Marconi

INSTALLING & OPERATING INSTRUCTIONS

FOLDER No.88467
RADIO RECEIVER TYPE SMR-3
WITH POWER UNIT AND CHARGING PANEL
MANUFACTURED FOR
ROYAL CANADIAN NAVY

CANADIAN MARCONI COMPANY
MARCONI BUILDING, MONTREAL
BRANCHES
VANCOUVER WINNIPEG TORONTO HALIFAX ST. JOHN'S, NFLD.

INSTRUCTIONS

FOR

MARCONI SMR-3 MARINE RECEIVER

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CANADIAN MARCONI COMPANY

MONTREAL

INSTRUCTIONS

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CIRCUIT DESCRIPTION

The SMR-3 is a nine-tube thirteen-function superheterodyne receiver designed for marine use. It is built on a very rigid chassis and housed in a metal cabinet. The receiver uses a separate loudspeaker and has a separate battery-operated power pack.

There are six tuning bands covering the frequencies from 97 kc to 515 kc in two bands, and from 1.5 Mc to 30 Mc in four bands. Utilizing the bandspread dial to extend the main scales, the extreme frequency coverages are from 96 kc to 525 kc and 1.49 Mc to 31 Mc.

Five tubes are of the metal type, four of these being single-ended. The tuning indicator and two 6C8G tubes are of the glass type. One stage of r-f amplification and two stages of i-f amplification are used. One of the i-f stages is of the resistance-capacity coupled type. The second detector is an "infinite impedance" triode. The output of the detector passes through an adjustable series-diode noise limiter to the volume control. One stage of a-f amplification is used ahead of the power tube. Manual r-f sensitivity control and A.V.C. are provided, either being made inoperative at will by means of individual switches. An adjustable beat-frequency oscillator with a control switch is employed for c-w reception. A resistance-capacity coupled amplifier feeding a diode provides amplified A.V.C. The start of the A.V.C. action is delayed so that no A.V.C. is supplied unless the signal is sufficiently strong to produce a reasonably loud output. This effect is very desirable in the reception of weak signals.

The power output transformer is an auto-transformer feeding the output terminals through a blocking condenser and the contacts of an output jack on the front panel. A high resistance is connected from the output side of the blocking condenser to ground to prevent this condenser from becoming discharged if the output is opened and so preventing a momentary surge of current when the output circuit is closed. The output jack is for headphones and when a plug is inserted, the output is disconnected

from the output terminals and is connected to a resistance load, thus keeping the power tube properly loaded. At the same time, the output of the jack is connected across a portion of this load resistance, supplying the headphones with a suitable low output.

All r-f and i-f tuned circuits are provided with high-frequency iron cores. These cores are all adjustable. In the r-f circuits these cores are used to adjust the inductances to the exact value required to track the circuits to the scales at the low frequency settings. In the i-f transformers, wave traps and beat-frequency oscillator, the coils are tuned by fixed low-loss mica condensers and the tuning adjustment is by means of the iron cores. The conversion oscillator series tracking condensers are of the low-loss silver-mica type and the tracking adjustment is by means of the iron cores.

The second detector is an "infinite impedance" triode. This type of detector does not load the i-f transformer as would a diode detector, thus allowing full selectivity to be obtained from this transformer. The i-f selectivity is thus markedly better than that usually obtained from two i-f transformers. In order to secure the required i-f sensitivity, a resistance-capacity-coupled stage of i-f amplification is employed. This gives a satisfactory total i-f amplification without the complication of using three i-f transformers.

The use of a stage of r-f amplification gives the necessary r-f pre-selection and adequate image rejection.

The frequency of 575 kc used for the i-f is in the standard broadcast band. To prevent interference from a possible nearby broadcast transmitter operating on this frequency, or a frequency near 575 kc, two anti-interference wave traps are employed. These are parallel tuned anti-resonant circuits consisting of a small adjustable iron-core tuned inductance and large low-loss fixed mica condenser. These wave traps are tunable from 540 kc to 675 kc and can be used to eliminate interference between these frequencies.

One wave trap is connected in the antenna circuit and introduces a high impedance in the antenna circuit to the interfering signal. The other is connected in the cathode circuit of the r-f amplifier and makes this tube highly degenerative at the frequency to which the trap is tuned. It is not necessary that both traps be tuned to the same frequency; each one could be tuned to a different interfering signal.

The series diode noise limiter functions to reduce noise peaks of short duration which are greater in amplitude than the signal. Ignition interference on the shorter wavelengths

is of this type. Where the amplitude of the interference is not markedly greater than the signal, or the duration of the separate pulses making up the interference is too long, the limiter will be ineffective. Certain types of electrical and atmospheric interference are of this class, particularly on the longer wavelengths. The action of the limiter is not to eliminate interference but to reduce its strength to that of the signal. A control is provided to set the limiting action to the audio output of the detector. On account of its limiting action, the noise limiter introduces some distortion mainly as a reduction in the percentage of modulation that can be handled without distortion. This effect is offset by the infinite-impedance detector which does not distort up to a very high percentage of modulation.

A break-in relay is provided for silencing the receiver during periods of transmission. This relay is to be controlled by the transmitter by means of a simple shorting contact.

The receiver is designed to operate from an external battery-operated power pack. The circuits are arranged to switch the power pack on and off from the receiver.

The chassis is constructed of heavy gauge steel and is strongly reinforced with welded-in partitions. This makes the chassis exceptionally rigid and prevents bending or warping with the accompanying displacements among the elements of the tuned circuits which would cause variations in tuning.

CONTROLS

Tuning Dial

The SMR-3 employs a translucent back-lighted dial which shows the full calibration of all scales. The scales are direct reading, the four short-wave bands being calibrated in megacycles, and the two long-wave bands in kilocycles. In addition, the dial has a bandspread scale the same length as the main scales. This scale is graduated from 0 to 100 divisions with an index mark at 50. The main scales read correctly only when the bandspread pointer is at 50. The two tuning controls employ the "inertia" method of tuning, so that a quick spin of either knob will cause the respective pointer to move rapidly across the scale. The frequency will change in the same way if either knob is turned in the same direction.

Tuning Indicator

The tuning-indicator tube is located near the upper right corner of the panel and should be used at all times for checking the accuracy of the tuning. The indicator functions on both manual r-f gain control and A.V.C. It is especially useful in indicating overload of the receiver when the A.V.C. is switched off.

This can be corrected by the M.V.C. switch and r-f gain control. The tuning indicator shows the amount of signal at the second detector. It is controlled by the A.V.C. diode through a separate filter to the A.V.C. circuit and amplifier tubes, thus permitting it to function independently of the position of the AVC-OFF switch.

Send-Receive Switch

This switch is located on the left side of the panel between the bandspread tuning knob and the side of the panel. This control is for the purpose of temporarily rendering the receiver inoperative and it becomes operative instantly on throwing the switch to the REC position. It is not an ON-OFF switch, In the SEND position, the cathode circuits of the r-f and the two i-f amplifier tubes are opened. All voltages are left applied to the tubes and the converter oscillator is left operating (also the B.F.O. if in use).

Limiter Control

This control is located below the SEND-REC switch and is for adjusting the operating level of the limiter tube. Turn clockwise as required for best limiting effect.

Range Switch

The range selector switch is to the right of the limiter control. Any one of the six frequency bands may be selected by means of this switch. The numbers indicated by the pointer on the switch correspond to the designations under the six upper scales on the dial. The range of each position is given in the following table and the frequencies correspond to the minimum and maximum frequencies covered by the main tuning control when the vernier control is set at 50 divisions.

Range 1	15	Megacycles	to	30	Megacycles
2	6.5	"	"	16.	"
3	3.3	"	"	7.5	"
4	1.5	"	"	3.5	"
5	235	kilocycles	to	515	kilocycles
6	97	"	"	240	"

R-f Gain Control

The r-f gain control is to the right of the range switch. This control performs the dual function of an ON-OFF switch and as a control of the r-f and i-f sensitivity. The ON-OFF switch turns on or off the heater circuit. The control circuit of the relay in the power pack is connected in parallel with the heaters, so the operation of this switch controls both the receiver and the power pack. This switch operates at the anti-clockwise end of its rotation. When the control pointer indicates off, the set will be off, and when it indicates 10 or less, the set will be on. The major portion of the rotation of the control has to do with the sensitivity; rotating the control clockwise increases the sensitivity and anti-clockwise rotation decreases it. This control introduces more or less resistance (over and above that required for normal auto-bias) between the cathodes and ground of the r-f and i-f amplifier tubes. The function of this control on sensitivity can be made operative or inoperative at will by means of the M.V.C. (Manual Volume Control) Switch.

MVC-OFF Switch

To the right and slightly above the r-f gain control is the MVC-OFF switch. In the up or MVC position, the r-f gain control described in the preceding section functions to control the sensitivity of the receiver as described. When in the down or OFF position, the control of sensitivity is inoperative, the receiver remaining at full sensitivity insofar as the sensitivity control is concerned. The MVC-OFF switch does not affect the On-Off function of the r-f gain control.

AVC-OFF Switch

This switch, located to the right of the MVC-OFF switch, controls the A.V.C. action. When in the up or AVC position, the A.V.C. circuit is in operation. In the down or OFF position, the A.V.C. is switched out of circuit. This is done by grounding the line supplying A.V.C. to the tubes.

A-f Gain Control

This control is located to the right and below the AVC-OFF switch. Turning the control clockwise increases the volume. It is a potentiometer in the grid circuit of the a-f amplifier and is supplied by the detector. The noise limiter circuit is between the detector and the volume control. A blocking condenser is in series with the input to the control to stop any d-c current flowing through the control and thus prevents any noise from this cause at the moving contact. It gives full control of the loudness of the headphone or loudspeaker signals. When not using M.V.C. it is the only control of the output level. When using M.V.C., the volume is controlled by the r-f gain control or the a-f gain control as desired. When using M.V.C. without A.V.C., the a-f gain should be kept well advanced, the main control being by means of the r-f gain control. Otherwise, distortion and overloading will occur when the r-f gain is too great for the strength of the signal being received.

Tone Control

The next control to the right is the tone control. Turning this control anti-clockwise cuts down the higher audio frequencies. It consists of a variable resistance in series with a condenser of suitable value, the combination being connected across the input to the volume control.

Note Control

This control is to the right of the tone control and varies the beat-frequency note by varying the tuning of the beat-frequency oscillator. The scale has the 0 in the centre. The control consists of a small variable condenser connected in parallel with the main tuning condenser of the B.F.O. When the pointer is in the centre position, the condenser is at one-half its maximum capacity and the frequency of the B.F.O. is the same as that to which the i-f amplifier is tuned.

Provided that a c-w signal is correctly tuned in and the B.F.O. is turned on, a very low or inaudible beat will be produced. Turning the control either way from the centre 0 position will alter the tuning of the B.F.O., causing its frequency to become increasingly greater or less than that of the i-f signal and the beat note will increase correspondingly as the difference in frequencies increases. In general, the signal should be tuned in accurately so that zero beat occurs at 0 on the scale and then the NOTE adjustment turned right or left as desired until the pitch of the note is as required. Under conditions of interference it may be more satisfactory to turn the control one way or the other.

