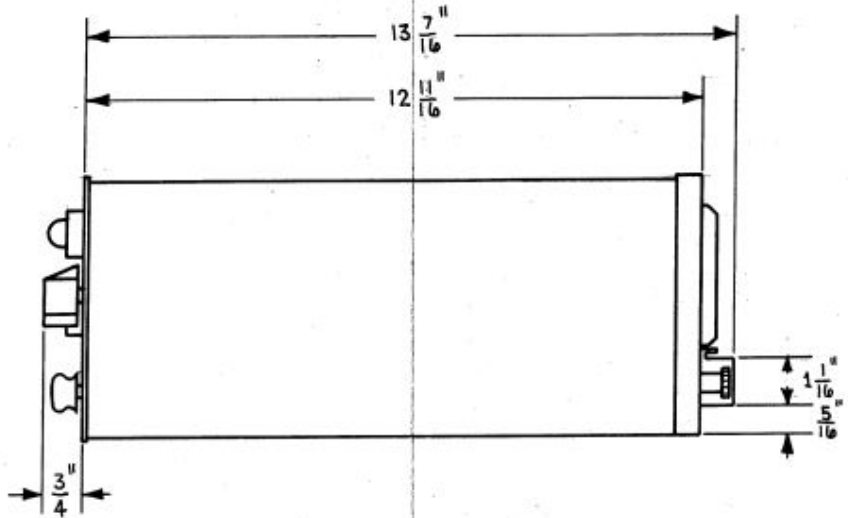
DRG. 80213C4.

P.V.-1126-O

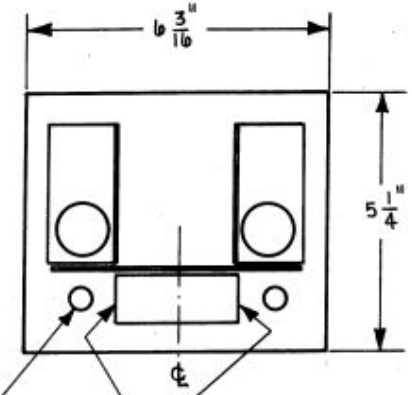
THIRD ANGLE PROJECTION

NOTE:
VENTILATION HOLES IN
ALL FOUR SIDES AND BACK.





MAX. PROJECTION
OF CONTROLS.



OPENINGS FOR CABLE IN
BOTH SIDES OF PROTECTIVE
COVER FOR CONNECTOR.

KNURLED CAPTIVE SCREWS
FOR REMOVAL OF COVER.

