

A. GENERAL DESCRIPTION

The Johnson Viking Challenger is a single knob bandswitched shortwave transmitter which covers the amateur 80 through 6 meter bands and provides both CW and Phone operation. Crystal or external VFO frequency control is provided by simple front panel plug-in arrangement without switching.

The power input rating is 120 watts CW and 70 watts Phone with the input restricted to 85 watts on the 6 meter band. A panel mounted meter monitors plate current (power input) and grid current of the final amplifier.

The meter leads and AC line cord utilize individual RF filters to supplement the excellent cabinet shielding and bonding which provides very good suppression of spurious radiation and harmonics and reduces interference to other services.

The circuitry employs a 6DS5 crystal oscillator (RF amplifier when driven by a VFO), a 6DQ6 as an RF buffer-driver, and a pair 6DQ6A's in parallel, bridge-neutralized, as the final power amplifier. A 12AX7 dual triode functions as a two stage speech amplifier to drive a 6AQ5 clamp tube modulator. On CW, the 6AQ5 clamps the final amplifier screens to limit the key-up plate dissipation. A 5U4GB rectifier delivers D.C. power to all stages.

The keyed CW waveform is shaped by an iron core choke, L1 and capacitor, C3, to eliminate key clicks.

The power consumption at the recommended nominal input voltage of 117 volts is:

115 watts in the "STBY" position
120 watts in the "TUNE" position
210 watts in the "PHONE" position
250 watts in the "CW" position

The satisfaction to be derived from this equipment will be a direct result of one's understanding of its operation and the care used in tuning it. Read the instructions carefully for thorough understanding.

B. CONTROLS, CONNECTORS AND FEATURES

1. CRYSTAL AND VFO

The CRYSTAL and VFO socket, J1, is located on the front panel of the transmitter to facilitate changing crystals or VFO. The crystal socket pin spacing accommodates standard type FT-243 crystals. 160 or 80 meter crystals should be used for 80 meter operation and 40 meter crystals used for 40, 20, 15 and 10 meter operation. For 6 meter operation, crystals in the 8.334 to 9 mc range should be used. A 6DS5 serves as an electron-coupled crystal oscillator.

A VFO can be plugged directly into the octal VFO socket through which power is fed to the VFO and the VFO RF output is fed back to the transmitter to the 6DS5 grid. The 6DS5 now serves as an RF amplifier for the VFO. The Johnson Model 122 VFO (for 80-10 meter operation) or the Johnson 6N2 VFO (for 6 meter operation) can be plugged directly into the Challenger after the following slight modification.

1. 6N2 VFO MODIFICATION

Remove ground lead in pin 4 of octal plug and connect it to pin 1. Connect center conductor of VFO output cable to pin 4 and solder. Add jumper between pins 5 and 6, solder both pins.

B. MODEL 122 VFO MODIFICATION

Remove the coaxial plug from the RF output cable. When unsoldering be careful not to damage the insulation.

Remove the cap from the octal plug.

Insert the RF output coaxial cable into the grommet of the octal plug cap and pull the cable out to the length of the plug. Connect a 100 mmf. capacitor to the inside conductor of the RF cable, make the lead as short as practical. Solder the connection and wrap with insulating tape. Place the other lead so that it protrudes through the pin (pin 4) and solder the connection. Connect the braid to pin 1 and solder. Replace cap on the plug.

Add jumper between pins 5 and 6, solder both pins.

The VFO has output on 160 meter and 40 meter bands. Use 160-80 meter position for 80 meter operation and 40, 20, 15 and 10 position for operation on 40, 20, 15 and 10 meters.

2. BAND SWITCH

A single knob bandswitch is used for switching all circuits to the proper band. SW1 is the bandswitch and consists of 2 wafers using both sides of the wafer for switching. SW1A front, switches the oscillator plate tank, SW1A rear, switches the multiplier tank. SW1B front, switches in 75 mmf. of padder on 80 meters for the final tank. SW1B rear, handles the switching of the final tank. After plugging in the proper VFO or crystal and selecting the band and frequency on the VFO, make sure the "BANDSWITCH" knob on the transmitter is on the desired band.