In some cases reception may be improved by also slightly retuning the receiver in the direction away from the interfering signal. The range of the NOTE control is up to approximately 5,000 cycles each way from 0.

CW-OFF Switch

This switch is to the right of the main tuning control. In the up or CW position the beat-frequency oscillator is switched on. In the down or OFF position the oscillator is stopped. The switch is in the high-tension supply of the oscillator.

When the B.F.O. is on, A.V.C. is removed from the converter tube V-2. This varying voltage on the signal grid of the tube may cause minor changes in the oscillator frequency, especially with strong signals on the shorter wavelengths. This slight mistuning is ordinarily not noticed, but when using the B.F.O. for c-w reception the variation in the beat note might be objectionable.

Output

This jack is located in the centre of the panel near the bottom. It is for plugging in high-resistance headphones. When a plug is inserted, the output of the power tube is automatically disconnected from the output terminals on the terminal panel and is connected to a resistor of such value as to correctly load the power tube. The phone plug connects across part of this resistor so that the power supplied to the headphones is approximately 1% of that which was in the loudspeaker. This proportion gives a good balance between headphone and loudspeaker volume.

Dial Lights

These lights serve the dual purpose of illuminating the dial and indicating that the set is on.

INSTALLATION

Power Requirement

The SMR-3 is designed for operation with a Marconi VP-1 Power Pack Type 85114. The battery load is 5.6 amps at 6.3 volts.

The power unit is connected to the receiver by means of the cable supplied with the power unit. This cable is fitted

with a plug connector at one end which fits a corresponding socket on the power unit. When a suitable location for the power unit has been determined, the cable should be shortened to the proper length required.

The power pack should be located well away from the receiver and antenna lead. Before mounting it permanently, the receiver should be checked at all frequencies, particularly in the region of 100 kc and 30 Mc, for "hash" from the power pack. The power pack should be tried at different distances from the receiver and turned to various positions to determine that the position chosen is suitable as regards "hash".

For complete operating instructions for this power unit, refer to Operating Instructions #321 accompanying the power pack.

Tubes

Tubes are installed in the receiver at the factory and the receiver adjusted and tested with these tubes. The tubes employed, their location in the circuit diagram, and their functions, are as follows:-

V-1	R-f Amplifier	6SK7
V-2	Pentagrid Converter	6SA7
V-3	1st I-f Amplifier	6SK7
V-4	2nd I-f Amplifier	6SK7
V-5	Detector & Noise Limiter	6C8G
V-6	Audio Amplifier & B.F.O.	6C8G
V-7	Pentode Output	6F6
V-8	Electron Tuning Indicator	6U5
V-9	A.V.C. Amplifier & A.V.C. Diode	6B8

R.V.C. Radiotrons are, as a whole, quite uniform in their characteristics among tubes of the same type. However, as the circuits of the SMR-3 are sharply tuned and the dial calibration errors small when the receiver leaves the factory, it is advisable to check any circuits which may be affected when a tube is changed. This will assure optimum performance from the receiver.

Antenna

The receiver is designed to operate with a standard open antenna of four metres effective height. The primaries of r-f input transformers are all of the low impedance type, so the receiver will work satisfactorily when a moderate length of shielded antenna lead-in is used.

The antenna and ground terminals are on the top of the chassis at the back, behind the send-receive relay. The ground terminal is marked #10 and is fastened directly to the metal chassis. The antenna lead is mounted on a bakelite strip and is marked #11. An opening is provided in the back of the cabinet behind the antenna terminal for bringing in the antenna and ground leads.

In making the installation, the antenna and ground leads, particularly the antenna lead, should be arranged so that they are kept well away from the power pack leads to the receiver, the power pack itself, the battery, the leads from the battery to the control panel and from the control panel to the power pack. In addition, the antenna lead should be kept well clear of all other circuits.

Output Circuit

The output transformer is designed to work into a load of 10,000 ohms. Marconi loudspeaker type 88615 has this impedance. The output terminals on the terminal panel at the rear right-hand corner of the chassis are #7 and #8. The output transformer is an auto-transformer and a blocking condenser is used to keep the d-c voltage from the output terminal.

Terminal Panel

A terminal panel is located at the rear right-hand corner of the chassis. This panel contains terminals for all external connections other than antenna and ground. There are eight terminals which have the following designations:-

1 - 180 V ⌿ (Red lead from power pack)
2 - Vibrator Relay(Green " " " ")
3 - 6 volts ⌿ (Yellow" " " ")
4 - 6 volts, grounded(Black lead from power pack)
5 - Break-in Relay
6 - Break-in Relay, POS.
7 - OUT - 10,000 OHMS,HOT.
8 - OUT - 10,000 OHMS,GROUNDED.

An opening is provided in the case immediately behind the terminal panel for the leads to the panel.

Send-Receive Relay

This relay is for the purpose of protecting and silencing the receiver during periods of transmission, and is for break-in operation.

It is intended to be controlled by the transmitter. In the "send" position the relay shortcircuits the antenna and ground connections and also the output. The relay operates by closing the circuit between terminals #5 and #6 on the terminal panel. If more than one receiver is controlled from common control contacts, the #5 terminals must be connected in parallel and so must the #6 terminals.

Cabinet

The cabinet is fitted with four rubber feet. To fasten the cabinet to the table, if so desired, four bushings and washers are supplied. Insert the bushings in the rubber grommets and suitable round-head wood screws through the washers, then put the wood screws through the bushings and tighten the screws.

OPERATING INSTRUCTIONS

Tuning

The main scales on the dial are only correct when the bandspread pointer is at 50 on its scale. Under this condition the main tuning pointer will indicate the frequency to which the receiver is tuned with an error of less than $\frac{1}{2}$ of 1%. To tune in a given frequency on the short-wave bands, set the band selector switch to the proper band and the main pointer to the required frequency. Then search for the desired signal with the bandspread control. On the longer waves it will be found unnecessary to use the bandspread control, as the main tuning control is not as critical.

The bandspread control operates a small variable gang condenser connected in parallel with the main tuning condenser. On account of this, the effectiveness of the bandspread control in changing the tuning will vary with the setting of the main tuning control, being greater when the main tuning control is toward the high-frequency ends of the scales and less when the main tuning control is toward the low-frequency ends.

Phone Or Modulated C-w Reception

When receiving phone or tone modulated signals, it is usual to use A.V.C. and adjust the output volume with the a-f gain control. Signals stronger than 3 to 10 microvolts (depending on the sensitivity of the receiver at that frequency) will then be substantially constant in output volume, irrespective of variations in the strength of the received signal. If the signal drops below the value up to which the A.V.C. delay operates, the output will vary with variations in the input signal. In cases

where the amount of electrical noise is objectionable, the receiver sensitivity may be reduced to a point where the noise is not too loud. This is accomplished by putting the M.V.C. switch in the up position and adjusting the r-f gain control to give the required sensitivity. The A.V.C. will then function from this condition. The M.V.C. may also be used to keep down the off-signal noise when tuning from one signal to another.

When searching for a weak signal it is sometimes an advantage to use the B.F.O. as an indicator, particularly if the wanted signal is not being modulated at the time of searching. The B.F.O. should be turned off once the signal has been found.

C-w Reception

For c-w reception, the beat-frequency oscillator should be turned on by putting the CW switch in the up position and setting the note control at 0. Tune the signal to zero beat and then turn the note control to the right or left until the pitch of the note is as desired. If interference is experienced from an adjacent signal, one position of the note control may give better reception than the other. Another expedient which may reduce the effect of an interfering signal is to proceed as follows.

With the note control at 0, tune the desired signal to a low pitch and then turn the bandspread control in the direction that increases the pitch of the interfering signal. Continue this until the pitch of the wanted signal has increased to 1,000 to 2,000 cycles. The pitch of the interference will be higher than the signal. Now turn the note control so that the pitch of the wanted signal goes down through zero and up the other side to a suitable tone. The difference in pitch between that of the interference and the wanted signal will now be much greater than before and under some conditions may be so high as to be inaudible.

Usually, the r-f gain control only will be used for adjusting sensitivity and volume, the A.V.C. switch being off and the a-f gain control at maximum. When A.V.C. is not used, care should be taken that the sensitivity of the receiver is such that the signal does not overload the receiver and so cause distortion or blocking out of the signals. This condition can be avoided if the a-f gain control is kept well toward maximum and turning back the r-f gain control to give the desired output. The tuning indicator will show when the receiver is being overloaded.

Wave Traps

Since the frequency of the i-f amplifier is in the standard broadcast band, interference may be experienced from a broadcast transmitter on a frequency near 575 kc. To prevent this,

two wave traps have been provided. These wave traps may be set at any frequency from 540 kc to 675 kc.

If interference is experienced from a transmitter working on a frequency within this range, adjust the wave traps thus:

Adjust the dial to the setting where the interference is the worst. Adjust each wave trap for minimum interference, by means of the iron-core adjustment on the top of its shield can. These shield cans are mounted at the back of the top of the chassis behind the gang condenser. The right-hand trap is in the antenna circuit and the left-hand one is in the cathode circuit of the r-f amplifier tube.

If one trap is sufficient to eliminate the interference from one station, the other trap can be adjusted to a second interfering station if there is more than one.

ALIGNMENT ADJUSTMENTS

I-f Alignment

The i-f amplifier is tuned to 575 kc. This frequency should be accurately maintained on account of the low frequency to which the receiver tunes. The first i-f transformer is directly behind the dial to the right of the condenser shaft. The adjusting screws are on the left side of the shield can. The other i-f transformer is located at the rear of the chassis to the right of the break-in relay. The adjusting screws for this transformer are on the back of the shield can and are accessible through holes in the back of the cabinet.

Apply the i-f signal to the grid of the converter tube. This can be done at the stator terminal of the middle section of the gang condenser. Use a 0.1-uf condenser in series with the high side of the signal generator. Set band switch at 5, M.V.C. and A.V.C. switches at OFF.

The i-f sensitivity will depend on whether or not the oscillator section of the converter tube is shorted. For measurement purposes, the oscillator grid must be shortcircuited by grounding terminal 6 of V-2. To do this the chassis must be removed from the cabinet. For aligning the i-f only, it is not necessary to ground this grid, but the apparent sensitivity will be indefinite, although the alignment will be correct.

B.F.O.

Apply the i-f signal, with modulation removed, to the

converter grid as in the i-f alignment, and turn on the B.F.O. by means of the CW switch. Set the note adjustment to 0. Adjust the iron core in the coil of the B.F.O. to give zero beat with the i-f signal. This adjustment is located on the top of the B.F.O. shield can which is mounted at the front right corner of the chassis. Check that the note control has the same range of pitch when turned to the right and left.