SCALE: 1:3

OUTLINE DIMENSIONS FOR
"SKYRANGER" H.F. TRANSCEIVER
DRG. 80213C1

P.V.-1125-O

PLATE 1

P.V.-1130-O

THE A.W.A. SKYRANGER

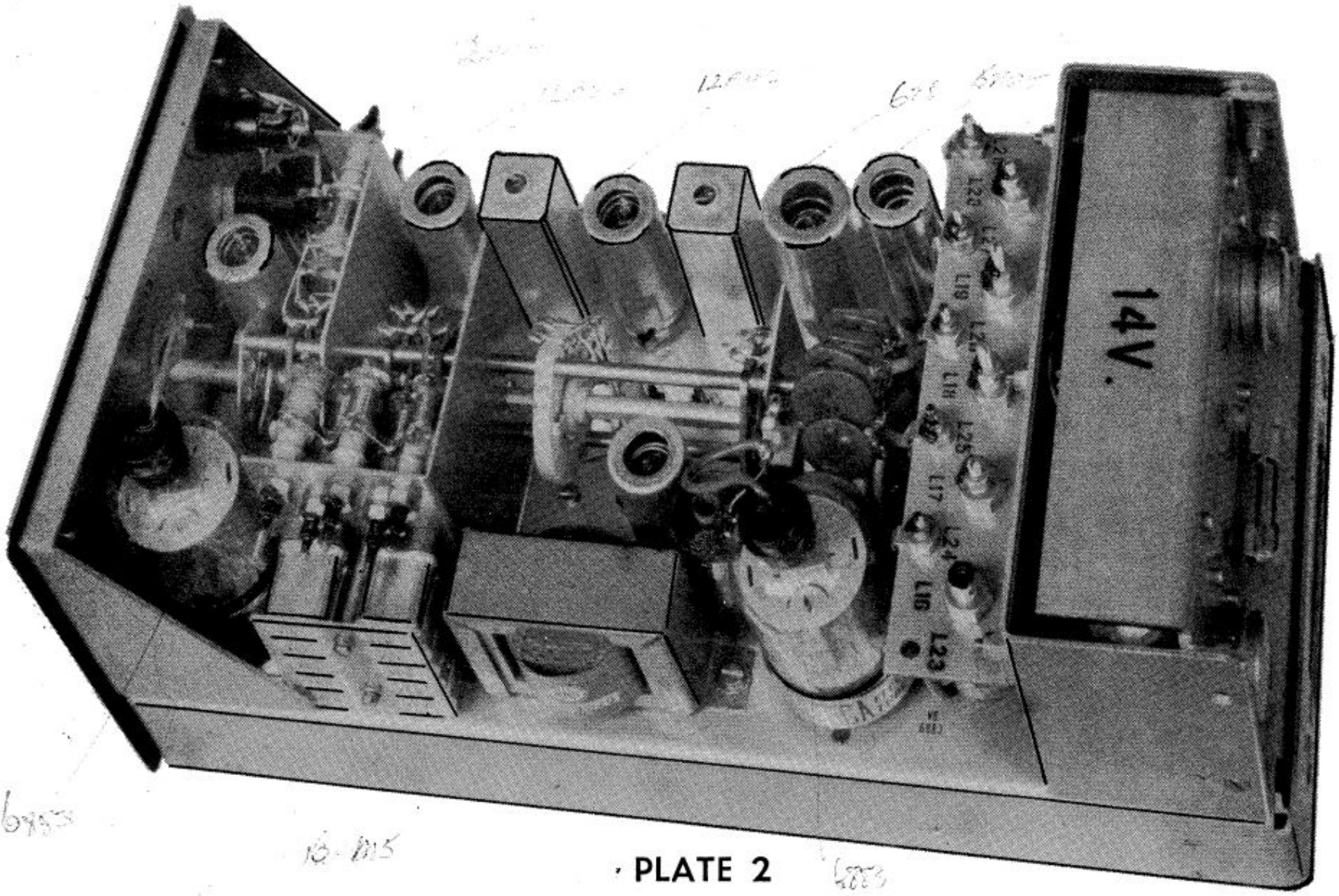


PLATE 2

SHOWING POWER SUPPLY AT REAR

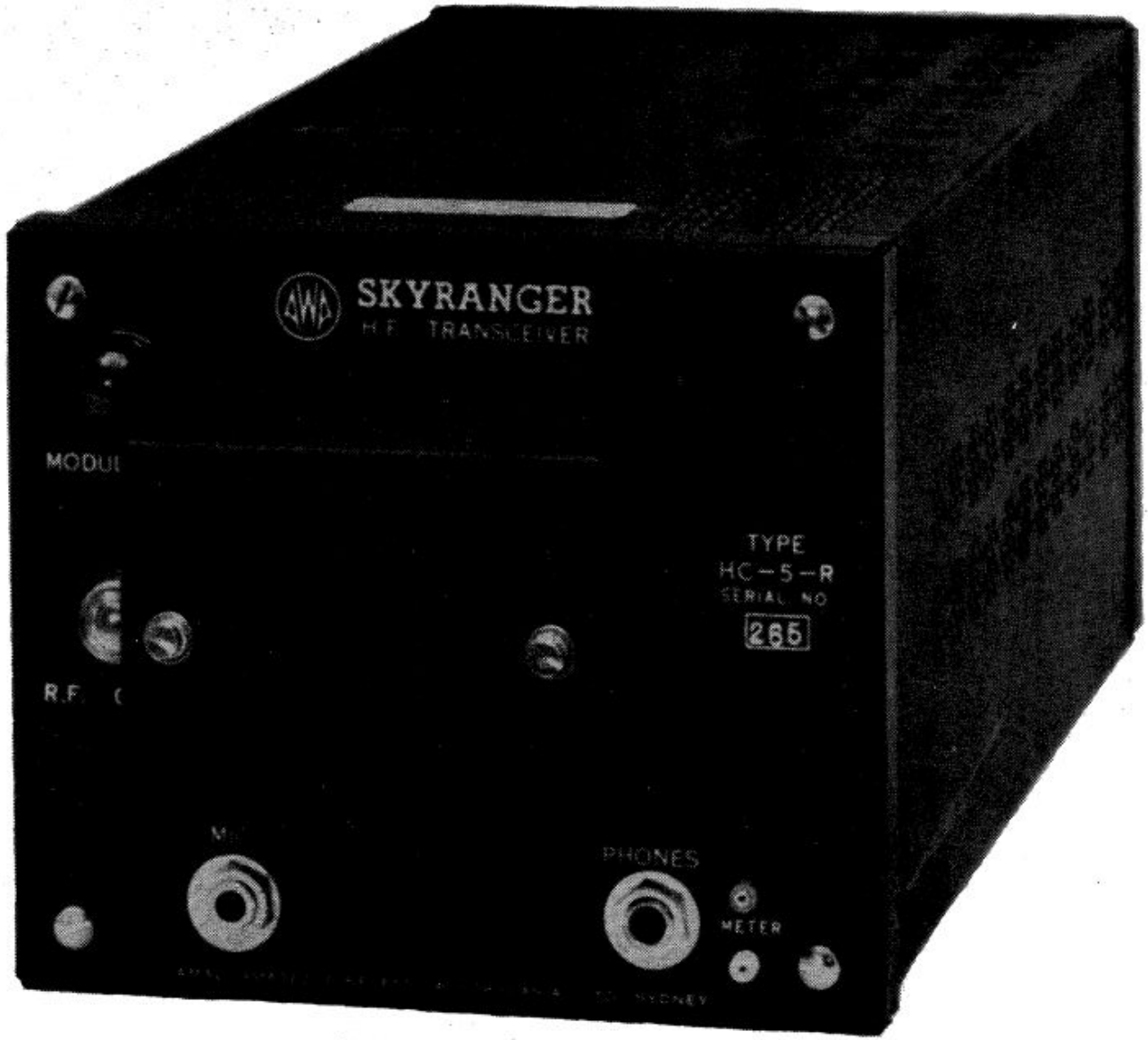
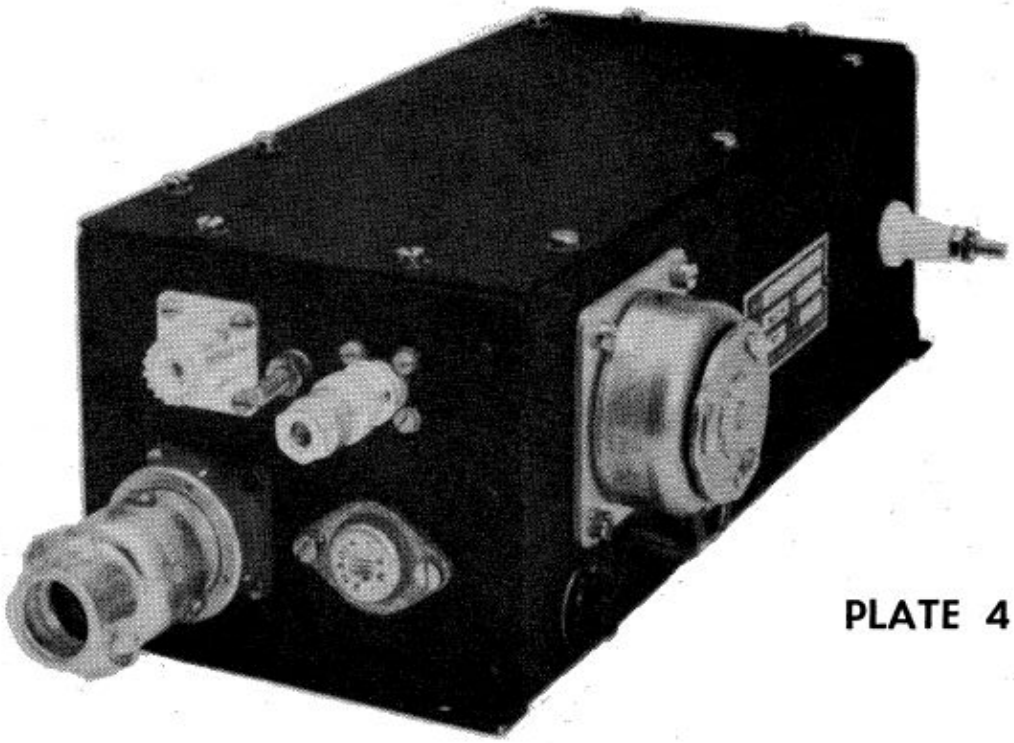


PLATE 3

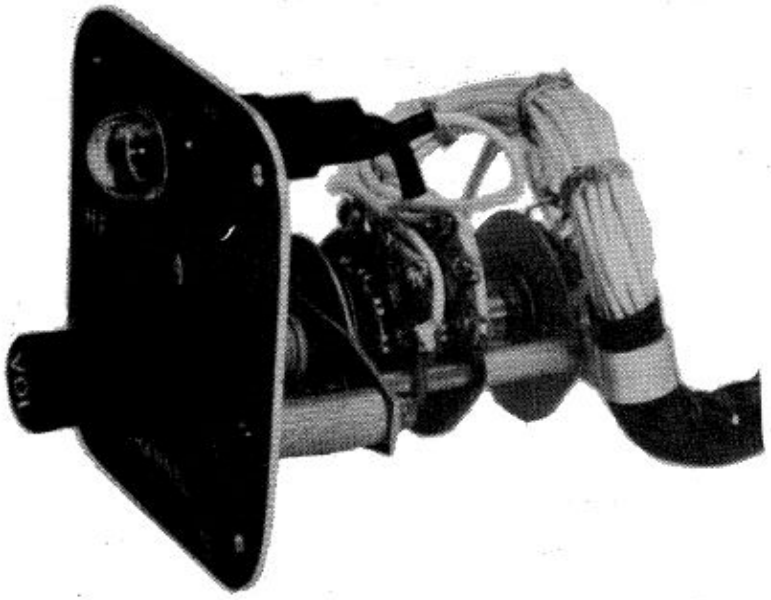
THE A.WA. SKYRANGER HC-5-R

P.V.—1300 - O



AERIAL LOADING UNIT HLC-5

PLATE 4



CONTROL UNIT HCC-5

P.V.—1301 - 9

INSTRUCTION BOOK No. 80213R

PART 2

SKYRANGER H. F. TRANSCEIVER

TYPE HC-5-R

(Manufacturer's Reference 2N80213)

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

47 YORK STREET, SYDNEY

110962

DETAILED INFORMATION

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DETAILED INFORMATION

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	Audio Interwiring HC-5-D and HC-5-R	80213D79
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1.—INTRODUCTION

There are two models of the Skyranger H.F. Transceiver—the HC-5-D (direct control) and the HC-5-R (remote control).

The two models are almost identical except for the method of control. Part 2 of this book describes the remote control model and sets forth the differences in the HC-5-R. It also describes the Control Unit type HCC-5 and the Aerial Loading Unit type HLC-5.

Where lack of space prevents the fitting of a Skyranger HC-5-D in a position convenient for direct control the Skyranger HC-5-R should be used.

2.—TECHNICAL INFORMATION

2.1 General

Technical information for the HC-5-R equipment is the same as for the HC-5-D except for the following details.

2.2 Ancillaries

In addition to the ancillaries set out in Section 1, Part 1 of this book the following items are required:

1. Control Unit type HCC-5.
2. Aerial Loading Unit type HLC-5.

2.3 Dimensions

	HC-5-R	HLC-5	HCC-5
Width (inches)	6-1/4	9-7/8	3-1/4
Height (inches)	5-1/4	3-3/16	3-1/4
Depth (inches)	15-1/2	4-3/8	3-7/8
Weight	10.5lb.	3lb.	12oz.

3.—BRIEF DESCRIPTION

3.1 General

The receiver, transmitter and power supply sections of the equipment are identical with the HC-5-D model as described in Section 2, Part 1 of this book. The main difference in the two models is that the channel selector switch in the HC-5-R is driven by a rotary solenoid.

A control unit provides channel selection, ON/OFF switching and volume control.

An Aerial Loading Unit type HLC-5 is normally used with the HC-5-R to provide automatic switching of the aerial loading coil when changing channels. If preferred the manually-switched aerial loading coil can be used provided that it can be mounted within reach of the operator.

3.2 Transceiver

Channel change operation in the remotely controlled model is by means of a rotary solenoid mounted on the front panel of the transceiver in a metal cover projecting 2½ inches. Interwiring between the transceiver and the remote control includes wiring for all control facilities. The channel number selected is visible through a window on the top of the cover.

R.F. OUTPUT and MODULATION indicators are retained on the front panel with the MIC and PHONES jacks to facilitate maintenance and tuning of the unit.

3.3 Control Unit

The power ON/OFF switch, channel-selector switch, volume control and R.F. indicator are mounted on the Control Unit type HCC-5. Microphone and headphone jacks are normally mounted on the instrument panel or in a jack box such as the type ZA-1. The channel selector switch controls rotary solenoids in both the transceiver and the aerial loading unit.

The leads from the control unit are terminated in a connector to allow easy removal from the aircraft for maintenance and servicing.

3.4 Aerial Loading Unit

The Aerial Loading Unit type HLC-5 provides an automatic means of selecting the aerial loading inductance appropriate to the selected frequency. It can be used with either the locally or the remotely controlled Skyranger.

4.—INSTALLATION

4.1 General

For general installation instructions on the transceiver refer to Section 3, Part 1 of this book.

Typical installation diagrams showing the control circuits involved in the remote version of the Skyranger are included in this book. Variations from these may be necessary to suit individual aircraft installation requirements.

Both the locally and remotely controlled Skyranger installations can incorporate either the automatic aerial loading unit or the manually-switched aerial loading coil. The installation of the manually-switched coil is described in paragraph 3.3.2, Part 1 of this book.

A trailing aerial installation can be used with either type of Skyranger or combined with a fixed installation when either type of aerial loading system is used.

4.2 Mounting the Transceiver in the Aircraft

The transceiver can be located in any convenient position because all controls for operation of the equipment are located on the control unit. The location should permit free movement of air around the unit for ventilation and a minimum length of cable to the control unit and aerial loading unit. Short lengths of coaxial cable to the aerial loading unit will minimise r.f. losses in the installation.

Cable lengths should preferably not exceed 17 feet, although longer cables are permissible if necessary.

In aircraft where the vibration level is high it may be desirable to shockmount the transceiver in order to reduce the possibility of failure due to vibration. Shockmounting should be done in an approved manner. The type of shockmount used, and the method of shockmounting, will depend on the particular installation. In all cases bonding strips must be provided to bond the case of the transceiver to the airframe.

Drawing No. 80213C7 shows the recommended method of shockmounting the remote-control transceiver type HC-5-R.