3. OPERATE SWITCH

The OPERATE switch has 5 positions, OFF, TUNE, PHONE, STANDBY and CW. It is designated SW3 and has 2 wafers plus the AC line switch and performs the following functions:

- a. When the switch is turned from "OFF" to "TUNE" position, AC is applied to the primary of T1 the power transformer. The clamp tube, V6 6AQ5, grid is switched to the grid of the final, below the choke L10. No screen voltage is applied to the final because SW3A which supplies the screen is in an open position. Voltage is applied to the plates and screens of the other stages. The key is connected to the key line. This permits tuning of the oscillator and driver stages for correct final grid current.
- b. When the "OPERATE" switch is turned to "PHONE" position, the audio is fed to the grid of V6, the 6AQ5 clamp tube. The B plus is put on the clamper plate and the final screens.
- c. When the "OPERATE" switch is turned to "STANDBY" position the B plus is removed from the clamper plate and final screens. The key is disconnected from the key line.
- d. When the "OPERATE" switch is turned to "CW" the grid of V6 is switched to the grid of the final below L10. R23 and R34 in the plate of V6 are shorted out as is R24 and C36 in the Cathode of V6. B plus is applied to the clamper plate and the screens of the final. The key is connected to the key line.

4. METER SWITCH

The meter switch, SW4, is located on the front panel below the meter. It is a slide

- B. 4. switch. Move the switch to the left for grid current, to the right for plate current. Normal grid current is 5 ma. for 80 - 10 meter operation and 2 1/2 ma. for 6 meter operation. Normal plate current is 215 ma. except on 6 meters where it is 150 ma.

5. EXCITATION CONTROL

The EXCITATION CONTROL is a variable capacitor, C6, in the plate circuit of V1, 6DS5, oscillator stage. By detuning the oscillator tank less voltage is supplied to the driver tube resulting in less grid current at the final stage. The proper grid current for bands 80 - 10 meters is 5 ma. This is read on the lower scale of the meter. On 6 meters the grid current is to be set at 2.5 ma. The "EXCITATION" control is adjusted after the DRIVER control has been peaked.

6. DRIVER CONTROL

A variable capacitor, C12, which is operated by the "DRIVER" knob, tunes the plate tank circuit of V2, 6DQ6A. It is tuned by observing the meter in "GRID" position and tuning the capacitor for maximum indication on the meter. On the higher frequencies the "EXCITATION" control may have to be tuned slightly to obtain a grid current reading. The plate circuit of V2, 6DQ6A is always on the operating frequency so the final amplifier is operating straight through. The driver is bridge neutralized. C7 and C11 are the capacitors in the bridge circuit. The tube is protected by R6, a 1800 ohm resistor in the cathode circuit. The stage is capacitively coupled to the final by C13, a 50 mmf. capacitor.

7. FINAL AMPLIFIER TUNING CONTROL

The plate control tunes the final amplifier plate circuit. It is always tuned for minimum PLATE current (dip).

8. LOADING CONTROLS

The "LOADING" controls serve to couple or load the final amplifier to the antenna system. Two loading controls, coarse and fine, are provided on coaxial shafts, coarse on the large knob, fine on the small knob.

Proper loading adjustment is achieved by making small increases in "LOADING" knob positions (increased numbers for increased loading) and tuning "PLATE" for minimum plate current (dip) after each incremental loading adjustment, until desired plate current value is obtained.

9. KEYING

The key jack, J2, is located on the rear apron of the chassis. It is a closed circuit jack and grounds the key line when there is no plug inserted. A 75 Mallory, P155, or equivalent will fit the jack. The key controls V1, the 6DS5 oscillator, and V2 the 6DQ6A driver by opening the cathodes. To prevent the full plate voltage from appearing across the key, R3, a 47K ohm resistor, is placed from the key line to ground. This holds the voltage across the key to less than 50 volts. The keyed wave is shaped by L1, a 2 henry choke and C3 a 2 mfd. capacitor. The key may be a straight hand key, automatic (bug) key or an electronic key.

10. MICROPHONE AND AUDIO

The microphone jack, J4, is the single phono type connector. The jack is located on the rear apron of the chassis. V5, a 12AX7, serves as the speech amplifier. Any good high impedance microphone will develop enough audio for a good signal. When the transmitter is switched to "PHONE" the audio output is switched to the grid of V6, 6AQ5, the clamper tube.