R-f Alignment

The signal is applied to the antenna and ground terminals of the receiver through a standard Universal Dummy Antenna. If the other circuits are not badly out of alignment, any band can be adjusted independently of the others and subsequent adjustment on any of the other bands will not affect its adjustment.

The circuits are adjusted alternately near the high-frequency and low-frequency ends of the band in question by means of the "aligning" condensers and the iron-core "tracking" adjustments. These adjustments should be repeated until both are in correct adjustment at the same time.

The aligning and tracking adjustments occupy the left half of the chassis. They are arranged in three double rows from back to front. These rows are numbered 1 to 6 from right to left, the numbers corresponding to the bands.

The dial pointer is set to the proper place on the scale and the signal generator adjusted to that frequency; then the signal is tuned in by means of the trimming or tracking adjustment as required. The aligning and tracking frequencies for each band are as follows:

BAND	TRACK	ALIGN
1	16 Mc	28 Mc
2	7 Mc	15 Mc
3	3.5 Mc	7 Mc
4	1.6 Mc	3.2 Mc
5	250 kc	480 kc
6	100 kc	220 kc

When aligning the detector circuit of bands 1 and 2, it is necessary to "rock" the tuning control as adjustments to the detector tuning cause a small change in the oscillator tuning at this end of their range. Care should be taken on these two bands to avoid a false adjustment due to an apparent maximum which may appear when the detector circuit is tuned to the image frequency or to the oscillator, rather than to the signal.

Note: On band 1 the oscillator is tuned to 575 kc lower than the signal frequency. On the other bands it is higher than the signal frequency.

Wave Traps

The factory adjustment of these wave traps is at the i-f frequency of 575 kc and in the absence of specific interference, the wave traps should be adjusted to this frequency. To make this adjustment, apply a signal of 575 kc to the antenna-ground terminals, tune the receiver to 350 kc and adjust the wave traps for minimum signal.

SERVICING

A good check on the condition of the components of the receiver is by voltage measurement at various points in the chassis. By reference to the Schematic Circuit Diagram (Diagram of Connections #88468) the defective part causing an abnormal voltage reading can be localized.

The following is a list of the normal voltages at the principal points on the chassis:

Voltages

Conditions: Send-Rec. switch on Rec.
Limiter control full anti-clockwise.
Range switch on range 5.
M.V.C. switch off.
A.V.C. " " .
A-f gain control maximum.
Tone control full clockwise.
C-w switch off.
Bandspread & main tuning controls at mid-scale.
Heater voltage at terminals 3 & 4 not less than 6 volts.
H-t supply at terminal 1, 175 volts ± 3 volts.

Tube socket voltages shown below are positive to chassis unless otherwise indicated.

Pin	V1	V2	V3	V4	V5	V6	V7	V8	V9
1	Ground	Ground	Ground	Ground	0	0	Ground	Heater	Ground
2	Heater	Heater	Heater	Heater	Heater	Heater	Heater	-	Heater
3	2.4	170	1.4	2.7	175	30	163	0	105
4	0	60	0	0	4.2	0.4	175	175	0
5	2.4	-3.2	1.4	2.7	17	-0.4	0	Ground	0
6	73	0	50	75	20	0	4.2	Ground	75
7	Ground	Ground	Ground	Ground	Ground	0	Ground	-	Ground
8	165	0	60	165	18	0	16	-	8

Other Voltages

Conditions as above except as specified.

Limiter Control: Right terminal 20 volts.
Middle " variable, 0 to 20 volts.
Left " ground.

R-f Gain Control: (M.V.C. Switch Off)
Right terminal ground.
Middle " 0.
Left " variable, 0 to 20 volts.

(M.V.C. Switch On)
Right terminal ground.
Middle " variable, 0 to 40 volts.
Left " " 20 to 40 volts.

C-w Switch - On: (At tube V6)
Terminal 8, 0 volts.
" 6, 65 volts.
" 5, -2.2 volts.

All voltages measured with a 1000-ohms-per-volt d-c voltmeter (except heater voltage if a-c is used on this circuit).

Limits on all voltages +/-10% except where specified otherwise.

For servicing the power pack, see Operating Instructions #321 for Marconi type 85081 Power Unit which accompany that unit.

PERFORMANCE & SENSITIVITY MEASUREMENTS

General Conditions

1. Output load resistance 10,000 ohms.
2. Standard output 100 milliwatts.
3. Modulation frequency 400 cps.
4. Modulation percentage 30%.
5. Signal input to antenna terminals through standard universal dummy antenna. *
6. Signal input to grids through 0.1-uf blocking condenser.
7. H-t voltage 175 volts +-3 volts.
8. Heater voltage 6.3 volts +-.3 volts.

*Note: Antenna and ground leads from dummy antenna to receiver terminals not to exceed 4 inches each.

I-f Measurements

Conditions: Same as for "Voltages"; also short circuit to ground terminal 5 of V2.

	V2 Grid	V3 Grid	V4 Grid	V5 Grid
Sensitivity	18 uv +-25%	1,000 uv +-20%	13,000 uv +-20%	1 volt +-20%
Bandwidth for 100 times	23 kc +-10%			
Bandwidth for 10 times	11.5kc +-10%	22 kc +-10%		

R-f Measurements

Conditions: Same as for "Voltages", except range switch and tuning controls.

	Frequency	Sensitivity			Noise	Bandwidth for 1000 times	Image Ratio
		Ant.	V1 Grid	V2 Grid			
Units	Mc	uv.	uv.	uv.	mwatts	kc.	
Tolerances		+-50%	+-25%	+-25%	+-25%	+-10%	+-25%
	28	10	-	-	1	40	7:1
Range 1	20	8	-	-	1	40	30:1
	16	9	-	-	2.5	40	57:1
	15	4.5	8	65	8	40	22:1
Range 2	10	5	9	72	9	40	100:1
	7	7	13	74	4	40	235:1
	7	5	18	85	3	40	250:1
Range 3	5	5	14	88	4	40	700:1
	3.5	4	10	75	9	40	2200:1
	3.2	3	17	64	7	38	1300:1
Range 4	2.4	2.5	12	62	10	36	2800:1
	1.6	2.5	10	60	15	32	7500:1
	.48	2.5	20	50	8	32	3800:1
Range 5	.35	2	10	50	35	26.5	7500:1
	.25	2.5	6.5	50	55	22	21000:1
	.22	3	32	78	10	23.5	unmeasurable
Range 6	.15	3.5	17	74	20	20.5	"
	.1	4	10	74	40	16	"

Calibration

With bandspread pointer at 50 divisions, the main pointer is to be correct at the aligning and tracking frequencies on all bands.

At all other parts of the main scales, the actual frequency is to be within 0.5% of dial calibration.

A.V.C.

Conditions: Same as for "Voltages" except:
1. AVC switch up (on).
2. Range switch on 4.
3. Tuning controls at 2.4 Mc.
4. Signal frequency 2.4 Mc.
5. Volume control set for 500 milliwatts output for 100,000 uv input.

Input uv.	Output mw.
100,000	500 ±0%
10,000	310 ±10%
1,000	190 ±15%
100	100 ±20%
10	50 ±20%
5	22 ±50%

B.F.O.

Conditions: Same as for "Voltages" except:
1. Range switch on 4.
2. Tuning controls at 2.4 Mc.
3. Signal frequency 2.4 Mc.

Adjust input to give standard output (100 mw). Remove modulation and put CW switch in up position.

Output should not be less than 500 mw when "Note" control is adjusted for optimum output.

Output Jack

Apply a signal and adjust input so that output is 500 milliwatts at terminals 7 and 8.

Insert a phone plug with 10,000-ohm load in output jack. Output 5 milliwatts ±25%

I-f Rejection

Apply an i-f signal of 100,000 uv to the Ant-Gnd terminals. When the receiver is tuned to any of the test frequencies used for antenna sensitivity measurements (except 480 kc), the output should be less than 100 milliwatts.

At 480 kc, the i-f signal for 100 milliwatts output is 13,000 uv ±20%

R-f Gain Control

With M.V.C. switch in up position, apply a signal of 1 volt at 2.4 Mc.

Turn r-f gain control anti-clockwise to minimum sensitivity.

Output to be less than 0.2 milliwatts.

Tuning Indicator

1. Apply a signal at 2.4 Mc.
2. M.V.C. off.
3. A.V.C. off.
4. C-W off.
5. A-f gain control at maximum.

Tune the signal and increase input until the indicator just starts to indicate.

Output should be between 200 and 400 milliwatts.

PARTS LIST

Part No.	Description	Manufacturer	Type No.
CONDENSERS			
C1	2000 uuf mica	Aerovox	1467XM
C2	15-50 uuf)		
C3	15-50 uuf) Trimmer Assembly	Marconi	91408
C4	15-50 uuf)		
C5	15-50 uuf)		
C6	15-50 uuf) Trimmer Assembly	"	91408
C7	15-50 uuf)		
C8	0.05 uf 200 v. rolled paper	Aerovox	
C9	0.0003 uf ≠ 1% @ 1000 Cy.	"	1469
C10	7 uuf Compensator	Marconi	91438

Part No.	Description	Manufacturer	Type No.
C11	2000 uuf	Aerovox	1467 XM
C12	Gang condenser)	Marconi	91301
C13	)		
C14	0.25 uf 200 v, rolled paper	Aerovox	
C15	.01 uf 200 v, rolled paper	"	
C16	4 uuf	"	1468XM
C17	15-50 uuf)	Marconi	91408
C18	15-50 uuf) Trimmer Assembly		
C19	15-50 uuf)		
C20	15-50 uuf Trimmer Assembly	Marconi	91436
C21	4 uuf	Aerovox	1468XM
C22	170 uuf	"	1468XM
C23	3-30 uuf Trimmer Assembly, part of C20	Marconi	91436
C24	0.05 uf 200 v, rolled paper	Aerovox	
C25	500 uuf	"	1467
C26	3-30 uuf Trimmer Assembly, part of C20	Marconi	91436
C27	0.1 uf 400 v, rolled paper	Aerovox	
C28	0.000325 uf $\leq$ 1% @ 1000 Cy.	"	1469
C29	7 uuf compensator	Marconi	91438
C30	Gang cond.) part of C12	"	91301
C31	" ")		
C32	0.1 uf 200 v, rolled paper	Aerovox	
C33	250 uuf	"	1468XM
C34	5-44 uuf Air Trimmer	Sickles	ATR-98