4.3 Fitting the Control Unit Type HCC-5

The control unit is designed to be mounted in a standard 3-1/8 inch instrument panel cut-out but it can be mounted in any other fashion convenient to the operator. If desired the essential components of the control unit, i.e., power ON/OFF switch, volume control, channel-selector switch and R.F. indicator, can be mounted separately and in any convenient position.

A connector on a short length of cable is attached to the control unit allowing it to be conveniently disconnected from the interwiring.

The channel selected on the control unit is identified by a number (1 to 5) in a window aperture. A chart showing the frequency on each channel should be fixed in some convenient position in the cockpit.

4.4 Aerial Loading Unit Type HLC-5

The Aerial Loading Unit type HLC-5 must be mounted as close as practicable to the aerial lead-through insulator to which it is connected by a short length of well-insulated wire.

Electrical connection to the unit is to the control unit in the HC-5-R installation, or to the transceiver in the HC-5-D installation. A length of coaxial cable type RG58A/U connects the unit to the transceiver.

When a series capacitor is required to tune the aerial to resonance it is mounted inside the aerial loading unit.

4.5 Trail/Fixed Switch

A TRAIL/FIXED changeover aerial switch is necessary when both fixed and trailing aerials are installed. The switch can be mounted in some convenient position, preferably close to the control unit.

Installation details of a remote controlled Skyranger (HC-5-R) using an aerial loading unit with both fixed and trailing aerials are given in drawing No. 80213C5.

4.6 R.F. Indicator

If the Aerial Loading Unit type HLC-5 is not used in a remote controlled Skyranger installation the R.F. indicator on the Control Unit will not operate. Examples of such installations are where only a trailing aerial is used and where the manually switched aerial loading coil is used instead of the aerial loading unit.

A description of an R.F. indicator for use in such cases is given in sub-section 5.5, Part 2 of this book.

For installation details refer to drawing No. 80213C6.

5.—TECHNICAL DESCRIPTION

5.1 General

A full description of the transceiver is given in Part 1 of this book and reference to it should be made for a circuit description. Drg. 80213A2 is the circuit diagram applicable to the HC-5-R.

5.2 Control System

The control system employs a rotary solenoid incorporating a detent mechanism and interruptor contacts with a spark suppression diode and capacitor. In the HC-5-R installation the channel-selector master switch wafers are in the control unit and the slave wafers are in the HC-5-R transceiver and aerial loading unit. When the aerial loading unit is used with the HC-5-D the master switch wafers are in the transceiver and the slave wafers are in the aerial loading unit.

The master and slave switch wafers in the transceivers and the control unit are identical but the slave switch wafer in the aerial loading unit is different.

Interconnection is via a "four-wire plus earth re-entrant wire saving circuit" for each slave wafer.

5.3 Aerial Loading Unit

A rotary solenoid is used in the aerial loading unit to rotate the loading coil selector switch to the position corresponding to the channel selected in the transceiver. The rotary solenoid is controlled by the frequency selector switch in the control unit in a HC-5-R installation or in the transceiver in a HC-5-D installation.

A changeover TRAIL/FIXED aerial switch is necessary in aircraft where both types of aerials are installed. When this switch is in the TRAIL position it causes the rotary solenoid to drive the loading unit into the "trailing aerial" condition regardless of the channel selected. This means that any channel may be operated on the trailing aerial by selecting the required channel and tuning the trailing aerial by means of the brilliance of the R.F. OUTPUT indicator lamp.

5.4 Rotary Solenoid

Low tension is supplied via the rotary solenoid coil and the interruptor contact to the slave wafer wiper contact. When the channel selector switch is turned to a new position it connects an earth to the slave wafer contact which causes the solenoid coil to become energised and the mechanism will turn clockwise in 30° steps, until the earth is removed by the slave wafer.

At the end of each energised 30° step the interruptor contacts open de-energising the solenoid coil and allowing the spring to return the armature to the rest position where the contacts are again closed. This sequence of operations will continue until the earth is removed by the slave wafer.

When the interruptor contacts open, the field collapses into the solenoid coil inducing a large back e.m.f. which is short-circuited by the

rectifier, the energy being dissipated in the resistance of the rectifier and the coil. The capacitor across the interruptor contacts provides spark suppression.

The aerial loading unit slave wafer is designed so that when the TRAIL/FIXED changeover switch is in the TRAIL position the slave wafer becomes a self open circuit device with the rotary solenoid rotating until the TRAIL position is found. With the TRAIL/FIXED selector switch in the FIXED position the master switch wafer in the frequency selector switch resumes control and both loading unit and transceiver rotary solenoid units will rotate to the channel selected.

5.5 R.F. Indication

The r.f. indicator circuit consists of a small toroid transformer, a transistor and diode in the aerial loading unit and a lamp in the control unit. The emitter of the transistor is connected to the +l.t. through the filament of the lamp and the base is connected in series with a diode and the secondary winding of the transformer to the +l.t. In this condition the transistor is cut-off and no current flows through the lamp. When the transmitter is keyed the r.f. current to the aerial will induce a voltage in the secondary winding of the transformer. The resultant current flow is rectified by the diode thus decreasing the positive bias voltage on the transistor base. The transistor will now be conductive and the low resistance path between emitter and collector will allow a current flow from the +l.t. through the lamp. R.F. by-pass capacitors are connected across the leads to the R.F. OUTPUT lamp and from the transistor base to the +l.t.

When a manually switched loading coil is used with a remotely controlled Skyranger the R.F. OUTPUT indicator on the control unit will not be operative because the indicator circuits are contained in the aerial loading unit type HLC-5. Indication of r.f. output can be obtained in this case by a filament type lamp receiving its current from a secondary winding of a toroid transformer consisting of two turns of insulated wire around two ferrite rings. The ferrite rings are placed over the inner conductor of the coaxial cable near where it is terminated on the aerial loading selector switch. The lamp should be situated so that the maximum length of connecting wires to it is not more than about twelve inches. The wires should be twisted together.

A similar method of r.f. indication can be used when a trailing aerial only is used with the remotely controlled Skyranger.

6.—MAINTENANCE

6.1 General

The maintenance of the HC-5-R is the same as for the HC-5-D with the additional inspection and care of the control unit, aerial loading unit and rotary solenoid.

6.2 Before First Flight Inspection

This inspection is the same as for the HC-5-D in sub-section 5.2, Part 1 of this book.

6.3 Minor Inspection

This inspection is the same as in sub-section 5.3, Part 1 of this book with the following additional checks:

(a) Check the condition and security of the shockmounts where used.

(b) Check the attachment and security of the control unit and aerial loading unit.

(c) Operate the channel selector switch on the control unit and check satisfactory operation of the rotary solenoid.

6.4 Major Inspection

As per sub-section 5.4, Part 1 of this book.

6.5 Equipment Overhaul

The overhaul of the HC-5-R is as for the HC-5-D described in sub-section 5.5, Part 1 of this book with the additional inspection of the rotary solenoid, aerial loading unit and control unit.

6.5.1 Rotary Solenoid

(a) Inspect the rotary solenoid assembly for firm attachment.

(b) Examine the contacts for condition and cleanliness and clean if necessary. Re-surface the interruptor contact faces as required.

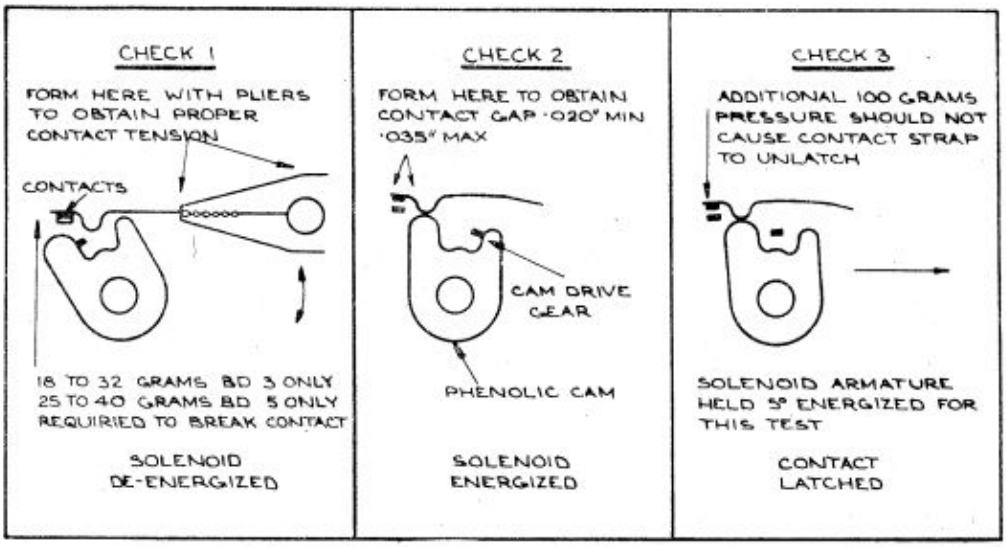
(c) Connect the unit to the remote control test set-up and check the operation of the rotary solenoid.

(d) Check that there is negligible sparking at the interruptor contacts. Replace the cover.

(e) Check that the unit stops at the correct channel for clockwise and anti-clockwise operation of the channel selector and that the channel indicator is correctly positioned in the window aperture.

(f) Check the operation of the rotary solenoid on 11.0V (14V equipment) and 22.0V (28V equipment).

NOTE: If the unit fails to meet the checks described above, adjustment of the interruptor contacts may be necessary. The adjustment is described below and should be attempted only if necessary and if the proper equipment is available.



NOTES:

1. Form cam drive gear in direction of arrow to obtain latching adjustment by twisting gear close to drive plate.
2. Contacts should not open earlier than 10° before full energised position.
3. For check 2 solenoid must first be advanced to full energised position the return approximately 5°.
4. The torque required to rotate the switch spindle must not exceed 3.5 lb./in. throughout the switch rotation.