B. 11. ANTENNA CONNECTOR

The antenna connector is a coaxial SO-239 type. It will accept a PL259 type plug. It is located on the rear apron of the chassis.

12. ANTENNA T-R SWITCH

No provision has been made for antenna relay control as it is assumed that a modern electronic T-R switch such as the Johnson 250-39 will be used.

13. FUSES

The line cord plug is of the enclosed fuse type. Two five ampere fuses are used. The equipment operates from 105 to 125 volts A.C. single phase 50/60 cps. To replace fuses, merely insert a small diameter object in the hole at the rear of the plug, and push the fuse out. A new fuse can be inserted from the plug end.

C. INSTALLATION

1. Observe all packages for damage due to mishandling or abuse during shipment.
2. Open all packages and inspect contents for hidden damage or missing parts. Remove chassis from cabinet and remove all packing materials.
3. Report all claims for transportation damage immediately to the carrier and not to the E. F. Johnson Company.

4. Report any missing parts to the Distributor from whom the unit was purchased.

5. TUBE INSTALLATION

Be sure that all tubes are installed in their correct sockets as shown in Figure E. Plate caps should be carefully pushed onto the 6DQ6A tubes. Place chassis in cabinet securing all fastenings tightly.

6. GROUND LEAD

A heavy copper wire or strap should be used to ground the transmitter by connecting it to the ground stud on the rear chassis apron. The length of the ground wire should be as short as possible. The use of several ground leads, each of a different length and selected at random, may be helpful in keeping the grounding impedance low at the transmitter even though the transmitter is some distance away from a true earth ground.

7. ANTENNA SYSTEM

Connect a good antenna to the transmitter and receiver through a modern electronic T-R switch such as the Johnson 250-39. Remember that the effectiveness of any transmitter depends to a major extent upon the antenna system. Try to obtain the best antennas - as high and as in the clear as possible.

8. KEY AND MICROPHONE

The key and microphone should be plugged into their respective jacks and placed in convenient operating positions. Key must be closed for phone operation.

D. TUNING AND OPERATION

It is assumed that the previous sections A, B and C have been read and understood, that ground wire and antenna have been attached, the key and microphone connected. Close key and leave closed until instructed otherwise. To facilitate gaining tuning familiarity, a dummy load consisting of a 75 watt light bulb with short leads may be used in place of the antenna.

1. With "OPERATE" switch in "OFF" position, plug line cord of transmitter into 117 volt (105 to 125 volt range), 50/60 cps. A.C. outlet.
2. Plug desired crystal or VFO into socket on front panel.
3. Set BAND switch to desired band. Set VFO, if used, to desired frequency.
4. Place meter switch in "GRID" position.
5. From Table 1 (page 8) set all dials to settings given for end of band desired.
6. Turn "OPERATE" switch to "TUNE". This turns on the transmitter which will warm up in approximately 30 seconds.
7. Adjust "DRIVER" tuning control for maximum grid current as indicated by the meter.
8. Adjust EXCITATION control for five (5) ma. grid current as read on lower scale of the meter. The grid current should be set at 5 ma. on the 80, 40, 20, 15 and 10 meter bands and set at 2.5 ma. only on the 6 meter band.
9. Switch the meter to PLATE position.
10. Rotate the "OPERATE" switch to the CW position. Immediately tune the "PLATE" for plate current dip (minimum plate current) as read by the meter (upper meter scale reads plate current). The transmitter is properly loaded to the antenna system when the plate current is 215 ma. (150 ma. on 6 meters only). At this point the plate current will probably be other than 215 ma. so the following adjustment will result in proper loading.
11. Adjust coarse and fine "LOADING" controls to increase or decrease plate reading (clockwise adjustment increases reading). After each incremental adjustment of the loading, the "PLATE" should be adjusted for dip. Adjustment for dip should always be the last adjustment.

The transmitter tuning procedure has been completed when the plate current at dip is 215 ma. (150 ma. on 6 meters). Retuning will only be necessary if bands are changed, if frequency is changed appreciably within a band, or different antenna systems used.