Part No.	Description	Manufacturer	Type No.
C35	5-44 uuf Air Trimmer	Sickles	ATR-98
C36	5-44 uuf " "	"	"
C37	5-44 uuf " "	"	"
C38	5-44 uuf " "	"	"
C39	5-44 uuf " "	"	"
C40	7 uuf	Marconi	91438
C41	0.0003 uf ≠ 1% @ 1000 Cy.	Aerovox	1469
C42	0.002925 uf ≠ 1% @ 1000 Cy.	"	1464
C43	0.002 uf ≠ 1% @ 1000 Cy.	"	1464
C44	0.001075 uf ≠ 1% @ 1000 Cy.	"	1464
C45	0.0003 uf ≠ 1% @ 1000 Cy.	"	1469
C46	0.00018 uf ≠ 1% @ 1000 Cy.	"	1469
C47	Gang condenser, part of C12	Marconi	91301
C48	" "		
C49	0.1 uf 200 v, rolled paper	Aerovox	
C50	250 uuf	"	1469
C51	250 uuf	"	1469
C52	0.01 uf 400 v, rolled paper	"	
C53	250 uuf	"	1468XM
C54	0.1 uf 200 v, rolled paper	"	
C55	0.01 uf 200 v, rolled paper	"	
C56	0.25 uf 200 v, rolled paper	"	
C57	250 uuf	"	1468XM
C58	0.01 uf 200 v, rolled paper	"	

Part No.	Description	Manufacturer	Type No.
C59	0.25 uf 200 v, rolled paper	Aerovox	
C60	0.1 uf 200 v, rolled paper	"	
C61	25 uuf	"	1468XM
C62	0.01 uf 400 v, rolled paper	"	
C63	250 uuf	"	1469
C64	250 uuf	"	1469
C65	125 uuf	"	1468XM
C66	0.5 uf 200 v, rolled paper	"	
C67	500 uuf	"	1468
C68	500 uuf	"	1468
C69	10 uf 24 v wkg dry elect.	Marconi	91437
C70	0.05 uf 400 v, rolled paper	Aerovox	
C71	250 uuf	"	1468XM
C72	17.5 uuf max.	Marconi	91444
C73	380 uuf	Aerovox	1468XM
C74	0.01 uf 200 v, rolled paper	"	
C75	0.01 uf 200 v, rolled paper	"	
C76	10 uf 3 v wkg, dry elect, (part of C69)	Marconi	91437
C77	0.01 uf	Aerovox	1467XM
C78	0.01 uf 400 v, rolled paper		
C79	10 uf 20 v wkg, dry elect, (part of C69)	Marconi	91437
C80	0.01 uf 600 v, rolled paper	Aerovox	
C81	0.1 uf 400 v, rolled paper	"	
C82	0.1 uf 400 v, rolled paper	"	

Part No.	Description	Manufacturer	Type No.
C83	0.1 uf 200 v, rolled paper	Aerovox	
C84	500 uuf	"	1468XM
C85	0.01 uf 200 v, rolled paper	"	
C86	10 uf 200 v wkg,)		
	) dry elect.	Marconi	91440
C87	10 uf 200 v wkg,)		
C88	25 uuf	Aerovox	1468XM
C89	25 "	"	1468XM
C90	15 "	"	1468XM
C91	90 "	"	1468XM
C92	125 uuf	Aerovox	1468XM

RESISTORS

R1	100,000 ohms $\frac{1}{2}$ watt	I.R.C.	BT$\frac{1}{2}$
R2	15,000 ohms, sensitivity control	Marconi	91298
R3	300 ohms $\frac{1}{2}$ watt	IRC	BT$\frac{1}{2}$
R4	50,000 ohms $\frac{1}{2}$ watt	"	"
R5	1,000 ohms $\frac{1}{2}$ watt	"	"
R6	1,000 ohms $\frac{1}{2}$ watt	"	"
R7	100,000 ohms $\frac{1}{2}$ watt	"	"
R8	25,000 ohms $\frac{1}{2}$ watt	"	"
R9	20,000 ohms $\frac{1}{2}$ watt	"	"
R10	0.5 megohm, in tuning eye socket	#91431	
R11	20,000 ohms $\frac{1}{2}$ watt	IRC	BT$\frac{1}{2}$
R12	100,000 ohms $\frac{1}{2}$ watt	"	"
R13	100,000 ohms $\frac{1}{2}$ watt	"	"

Part No.	Description	Manufacturer	Type No.
R14	1500 ohms ½ watt	I.R.C.	BT½
R15	650 ohms ½ watt	"	"
R16	1,000 ohms ½ watt	"	"
R17	100,000 ohms ½ watt	"	"
R18	20,000 ohms ½ watt	"	"
R19	35,000 ohms ½ watt	"	"
R20	300 ohms ½ watt	"	"
R21	0.25 megohm ½ watt	"	"
R22	400 ohms ½ watt	"	"
R23	15,000 ohms 1 watt	"	BT1
R24	0.5 megohm ½ watt	"	BT½
R25	1,000 ohms ½ watt	"	"
R26	2,000 ohms ½ watt	"	"
R27	50,000 ohms ½ watt	"	"
R28	100,000 ohms ½ watt	"	"
R29	50,000 ohms ½ watt	"	"
R30	Limiter control, 15,000 ohms	Marconi	91297
R31	100,000 ohms ½ watt	I.R.C.	BT½
R32	50,000 ohms ½ watt	"	"
R33	2,000 ohms ½ watt	"	"
R34	Vol. control, 500,000 ohms	Marconi	91300
R35	Tone control, 500,000 ohms	"	91299
R36	650 ohms ½ watt	I.R.C.	BT½
R37	10,000 ohms ½ watt	"	"

Part No.	Description	Manufacturer	Type No.
R38	0.25 megohm ½ watt	I.R.C.	BT½
R39	0.5 megohm ½ watt	"	"
R40	1,000 ohms 1 watt	"	BT1
R41	10,000 ohms 1 watt	"	"
R42	1,000 ohms ½ watt	"	BT½
R43	0.25 megohm ½ watt	"	"
R44	1 megohm ½ watt	"	"

TRANSFORMERS

T1	Band 1 R-f Coil Assembly	Marconi	91413
T2	" 2 R-f " "	"	91044
T3	" 3 R-f " "	"	91052
T4	" 4 R-f " "	"	91062
T5	" 5 R-f " "	"	91068
T6	" 6 R-f " "	"	91419
T7	" 1 Det. " "	"	91415
T8	" 2 Det. " "	"	91046
T9	" 3 Det. " "	"	91054
T10	" 4 Det. " "	"	91057
T11	" 5 Det. " "	"	91064
T12	" 6 Det. " "	"	91423
T13	" 1 Osc. " "	"	91417
T14	" 2 Osc. " "	"	91048
T15	" 3 Osc. " "	"	91050
T16	" 4 Osc. " "	"	91060

Part No.	Description	Manufacturer	Type No.
T17	Band 5 Osc. Coil Assembly	Marconi	91072
T18	" 6 Osc. " "	"	91427
T19	Antenna wave trap assembly	"	90410
T20	R-f cathode wave trap assembly	"	90407
T21	#1 I-f transformer assembly	"	90412
T22	#2 I-f " "	"	90413
T23	B.F.O. osc. coil assembly	"	90416
T24	Output auto-transformer ass'y.	"	89333
TUBES			
V1	R-f Amplifier	R.V.C.	6SK7
V2	Converter	"	6SA7
V3	1st I-f Amplifier	"	6SK7
V4	2nd I-f Amplifier	"	6SK7
V5	Detector and Limiter	"	6C8G
V6	A-f Amp. and B.F.O.	"	6C8G
V7	Output Amplifier	"	6F6
V8	Tuning Indicator	"	6U5
V9	AVC Amp. and Diode	"	6B8
	Dial light (2)	Marconi	93018
SWITCHES			
S1	R-f Primary band selector switch section		
S2	R-f secondary " " " "		
S3	Det. Primary " " " "		

Part No.	Description	Manufacturer	Type No.
S4	Det. Secondary band selector switch section)	Marconi	91430-483
S5	Osc. tuned circuit" " " ")		
S6	Osc. cathode tap " " " ")		
S7	Osc. tracking condenser" " ")		
S8	MVC-OFF Toggle switch, S-P S-T	Marconi	86655
S9	SEND-REC. toggle switch S-P S-T	"	86655
S10	(		
	(CW-OFF toggle switch D-P D-T	"	86654
S11	(		
S12	ON-OFF switch, part of sensitivity control R2.		
S13	AVC-OFF toggle switch, S-P S-T	Marconi	86655

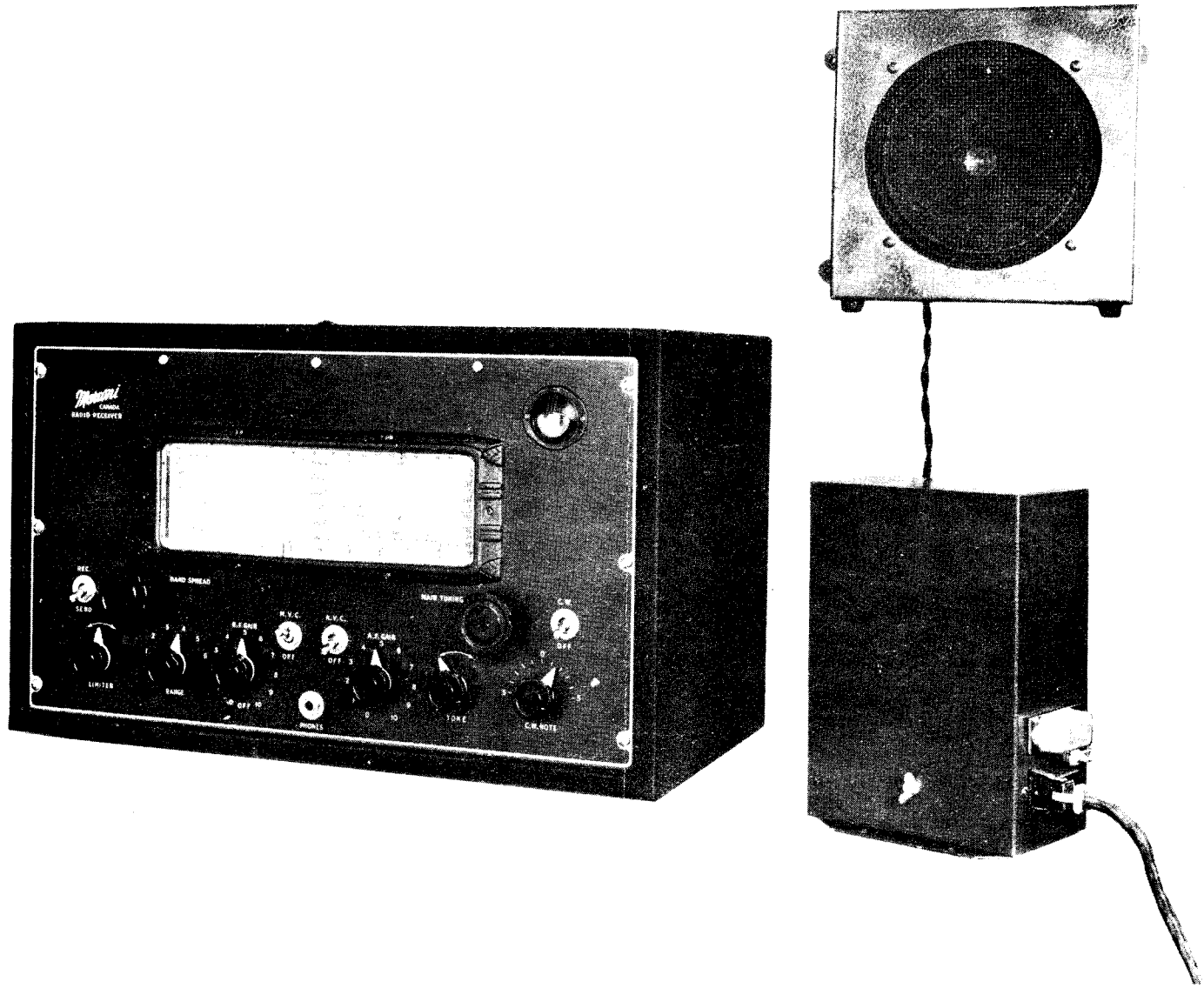
MISCELLANEOUS

RL-1	Send-Receive relay, 6 v d-c 24 ohms	Leach	1037
	Tube sockets, V1, V2	Amphenol	SS8
	Tube sockets, V3,V4,V5,V6,V7,V9	Marconi	68087
	Tube socket, Tuning Indicator V8	"	91431
	Front panel mask	"	92205
	Iron core, $\frac{1}{4}$"	"	91302
	" " $\frac{1}{2}$"	"	68486
	Knob, large, less pointer	General Radio	637G
	Knob, small, with pointer	" "	637A
	Pilot lamp socket	Marconi	82955
J1	Phone jack, contact combination X4A	Mallory	700
	Flexible coupling, for $\frac{1}{4}$" shaft	National	TX10