6.5.2 Aerial Loading Unit

(a) Examine the unit visually for signs of dirt and corrosion.

(b) Examine all components and associated wiring for good connection and freedom from burning or arcing. Check that all components are secure and that all attachment screws are tight.

(c) Clean the wafer switch and examine the contacts for bending or arcing. Attempts to straighten or realign contacts of this type are not usually successful and the preferred action is to replace the whole wafer when damaged contacts are discovered.

(d) Carry out a check of the rotary solenoid as described under paragraph 6.5.1.

(e) Operate the unit in a test set-up with a 50-ohm R.F. power meter connected to the trailing aerial terminal. With the TRAIL/FIXED aerial selector switch on the TRAIL position, key the transmitter and check that the R.F. indicator lamp on the control unit is illuminated.

6.5.3 Control Unit

(a) Examine the unit visually for signs of dirt and corrosion.

(b) Examine the wiring and connections for broken strands and good condition. Check that all components are secure and screws are tight.

(c) Clean and examine the switch wafers and contacts.

(d) Test the potentiometer with an ohmmeter, ensuring that the moving arm is making positive connection to the resistance strip at all points.

(e) Operate the power ON/OFF switch and check continuity of the switch in the ON position and open circuit in the OFF position.

(f) Check that the R.F. indicator lamp is the correct type.

(g) Check that the knobs are securely attached to the shafts and that the channel indicator is properly aligned in the window aperture.

(h) Check that the front panel is clean and that the lettering is legible.

(i) Connect the unit in the test set-up and carry out a full functional check, paying particular attention to the potentiometer for quietness of operation.

7.—COMPONENT SCHEDULE

HC-5-R

Items as for the HC-5-D transceiver plus the following for the rotary solenoid.

Capacitor, 0.01μF ±10%, 125VW, tub., polyester	Philips C296AA/A
Rectifier, silicon diode	1N1763
Rotary Solenoid, shaft modified to 1/2 inch:	
for 14V unit	NSF LX/SI1/14634/-DH1
for 28V unit	NSF LX/SI1/14935/-DH1

7.1 Control Unit Type HCC-5

Circuit Ref. No.	Description	Manufacturer's Ref. No.
	Holder, lamp (red bezel)	RAFI 2210LS4
	Knob, volume	AWA 2992.12
	Knob, frequency change	AWA 2992.8
2LP1	Lamp, pilot	GE44
SKC	Plug, 19-way	SK-19-22C
2RV1	Resistor, variable, 3kΩ, curve H, with switch	Ducon PSS
2SWA/1	Switch, wafer	AWA 2992.13
2SWA/2	Switch, wafer	AWA 2992.13

7.2 Aerial Loading Unit Type HLC-5

	Capacitor, 47pF ±20%, ceramic (if reqd.)	Ducon CAB18
3C1	Capacitor, 0.001μF ±10%, 500VW	Simplex SS
3C2	Capacitor, 0.001μF ±10%, 500VW	Simplex SS
3C3	Capacitor, 0.1μF ±10%, 125VW, tub., polyester	Philips C296AA/A
	Coil clip	58971V3
SKE	Connector, 12-way	SK-12-32S
SKG	Connector, coaxial socket	UG-290A/U
SKK	Connector, coaxial socket	Film & Equipment SO-239
3FS1	Fuse, glass cartridge, loaded 3A, 3AG	Belling Lee L1055
	Fuse holder	Belling Lee L356

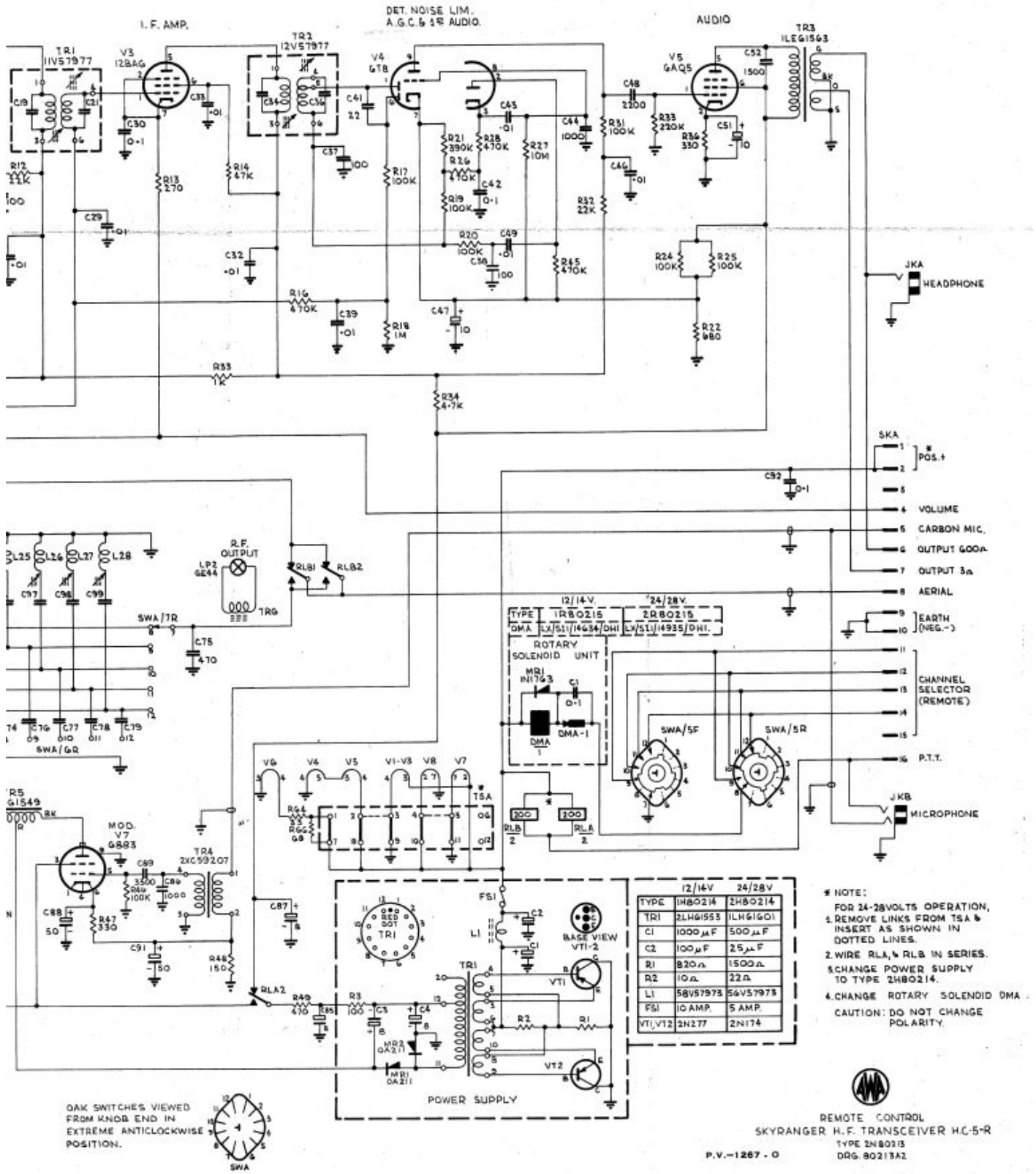
Aerial Loading Unit type HCL-5 (continued)

Circuit Ref. No.	Description	Manufacturer's Ref. No.
3L1	Inductor, aerial loading	AWA 403V60101
FT1	Insulator, lead-through	LT075
3MR1	Rectifier	1N34A
3MR2	Rectifier	1N1763
3R1	Resistor, 180Ω ±10%, 1/2W, comp., grade 2	
3R2	Resistor, 470kΩ ±10%, 1W, comp., grade 2	
	Socket, red	Oxley 50S/156 (red)
	Socket, white	Oxley 50S/156 (white)
3DMA	Rotary Solenoid	AWA 2997.7
3SWA1	Switch, wafer, ceramic	AWA 2997.5
3SWA2	Switch, wafer, ceramic	AWA 2997.5
3SWA3	Switch, wafer, ceramic	AWA 2997.6
	Index Mechanism	AWA 214296
3TR1	1 Ferramic shell, Part No. 39117	AWA 787540
3VT1	Transistor	2N301A

SKYRANGER MODELS HC-5-D AND HC-5-R

There are two models of the Skyranger H.F. Transceiver — the HC-5-D (direct control) and the HC-5-R (remote control). The two models are very similar, differing chiefly in the method of control.

The first part of this book describes the direct-control model, HC-5-D. Much of this part applies also to the HC-5-R, but, where there are differences, these are described in Part 2 of this book.