12. Switch meter to "GRID". Adjust EXCITATION for 5 ma. grid current (2.5 ma. on 6 meter if the current has changed from this value. During operation, the meter may be left in either the "PLATE" or "GRID" position but both currents should be monitored occasionally to assure proper tuning and loading.
13. The key may now be opened and manipulated for CW communication.
14. PHONE operation merely requires switching the "OPERATE" switch to the "PHONE" position after first loading the transmitter in CW position to the specified values. The OPERATE switch is then manipulated between "STANDBY" and "PHONE" to listen or transmit, respectively. Speak clearly and directly into the microphone for best results. Adjust distance from microphone for best audio reports. Readjust grid current to 5 ma. if necessary (2.5 ma. on 6 meters).

D.

TUNING RESUME

Tuning is simply the adjustment necessary to obtain 215 ma. plate current at dip (150 ma. on 6 meters) with 5 ma. grid current (2.5 ma. on 6 meters).

Loading is the same for CW or PHONE operation - always load in the CW position - switching to PHONE after loading in CW first.

NOVICE OPERATION

For NOVICE operation on 80, 40 and 15 meters, load the final to 125 ma. at plate current dip with 5 ma. grid current. This will give 75 watts input.

15. NEUTRALIZATION

The power amplifier of the Viking Challenger is neutralized by C37 a double spaced Johnson type S capacitor. The capacitor adjustment is reached from below the chassis. The capacitor is located near the center of the chassis. Wired transmitters have been neutralized at the factory.

CAUTION: THE NEUTRALIZING CAPACITOR HAS FULL PLATE VOLTAGE APPLIED TO IT. ADJUSTMENT SHOULD BE MADE WITH AN INSULATED SCREWDRIVER.

Tune up the transmitter at any convenient frequency on the 15 meter band and load the amplifier to 150 ma. with a dummy load (75 watt light bulb with short leads). Note the exact reading of the "PLATE" dial where resonance (minimum plate current) occurs.

Turn the meter switch to the "GRID" position. Detune the "PLATE" dial slightly in the direction which causes grid current to increase. (Don't move "PLATE" dial far nor leave the amplifier out of resonance very long because plate current increases rapidly and plate dissipation becomes prohibitive).

If an increase in grid current occurs with a decrease in "PLATE" dial reading, the neutralizing capacity is too great.

If an increase in grid current occurs with an increase in "PLATE" dial reading, the neutralizing capacity is too small.

\ Adjust C37 in the direction indicated, retune amplifier to resonance while observing grid current, detune "PLATE" dial again in the direction causing grid current to rise. Repeat this step as necessary.

The amplifier is neutralized when detuning the "PLATE" causes little or no change in grid current or when detuning the "PLATE" dial in either direction causes grid current to fall off.

16. VFO ZEROING

To zero beat a signal with the VFO, turn the OPERATE switch to TUNE and zero the VFO. If a key is plugged into the transmitter, it must be closed to actuate the VFO.

E. TROUBLE SHOOTING

Operating problems may be due either to tube failure, component failure, or improper operational technique. Frequently, malfunction of a piece of equipment such as the Challenger is a result of tube failure. Meter readings will usually indicate the probable stage affected and