Part No.	Description	Manufacturer	Type No.
	Grid cap connector	UCF	6005
	Rubber grommet for cabinet feet	Marconi	67110
	Sleeve for cabinet feet	"	92446
	Main panel escutcheon, complete	"	92894

Canadian MARCONI Company,
Montreal, February 3, 1941.

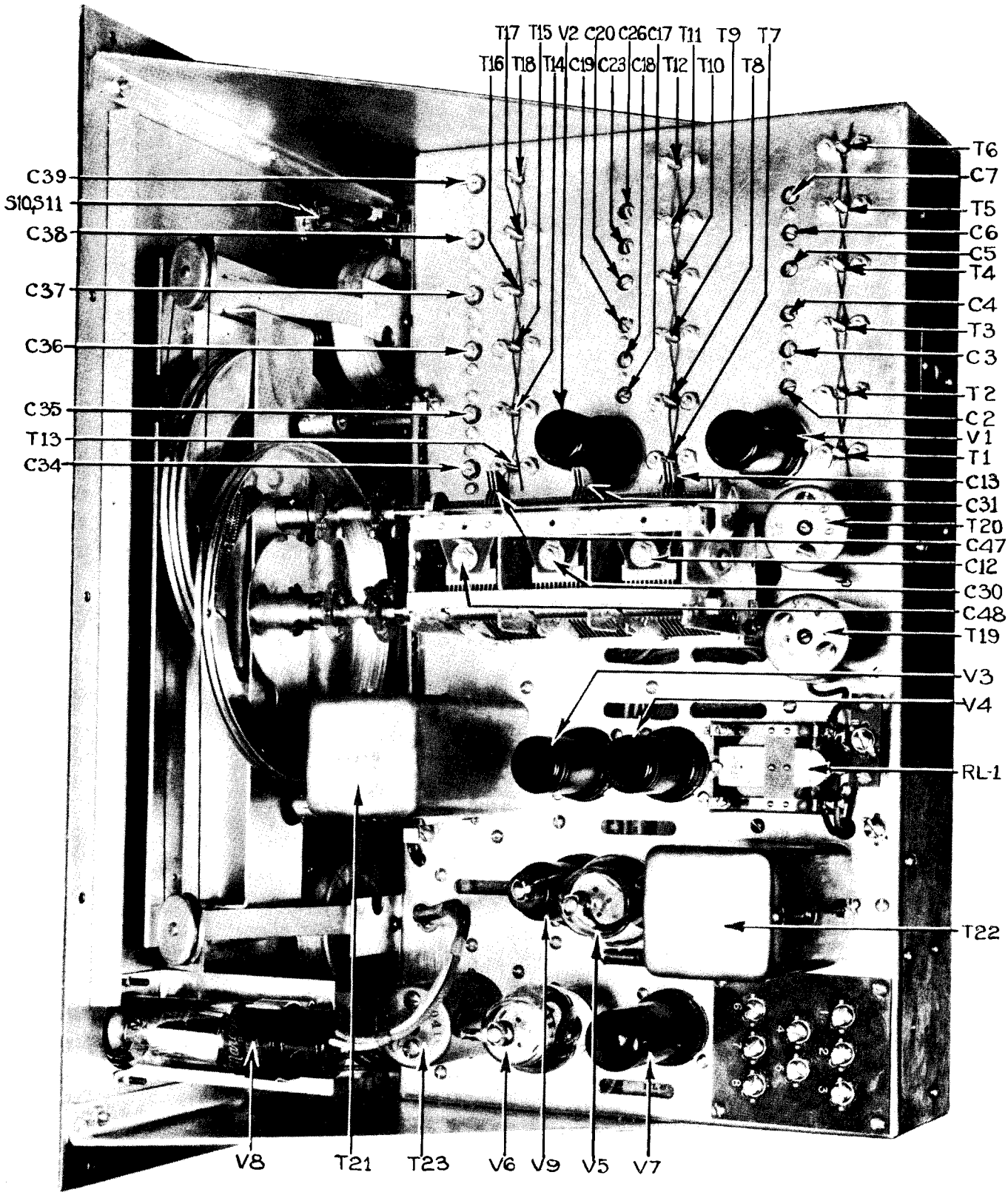
MARCONI SMR-3 RECEIVER
TYPE 86822



GENERAL VIEW

FORM 2003

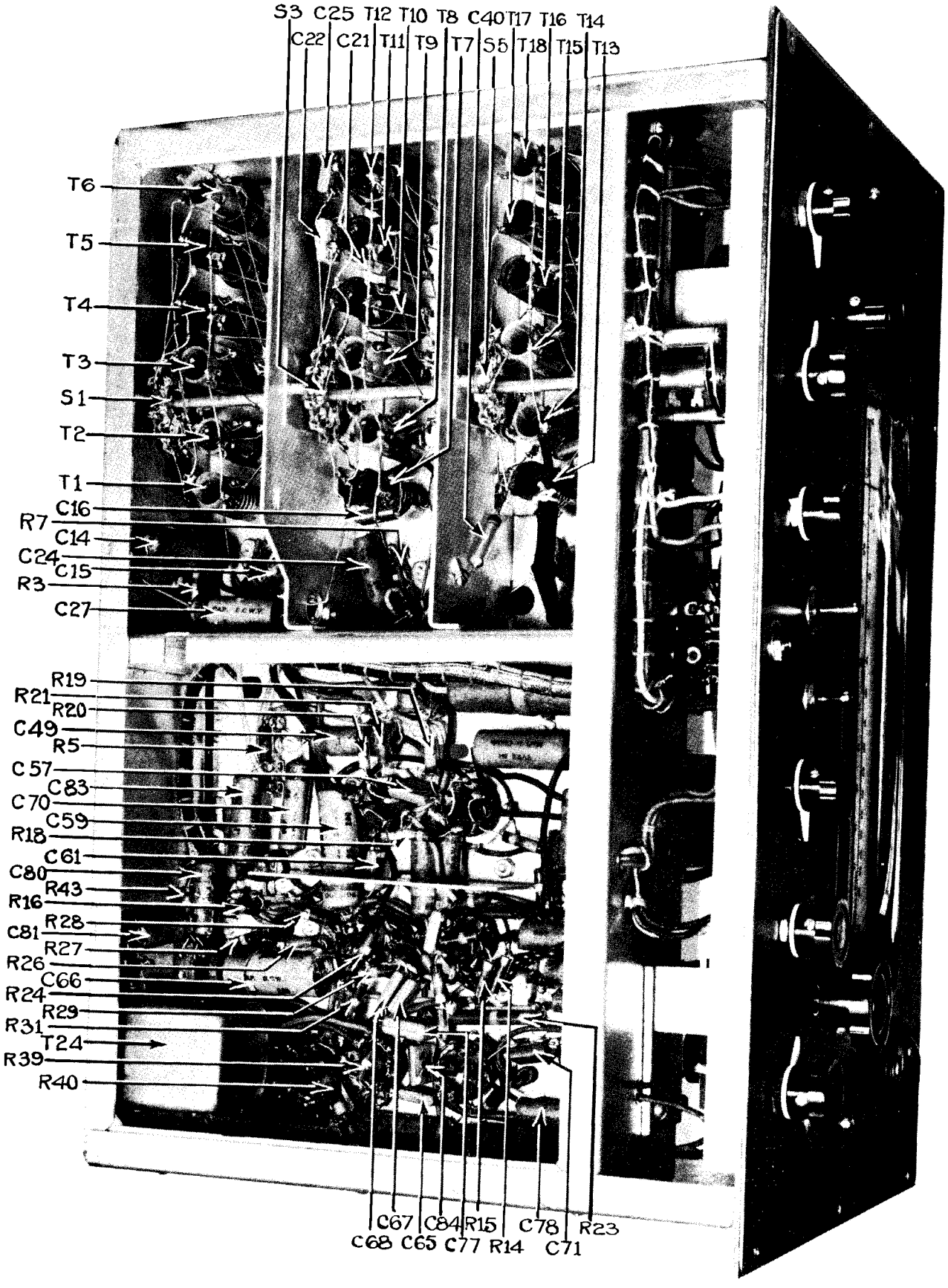
MARCONI SMR-3 RECEIVER