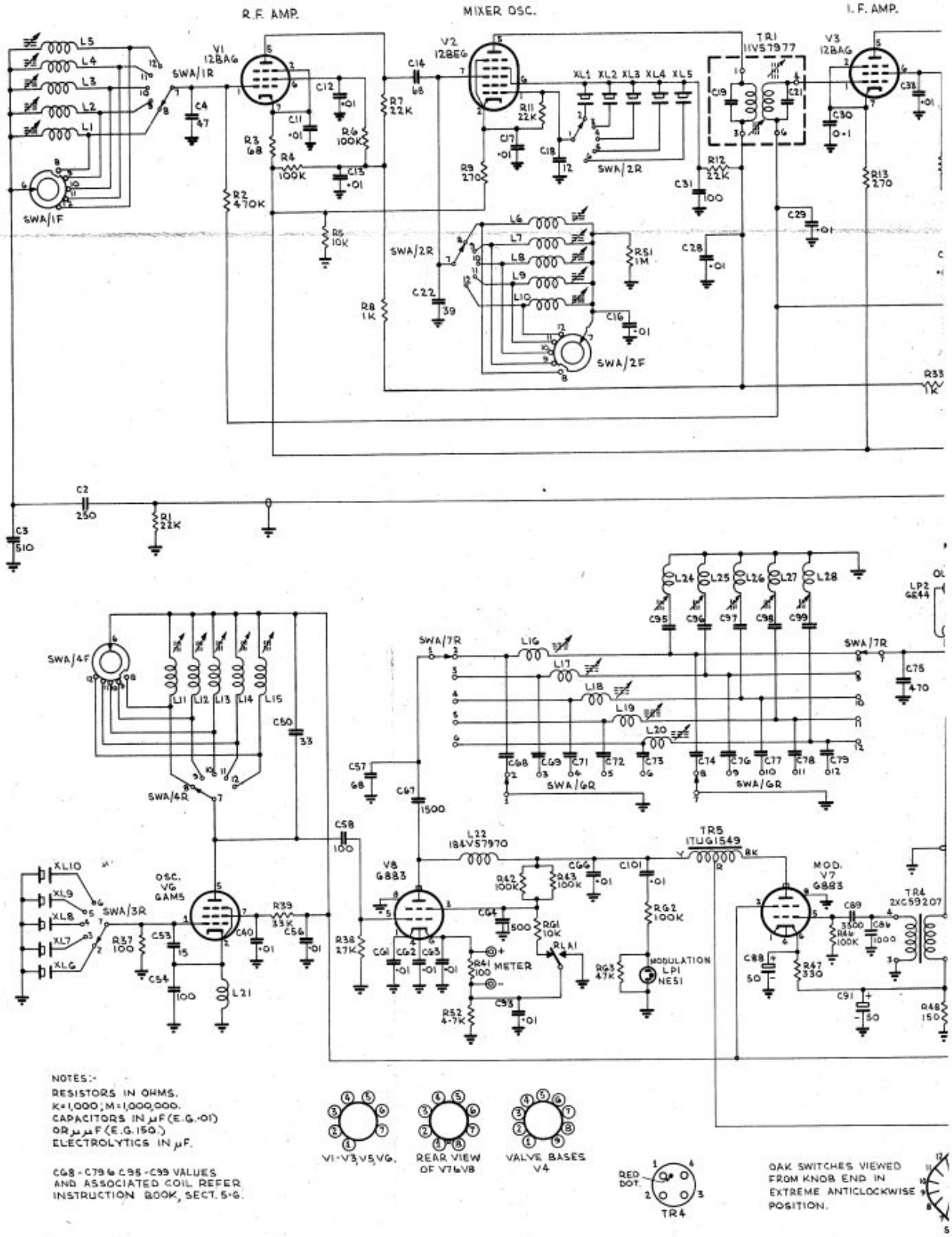


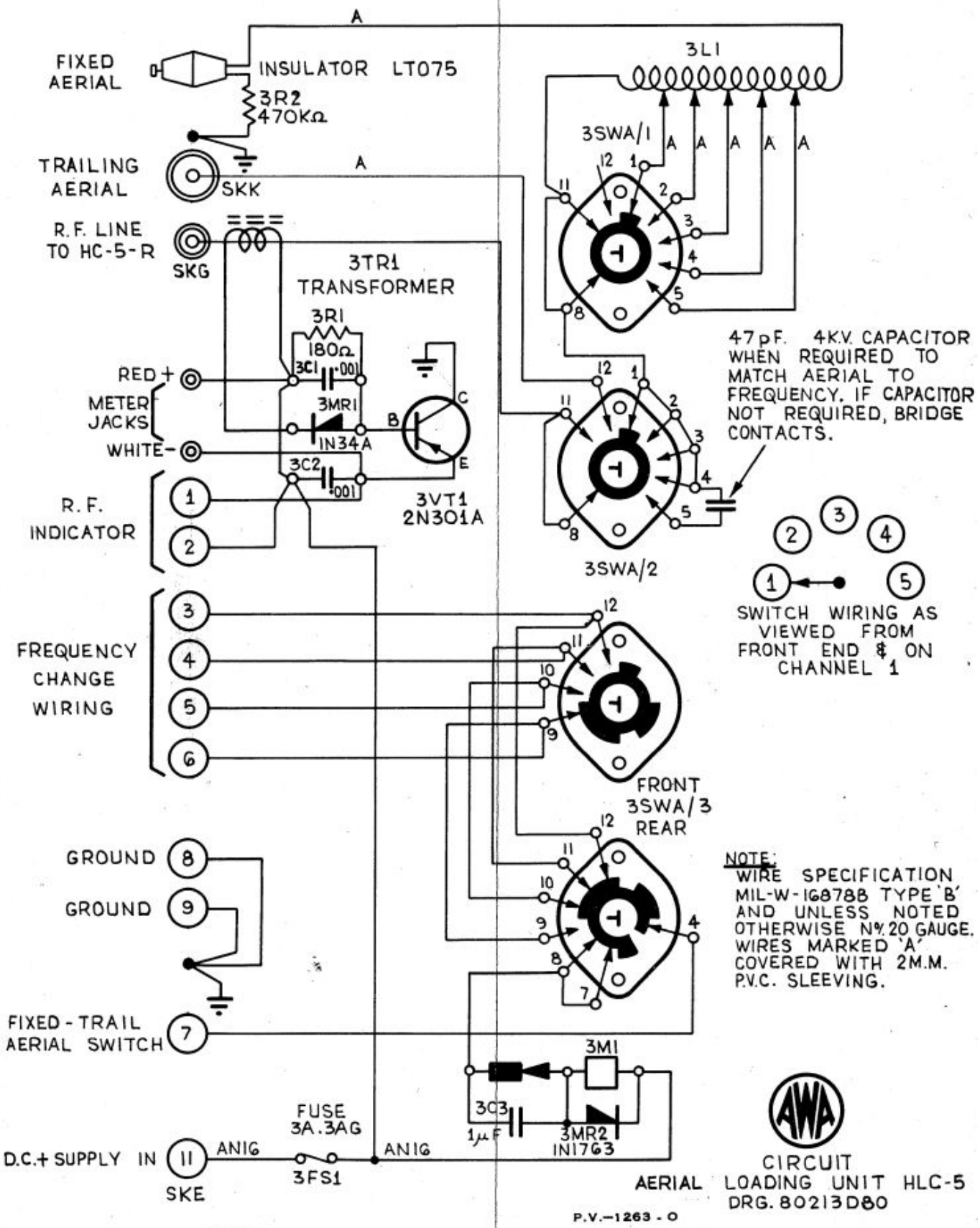
TYPE	12/14V	24/28V
TR1	2LH61553	1LH61601
C1	1000 μF	500 μF
C2	100 μF	25 μF
R1	820 Ω	1500 Ω
R2	10 Ω	22 Ω
L1	58V57973	56V57973
FS1	10 AMP.	5 AMP.
VT1, VT2	2N277	2N174

* NOTE:
FOR 24-28 VOLTS OPERATION,
1. REMOVE LINKS FROM TSA & INSERT AS SHOWN IN DOTTED LINES.
2. WIRE RLA & RLB IN SERIES.
3. CHANGE POWER SUPPLY TO TYPE 2HB0214.
4. CHANGE ROTARY SOLENOID DMA.
CAUTION: DO NOT CHANGE POLARITY.