TYPE 86822



CHASSIS ASSY
TOP VIEW

FORM 2004

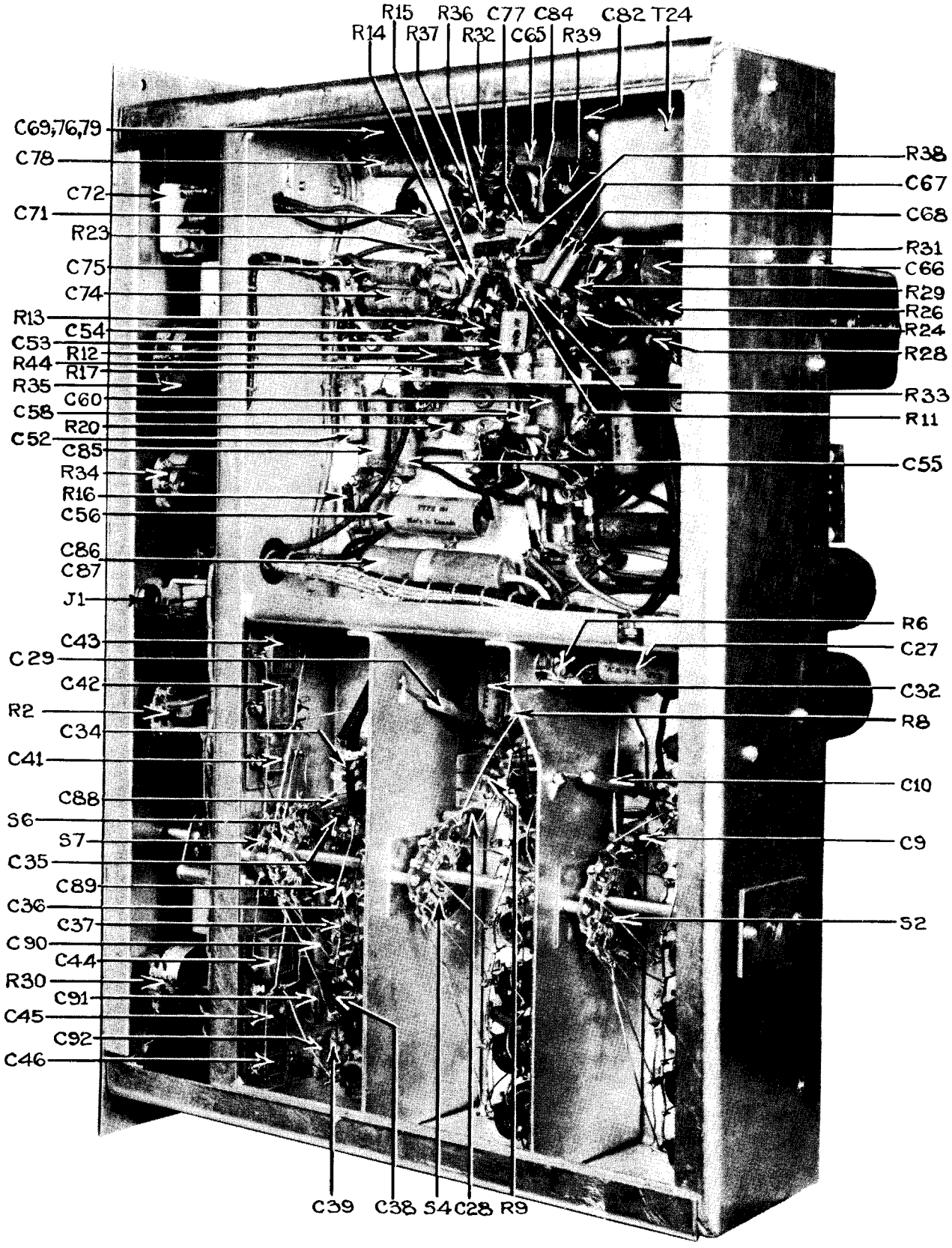
MARCONI SMR-3 RECEIVER
TYPE 86822



CHASSIS ASSY
BOTTOM VIEW

FORM 2005

MARCONI SMR-3 RECEIVER
TYPE 86822



CHASSIS ASSY
BOTTOM VIEW

FORM 2006

DIAGRAM OF CONNECTIONS
S.M.R-3 RECEIVER TYPE Nº 86822

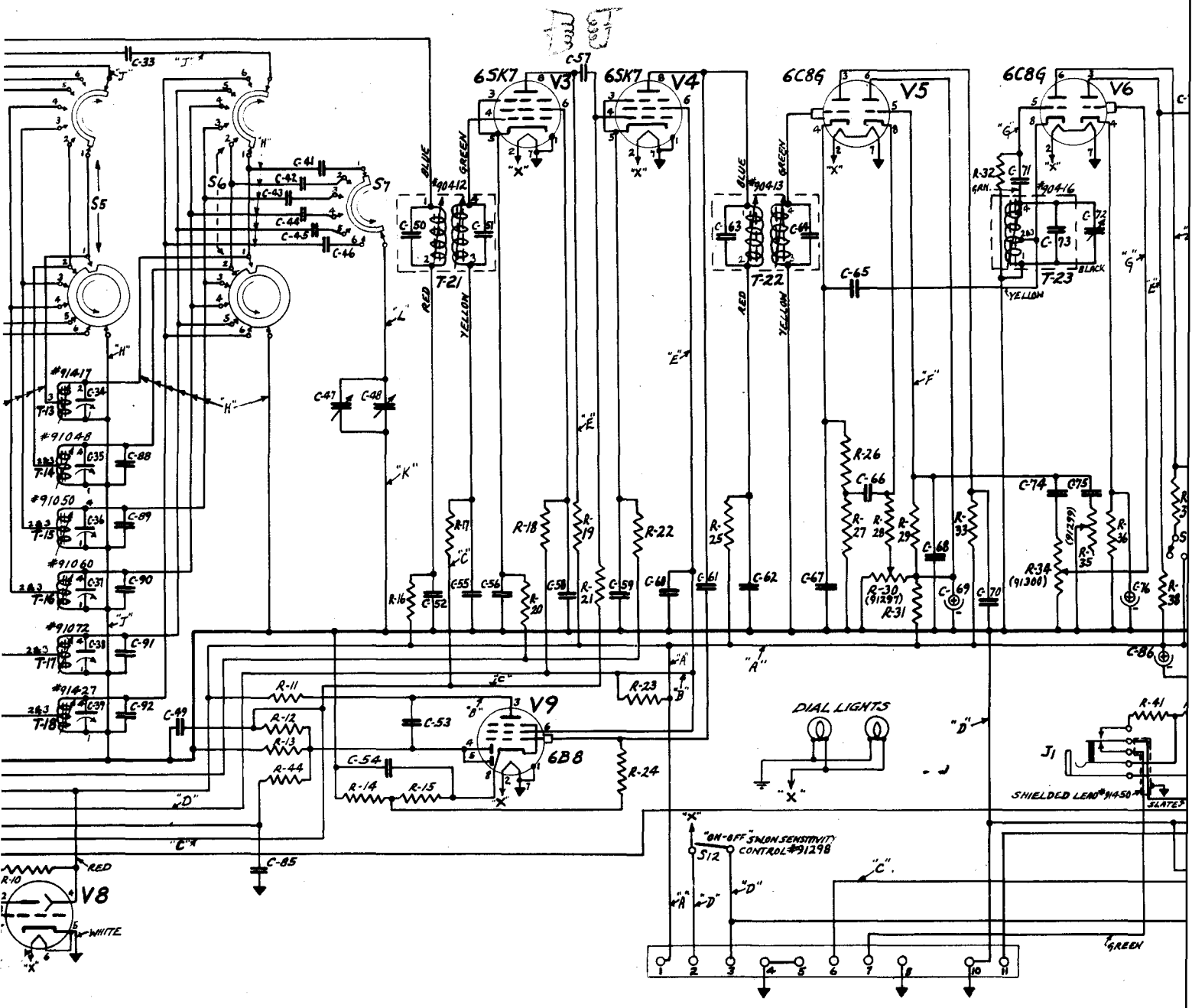
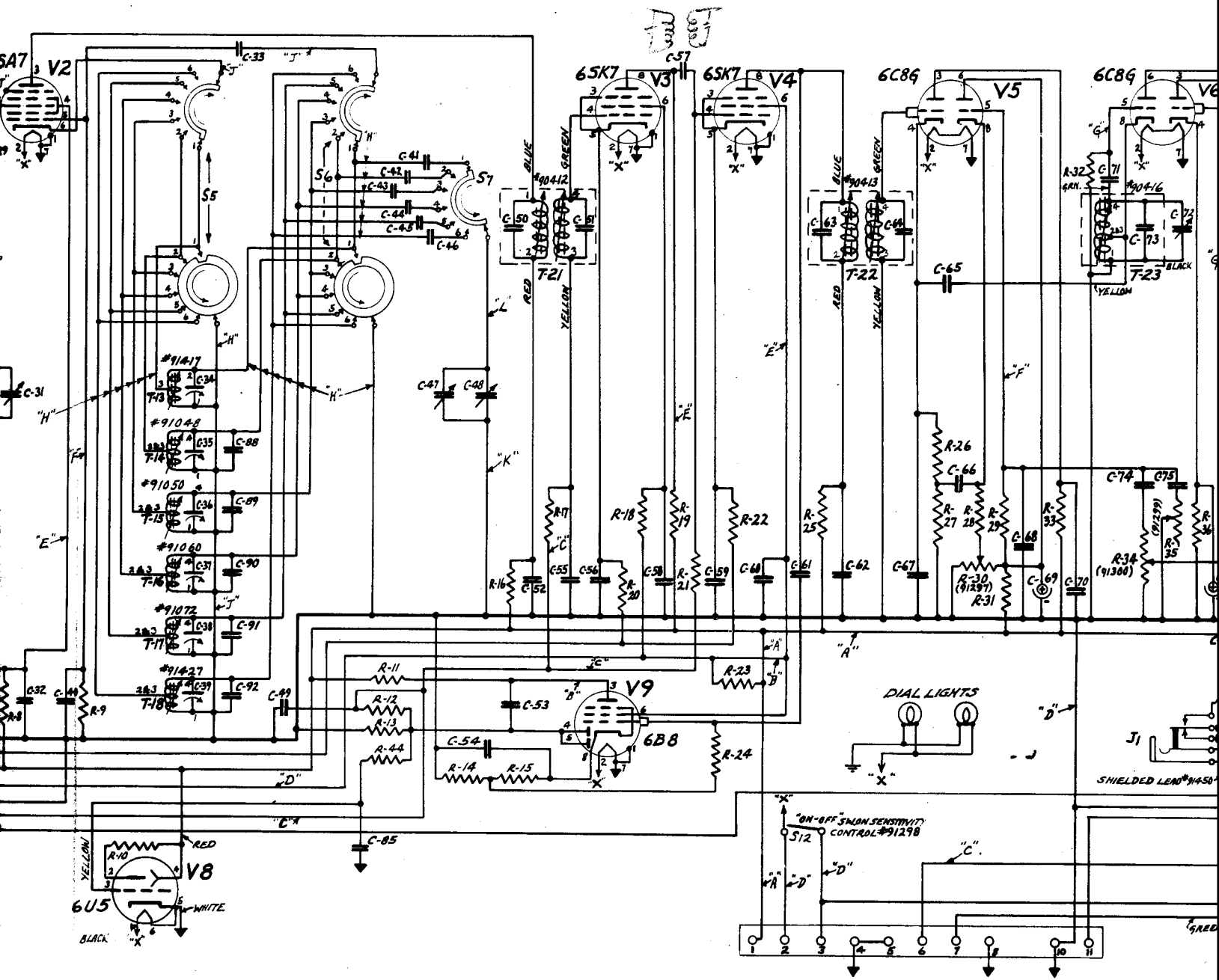
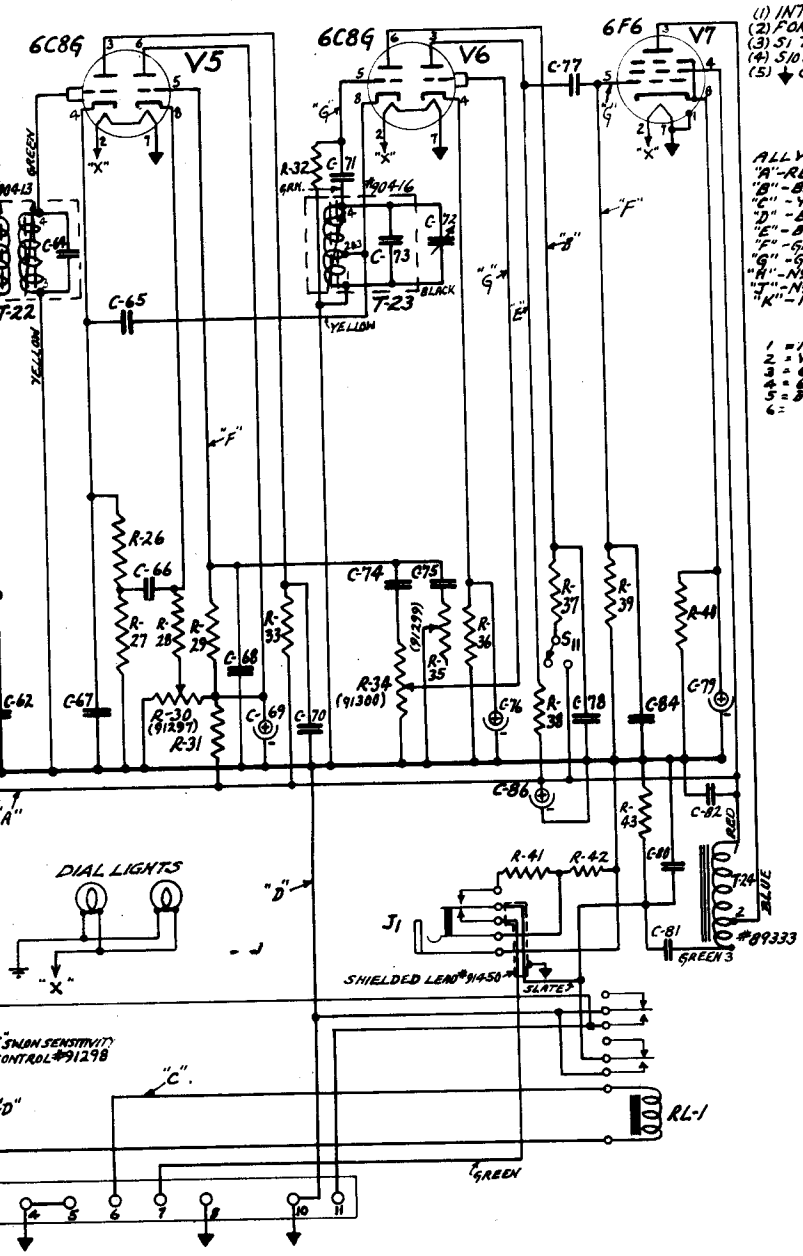