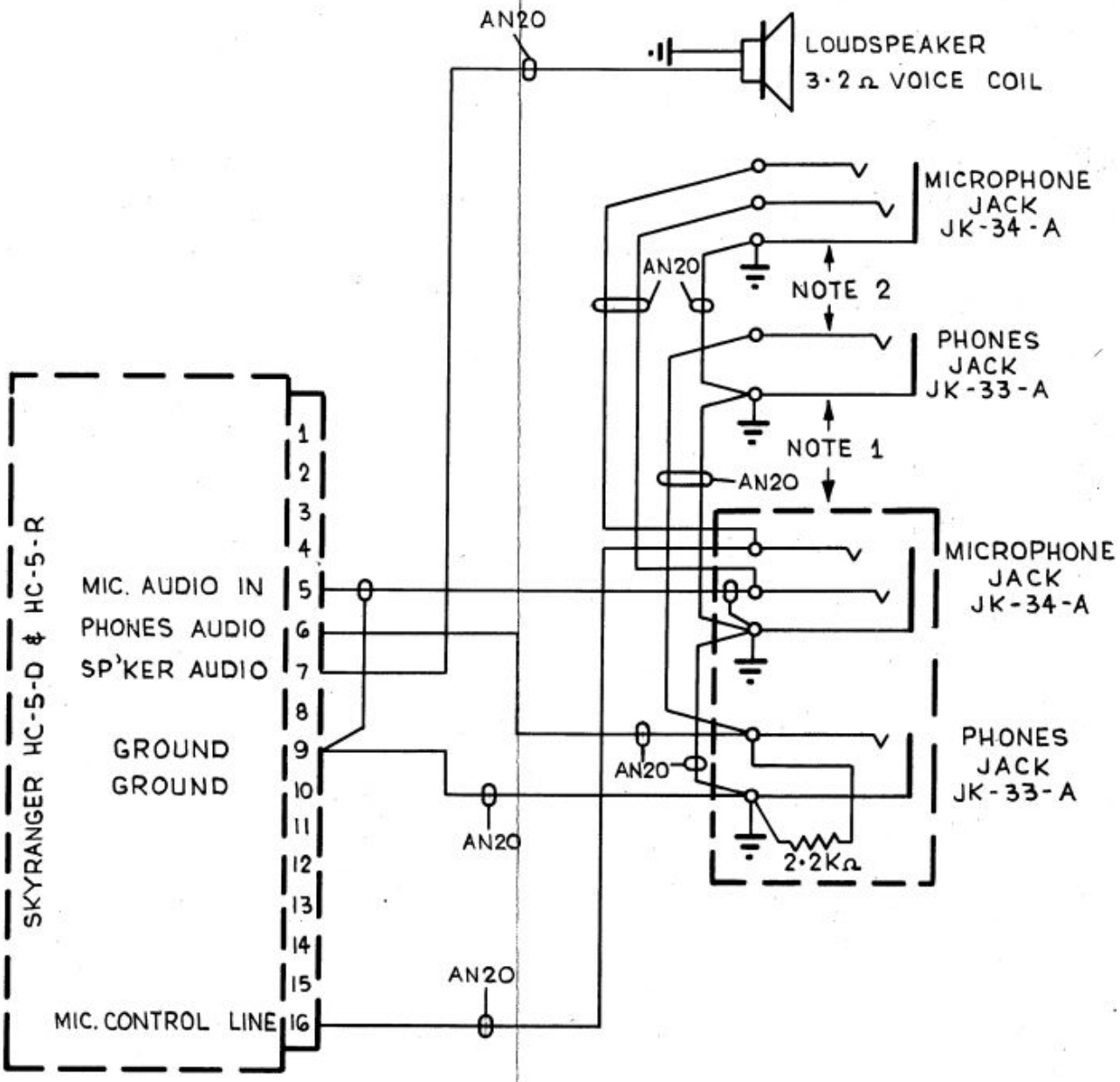
REMOTE CONTROL
SKYRANGER H.F. TRANSCEIVER H.C-5-R
TYPE 2NB0213
DRG. B0213A2

P.V.-1267 - O


R.F. AMP.
MIXER OSC.
I.F. AMP.
V1 12BA6
V2 12BE6
TR1 IIV57977
V3 12BA6
SWA/1R
SWA/1F
SWA/2R
SWA/2F
SWA/3R
SWA/4F
SWA/4R
SWA/6R
SWA/7R
L1 L2 L3 L4 L5
L6 L7 L8 L9 L10
L11 L12 L13 L14 L15
L16 L17 L18 L19 L20
L21
L22 184V57970
L24 L25 L26 L27 L28
XL1 XL2 XL3 XL4 XL5
XL6 XL7 XL8 XL9 XL10
R1 22K
R2 470K
R3 68
R4 100K
R5 10K
R6 100K
R7 22K
R8 1K
R9 270
R11 22K
R12 22K
R13 270
R33 1K
R37 100
R38 27K
R39 3.3K
R41 100
R42 100K
R43 100K
R46 100K
R47 330
R48 150
R51 1M
R52 4.7K
RG1 10K
RG2 100K
RG3 47K
C2 250
C3 510
C4 47
C11 .01
C12 .01
C14 68
C15 .01
C16 .01
C17 .01
C18 12
C22 39
C28 .01
C29 .01
C30 .1
C31 100
C38 .01
C40 .01
C50 33
C53 15
C54 100
C56 .01
C57 68
C58 100
C67 1500
C68 C69 C71 C72 C73 C74 C76 C77 C78 C79
C75 470
C95 C96 C97 C98 C99
C101 .01
CG1 CG2 CG3 .01
CG4 500
CG6 .01
C88 50
C89 3300
C86 1000
C91 50
V8 G883
MOD. V7 G883
OSC. VG GAM5
TR5 ITUG1549
TR4 2XC59207
RLA1
METER
MODULATION LP1 NE51
LP2 6E44
OSC. COIL
NOTES:-
RESISTORS IN OHMS.
K=1,000; M=1,000,000.
CAPACITORS IN µF (E.G. .01)
OR µµF (E.G. 150.)
ELECTROLYTICS IN µF.
CG8 - C796 C95 - C99 VALUES AND ASSOCIATED COIL REFER INSTRUCTION BOOK, SECT. 5-6.
V1-V3, V5, V6.
REAR VIEW OF V7&V8
VALVE BASES V4
RED DOT.
TR4
OAK SWITCHES VIEWED FROM KNOB END IN EXTREME ANTICLOCKWISE POSITION.



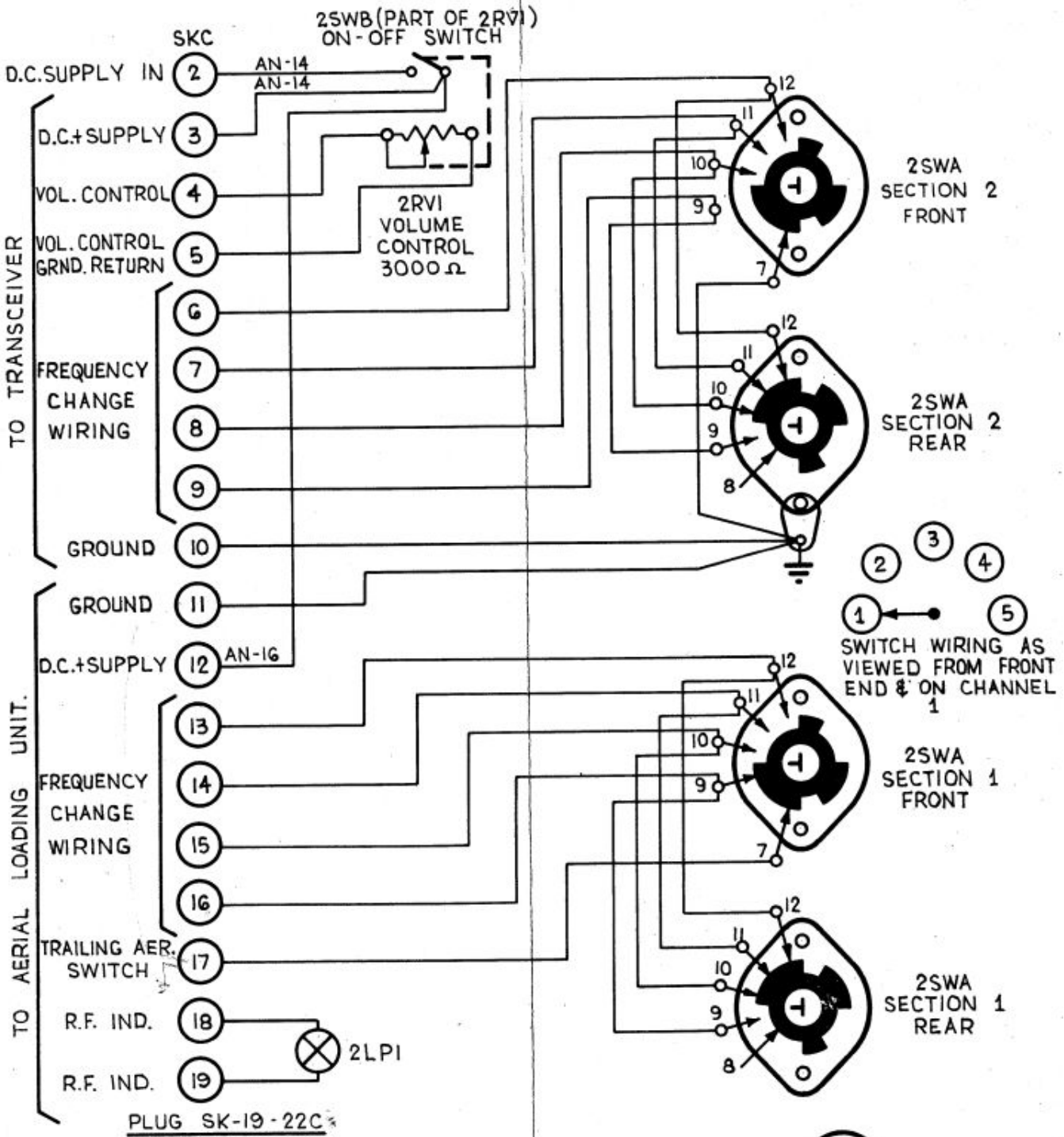
NOTE:
WIRE SPECIFICATION MIL-W-16878B TYPE 'B' AND UNLESS NOTED OTHERWISE No. 20 GAUGE. WIRES MARKED 'A' COVERED WITH 2M.M. P.V.C. SLEEVING.

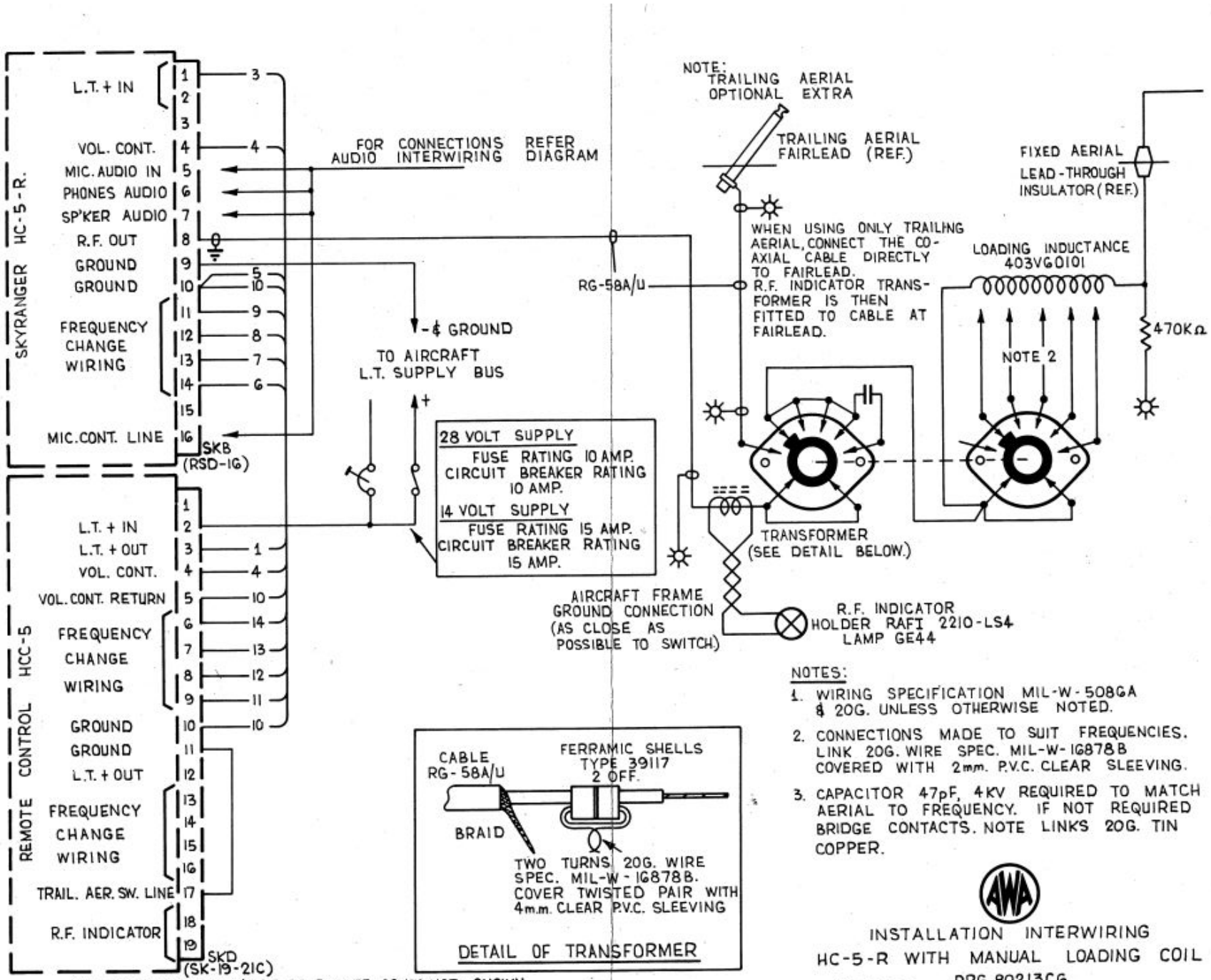


1. PHONE & MICROPHONE JACKS MAY EITHER BE MOUNTED DIRECTLY ON AIRCRAFT INSTRUMENT PANEL OR USED AS A JACK BOX ASSEMBLY TYPE ZA-1.
2. DELETE THESE JACKS & WIRING IF ONLY ONE SET OF JACKS REQUIRED.
3. ALL WIRING TO CONFORM TO MIL-W-5088A SPECIFICATION.

AUDIO INTERWIRING
HC-5-D & HC-5-R

P.V.-1260-0 DRG. 80213D79


2SWB (PART OF 2RV1)
ON-OFF SWITCH
SKC
D.C. SUPPLY IN
2
AN-14
AN-14
D.C.+ SUPPLY
3
VOL. CONTROL
4
VOL. CONTROL GRND. RETURN
5
2RV1
VOLUME
CONTROL
3000 Ω
TO TRANSCEIVER
FREQUENCY CHANGE WIRING
6
7
8
9
GROUND
10
GROUND
11
D.C.+ SUPPLY
12
AN-16
FREQUENCY CHANGE WIRING
13
14
15
16
TRAILING AER. SWITCH
17
R.F. IND.
18
R.F. IND.
19
2LP1
TO AERIAL LOADING UNIT.
PLUG SK-19-22C
2SWA SECTION 2 FRONT
2SWA SECTION 2 REAR
2SWA SECTION 1 FRONT
2SWA SECTION 1 REAR
SWITCH WIRING AS VIEWED FROM FRONT END & ON CHANNEL 1
NOTE:
WIRING SPECIFICATION MIL-W-508GA & UNLESS NOTED OTHERWISE N°. 20G
AWA
CIRCUIT
CONTROL UNIT HCC-5
DRG. 80213D82
P.V.-1261-0



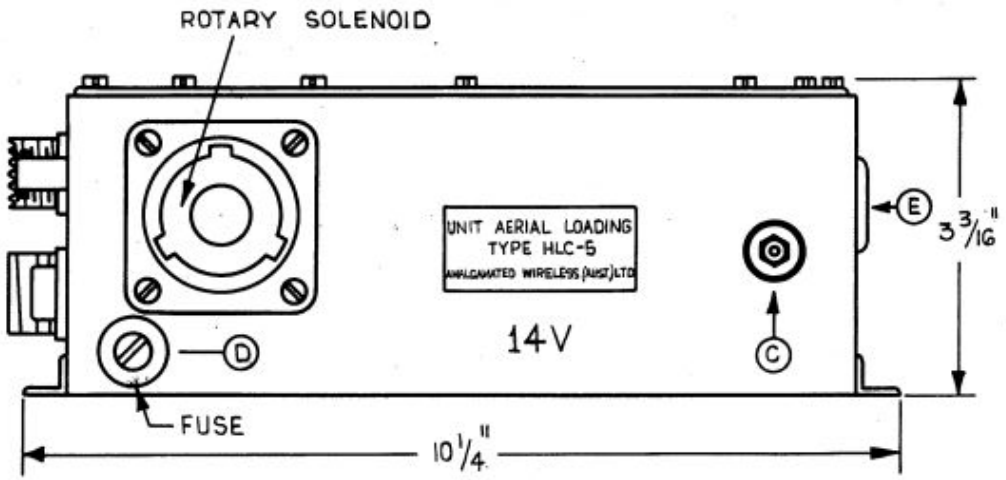
NOTES:

1. WIRING SPECIFICATION MIL-W-5086A & 20G. UNLESS OTHERWISE NOTED.
2. CONNECTIONS MADE TO SUIT FREQUENCIES. LINK 20G. WIRE SPEC. MIL-W-16878B COVERED WITH 2mm. P.V.C. CLEAR SLEEVING.
3. CAPACITOR 47pF, 4KV REQUIRED TO MATCH AERIAL TO FREQUENCY. IF NOT REQUIRED BRIDGE CONTACTS. NOTE LINKS 20G. TIN COPPER.

AWA

INSTALLATION INTERWIRING
HC-5-R WITH MANUAL LOADING COIL

P.V.-1265-0 DRG. 80213CG



NOTES: 1. THE UNIT MAY BE MOUNTED IN ANY POS'N

2. ACCESSIBILITY REQUIREMENTS:

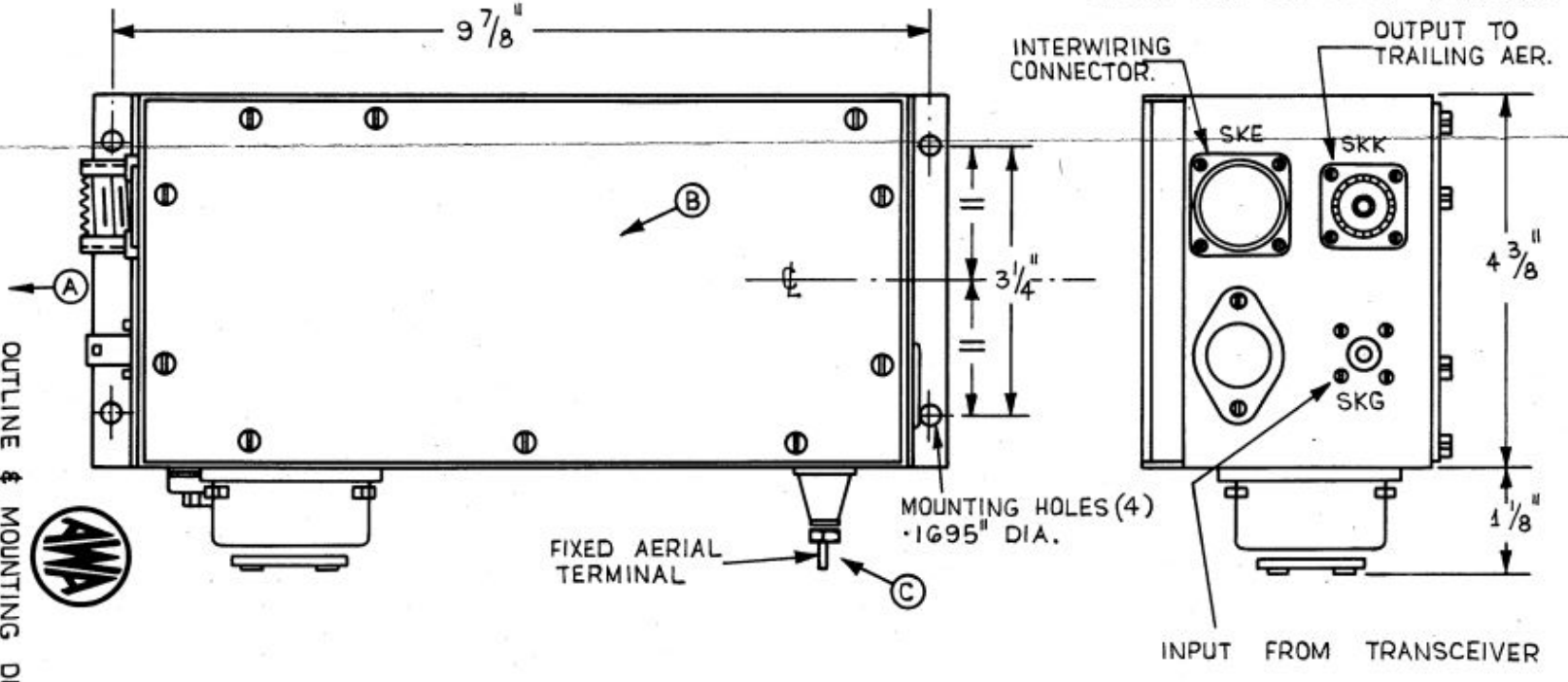
(A) A MINIMUM CLEARANCE OF 3½" SHOULD BE ALLOWED FOR CABLE DISCONNECT'S TO BE MADE.