DIAGRAM OF CONNECTIONS
S.M.R-3 RECEIVER TYPE Nº 86822





NOTES

(1) INTERMEDIATE FREQUENCY:- 575 KC.
(2) FOR LIST OF CONDENSERS & RESISTORS SEE DWG. 88468-L
(3) S1 TO S7 - SECTIONS OF SWITCH #91430-4380
(4) S10 & S11 - " " B.F.O. SWITCH #86654
(5) ⏚ CHASSIS

WIRE LEGEND

ALL WIRING TO BE V.H.R-6420, SOLID, UNLESS OTHERWISE SPECIFIED.
"L" - #16 SOLID TINNED CU. WIRE

"A" - RED
"B" - BLUE
"C" - YELLOW
"D" - BLACK
"E" - BROWN
"F" - GREEN
"G" - GREEN - V.H.R.-6420, FLEX.
"H" - N#20 SOLID, TINNED, CU. WIRE
"J" - N#18 " " "
"K" - N#14, 41/30 S.B. WAXED, 300V. INS.

TERM. PANEL DESIGNATIONS

1 = 180 V. +
2 = V. BAYTOR RELAY
3 = 6 V. +
4 = 6 V. - GROUNDED
5 = BREAK IN RELAY POS.
6 = " " "
7 = OUT - 10,000 OHMS HOT
8 = OUT - " " GROUNDED
9
10 = GROUND
11 = ANTENNA

FORM 2007

Inst. 321

INSTRUCTIONS

FOR

MARCONI POWER UNIT

TYPE VP-1

CANADIAN MARCONI COMPANY

MONTREAL

OPERATING INSTRUCTIONS

MARCONI VP-1 POWER UNIT

TYPE 85025

WITH OVERALL COVER TYPE 85114

DESCRIPTION

The Marconi Type VP-1 Power Unit is a vibrator type power supply designed to deliver a maximum output of 180 volts d-c at 40 milliamperes when used with a fully charged storage battery of 6.3 volts applied through 10 ft battery leads consisting of No. 12 flex wire.

Two chassis, mounted one on top of the other and insulated from each other by rubber mounting washers, comprise the complete unit. The upper chassis contains the vibrator, shielded transformer, timing capacity and an r-f filter system. The lower chassis contains the audio filter and additional r-f hash filtering for use with receivers operating below the broadcast band.

This power unit is designed especially for use with the Marconi LFR-7 receiver, but may be used with any receiver requiring the maximum voltage and current referred to above and in which "B" negative is at ground potential. A voltage range switch is provided for lower voltage and current ratings than 180 volts at 40 ma, a table of which is as follows:

Position No. 1 - 115 volts at 30 ma
- 100 volts at 40 ma

Position No. 2 - 145 volts at 30 ma
- 130 volts at 40 ma

Position No. 3 - 175 volts at 30 ma
- 160 volts at 40 ma

Position No. 4 - 200 volts at 25 ma
- 180 volts at 40 ma

Control of the power unit is by the receiver On-Off filament switch, a relay being employed for turning the unit on and off. Protection is given by a 15-ampere fuse which is accessible from outside the chassis.

This power unit may be used with either "A" positive or "A" negative of the storage battery grounded by placing the vibrator in its socket according to the information supplied on top of the vibrator transformer.

The unit is supplied complete with fuse, vibrator, inter-unit cable, mounting screws, and terminal lugs for connecting the "A" positive and "A" negative wires to the input terminals.

INSTALLATION

5/8" flanges are provided on all four sides of the unit for rigid mounting and it should be mounted by means of the wood screws supplied; if it is to be mounted on a wall it should be mounted in such a manner as to cause the least strain on the mounting screws, it being preferable to mount the unit with the input terminals and output socket nearest the floor.

The battery cable leads supplying the 6 volts to the power unit must not be smaller than No. 12 flex. wire and should be kept as short as possible to cut down the voltage drop and should be kept away from the antenna lead-in to the receiver.

Connections from the power unit to the LFR-7 receiver is by means of the Type 85839 cable supplied. Connections are as follows:-

Yellow Lead to "A" HOT Terminal

Black Lead to "A" GROUND "

Green Lead to "A" RELAY "

Red Lead to H-T "

Connections to any other receiver are as follows:-

Yellow Lead to "A" HOT or ungrounded side of filaments.

Black Lead to "GROUND", "B" Negative.

Green Lead to the filament side of the filament on-off switch.

Red Lead to H-T Positive.

NOTE: As the Green Lead of the Type 85839 inter-unit cable carries the 6 volts for operating the On-Off relay of the power unit, it must be connected in such a manner as to give control of the unit by the receiver filament switch.

Before the battery is connected to the power unit the voltage range switch should be set to the required tap as noted under "DESCRIPTION"; for the LFR-7 the tap is No. 4. Also, the vibrator should be placed in its socket according to the instructions on the top of the vibrator transformer.
NOTE: It is advisable that the power unit be turned off when any adjustment is made on the voltage range switch.

A good ground must be provided for the receiver earth connection.

MAINTENANCE

Should a hum develop, it is advisable to try a new vibrator in the unit before any check of the internal components is made. If this does not cure the trouble, C2 in the lower chassis should be investigated and replaced if found faulty. Also check C3 in the upper unit. See diagrams of connections 86436 and 86448.

The power unit is well filtered for hash suppression between the frequencies of 150 kc to 21 mc and all condensers used have a voltage rating well above any voltage that is liable to develop within it. In view of this it is advisable to definitely identify any suspected interference as r-f hash before any change to the unit's components is made. This may be done by bringing the antenna lead-in to the receiver near the power unit. If the interference suspected is hash, a definite rise in volume will be noticed. If this does not occur the noise is from some outside source and, if desired, this may further be checked by connecting the receiver to a battery supply. If it is definitely shown that hash is being induced from the power unit, C1 in the lower unit and C1 and C2 in the upper unit should be checked and the faulty unit replaced.

If the power unit becomes inoperative it is advisable to check the fuse before investigating into possible internal trouble.

TEST VOLTAGES

All voltages are taken with a 1000-ohms-per-volt meter with the voltage switch on tap 4 and with a 40 milliamperes load at 180 volts d-c.

Lower Unit

Terminal "A" HOT	6 volts	±5%
Terminal 3 of output socket	6 volts	±5%
Junction of L2 and relay contact	6 "	±5%
Terminal 4 of output socket...	180 "	±5%

Upper Unit

"A" Hot Terminal	6 volts	±5%
Junction of L1 and C1.....	6 volts	±5%
B+ Terminal	225 volts	±5%
Junction of L2 and C3.....	225 "	±5%

With a load of 40 milliamperes at 180 volts d-c connected across terminals 4 and 2 of the output socket and with no receiver filaments connected, the current drain of the Power Unit from the battery should be 2.0 amperes plus or minus 5%.

PARTS LIST

Lower Unit

C1 - 1 uf - 200 volt tubular aerovox
C2 - Dual dry electrolytic - 10-10 uf, 350 volts Mallory Type FPD-310.
L1 - Audio Choke Marconi Type 57706
L2 - R-F Choke Marconi Type 62942
Relay - 86434.

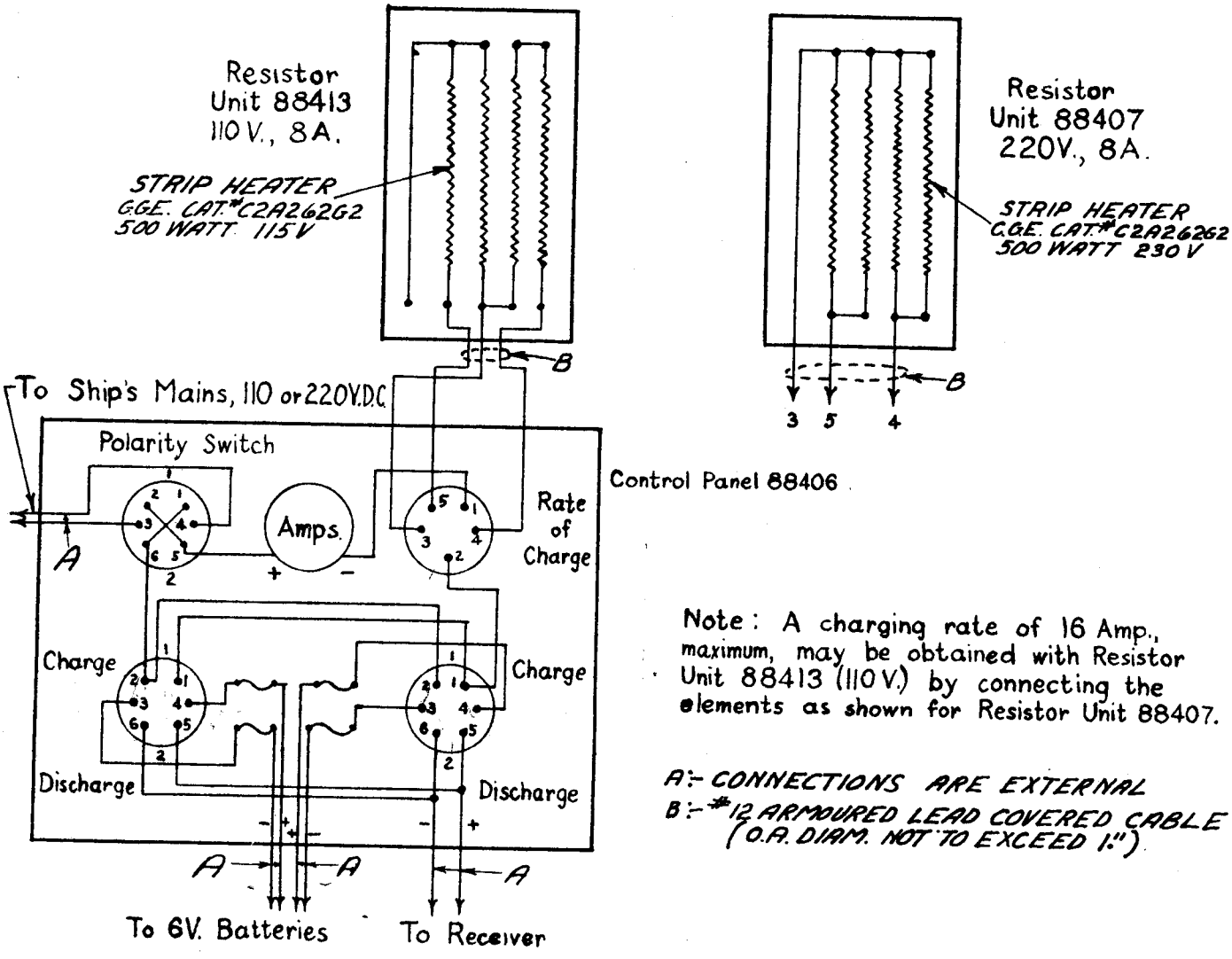
Upper Unit

C1 - .5 uf - 50V. Mallory Type RF481
C2 - .0075 uf - 1600 V. Mallory Type 0T372
C3 - .1 uf - 400 V. Mallory Type TP 428
C4 - 1. uf - 50 V. Mallory Type RF482
L1 - R - F Choke Mallory type RF583
L2 - Audio Choke Mallory type A -40919-1
T1 - Vibrator Transformer Mallory B-40966-1
R1 - 5000 ohms ½ watt.
Vibrator - Mallory type 725.

Inter-Unit Cable

Marconi Type 85839

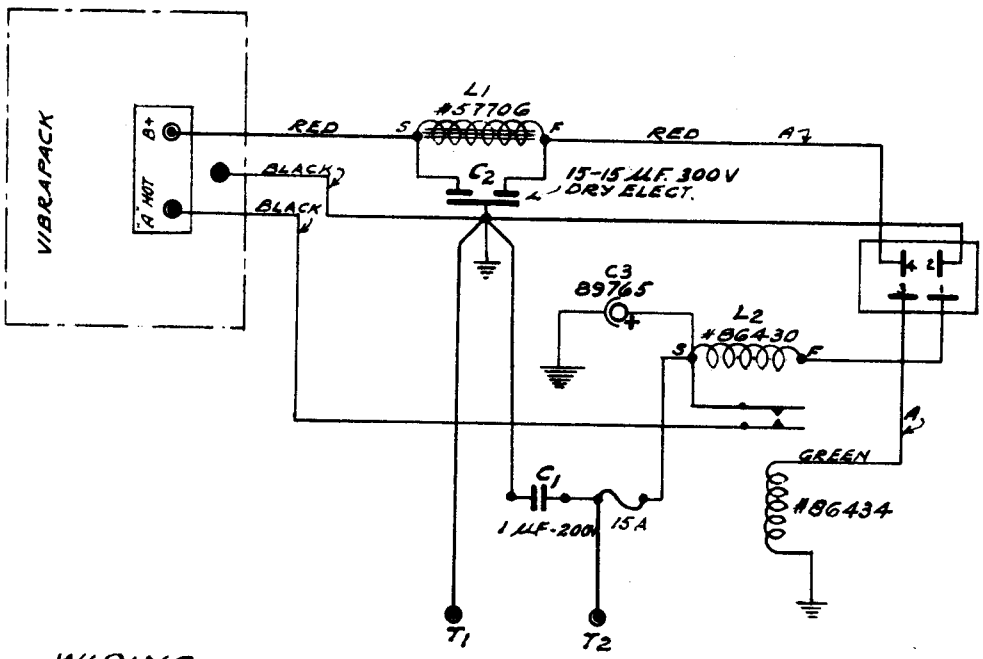
Canadian MARCONI Company,
Montreal, September 18, 1939

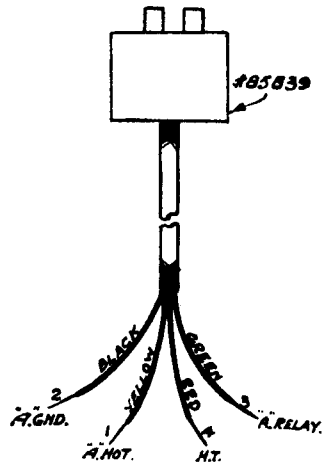


Note: A charging rate of 16 Amp., maximum, may be obtained with Resistor Unit 88413 (110 V.) by connecting the elements as shown for Resistor Unit 88407.

A:- CONNECTIONS ARE EXTERNAL
B:- #12 ARMOURED LEAD COVERED CABLE (O.A. DIAM. NOT TO EXCEED 1.")

FORM #2008

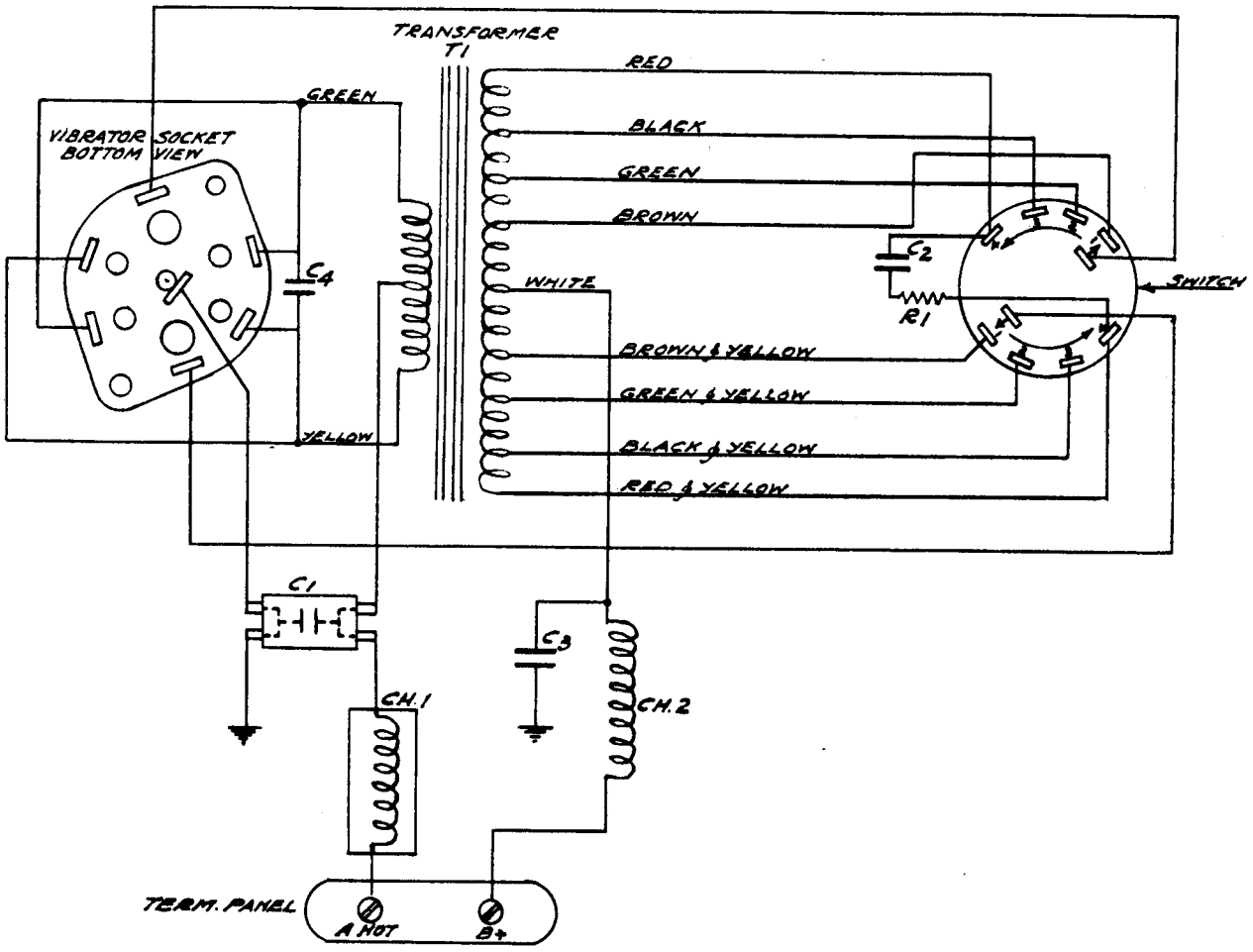




WIRING.

A- #20 Ga. FLEX. V.R.32-COTTON BRAID.
ALL OTHER WIRING #18 Ga FLEX. V.R.32-COTTON BRAID.

FORM#2009



	VALUE	MALLORY PART No.
C1	.5 MF - 50 V.	RF 481
C2	.0075 MF - 1600 V	OT 372
C3	.1 MF - 400 V	TP 428
C4	1 MF - 50 V.	RF 482
CH.1		RF 582
CH.2		A 40919-1
TRANS		B 40966-2
SWITCH		B 110755-1
R1	5000 Ω - ½ WATT	

FORM # 2010