(B) ACCESS TO UNIT INTERIOR FOR ADJUSTMENTS WHEN TUNING MUST BE PROVIDED. A FREE ACCESS ABOVE THE LID IS DESIRABLE.

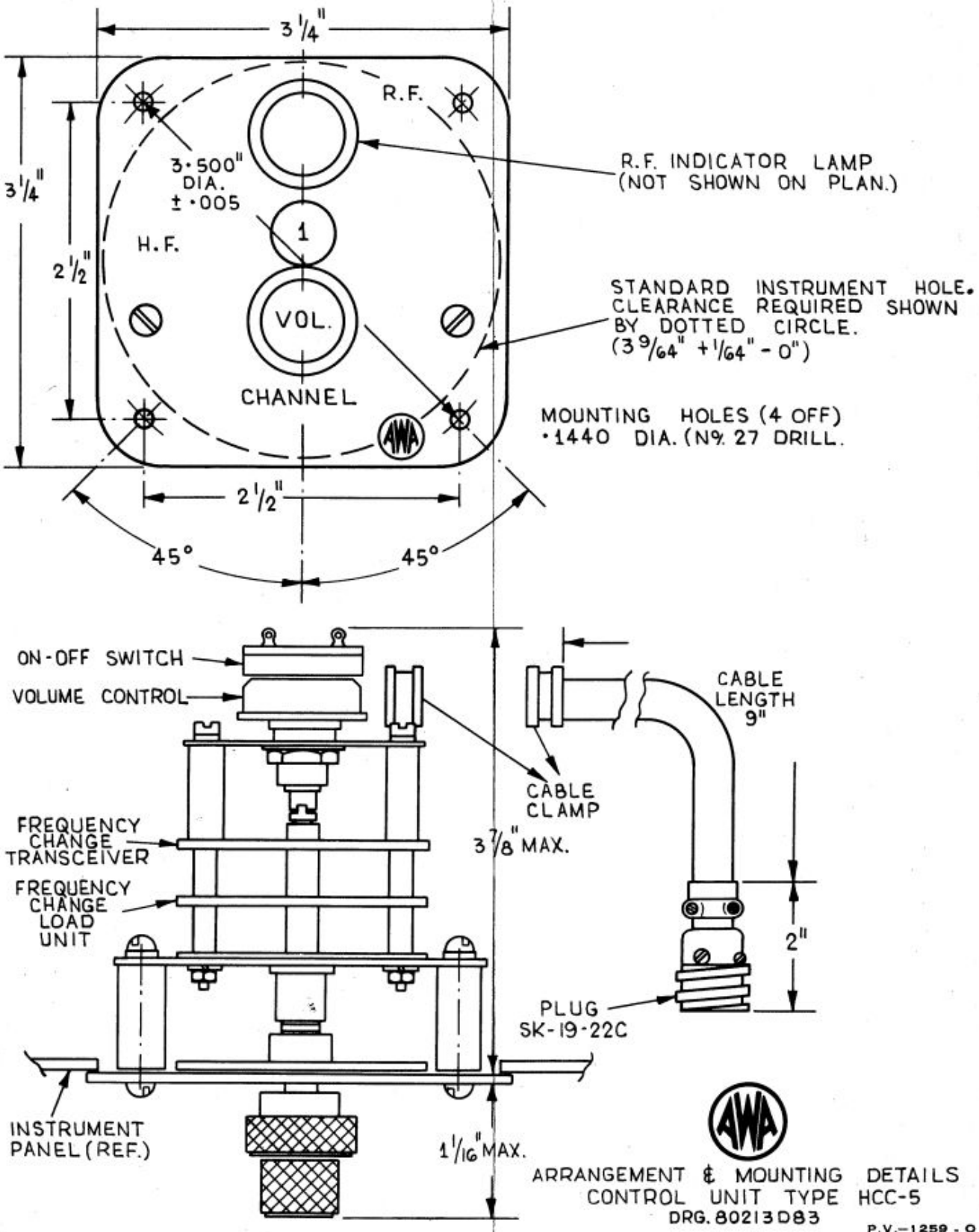
(C) LEAD THROUGH INSULATOR MUST HAVE A CLEARANCE FROM METAL STRUCTURE OF AT LEAST 2". POSITIONING THE INSULATOR TERM'L CLOSE TO METAL EDGES SHOULD BE AVOIDED.

(D) FUSE REMOVAL CLEARANCE IS 3" MIN.

(E) AN ACCESS HOLE FITTED WITH A BLIND GROMMET IS AVAILABLE FOR INSERTING A SCREWDRIVER FOR EASIER COIL CONNECTION TIGHTENING.

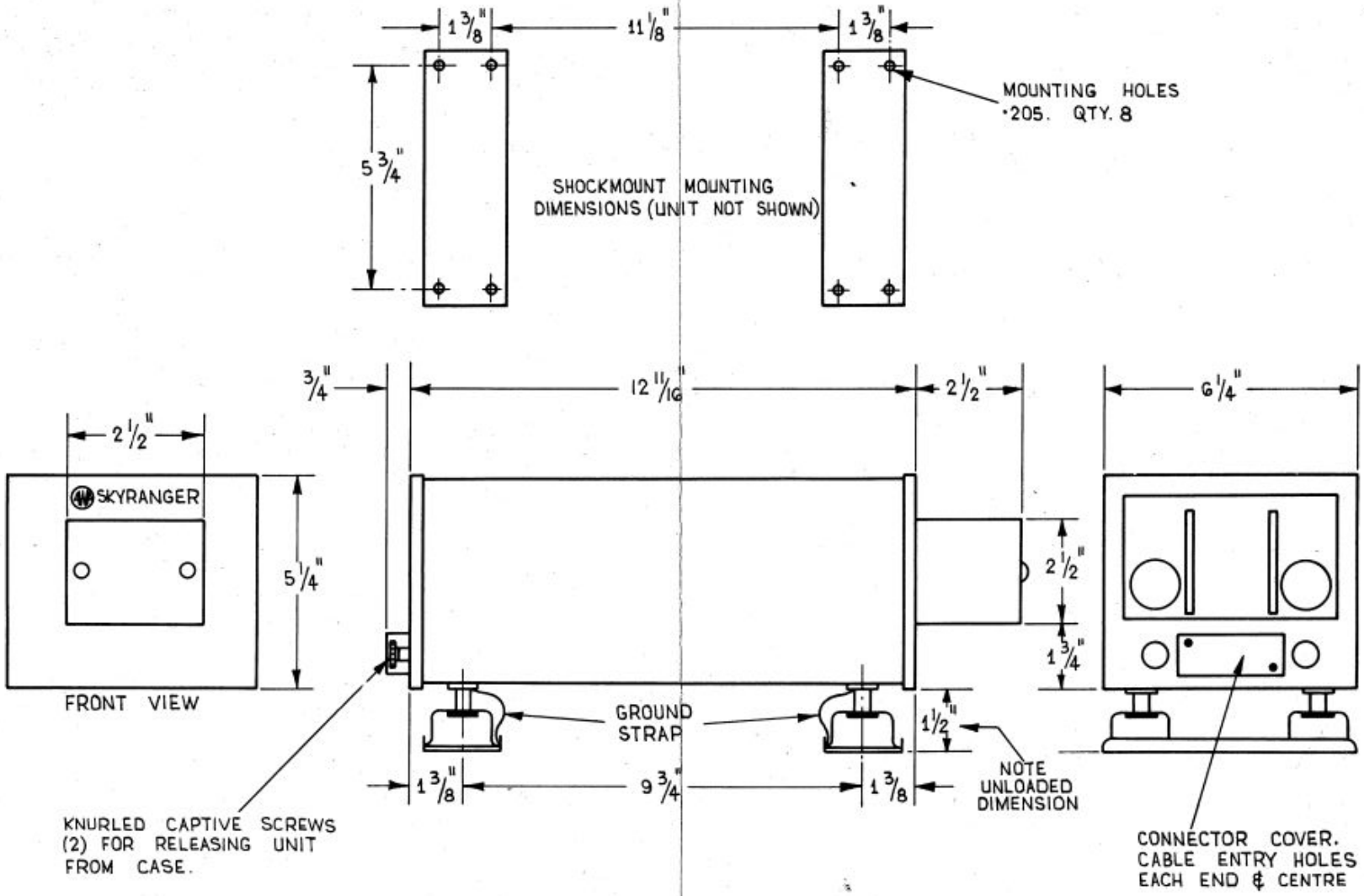


OUTLINE & MOUNTING DETAILS
AERIAL LOADING UNIT HLC-5
DRG. 80213 D81
P.V.-1258-0



ARRANGEMENT & MOUNTING DETAILS
CONTROL UNIT TYPE HCC-5
DRG. 80213D83

P.V.-1259 - O



NOTE:
SHOCKMOUNTS SHOWN ARE OPTIONAL. RECOMMENDED TYPE IS BARRYMOUNT GB770-3G.

OUTLINE DIMENSIONS
'SKYRANGER' H.F. TRANSCEIVER
DRG. 80213C7

P.V.-1266 - O