PUSH-TO-TALK MODIFICATION FOR CHALLENGER

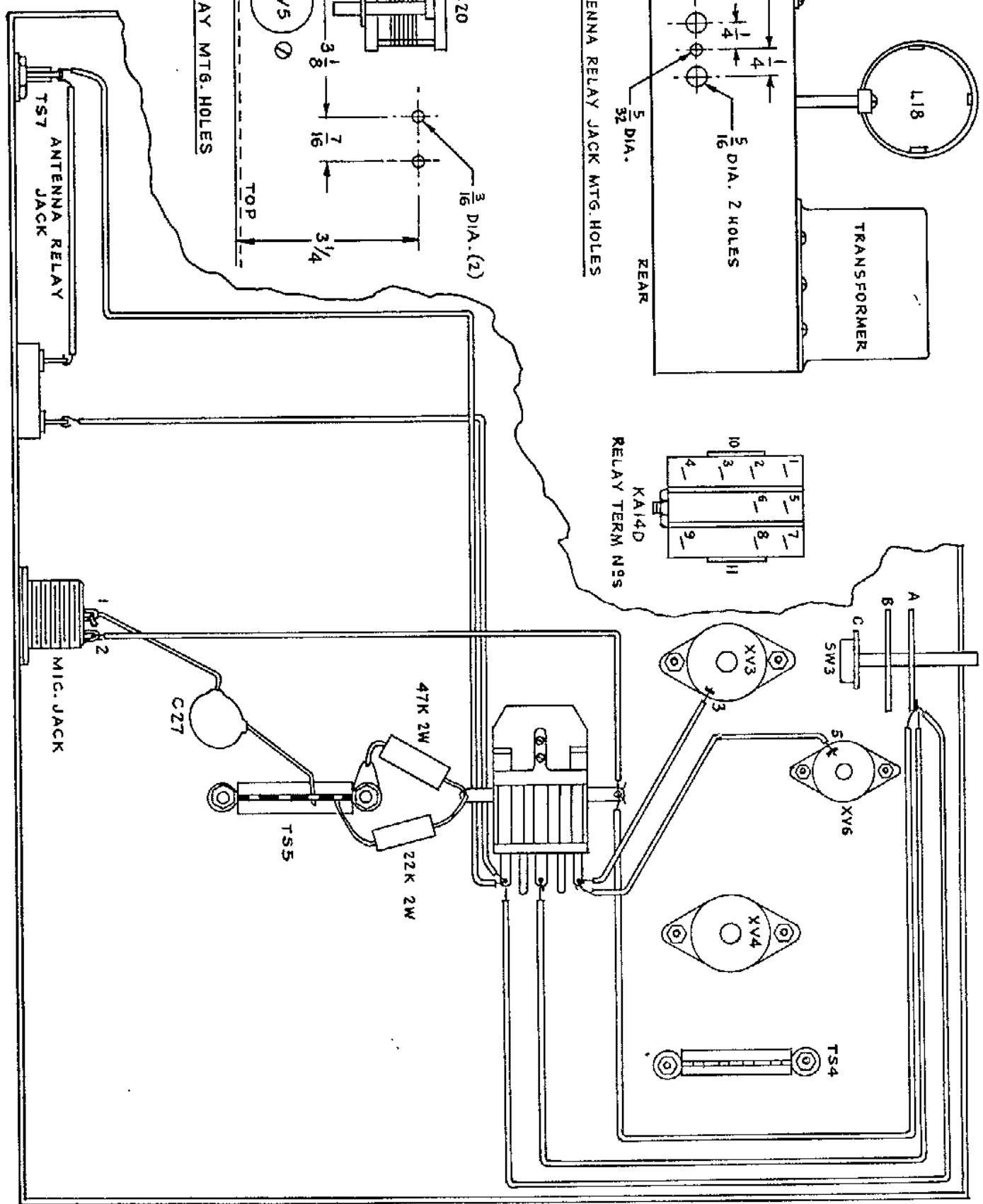
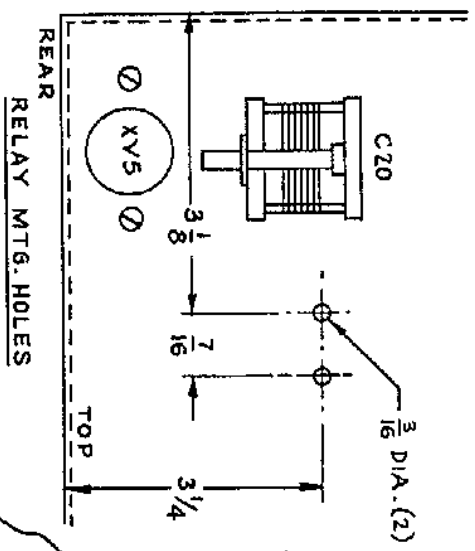
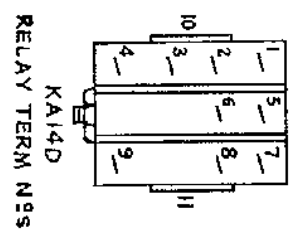
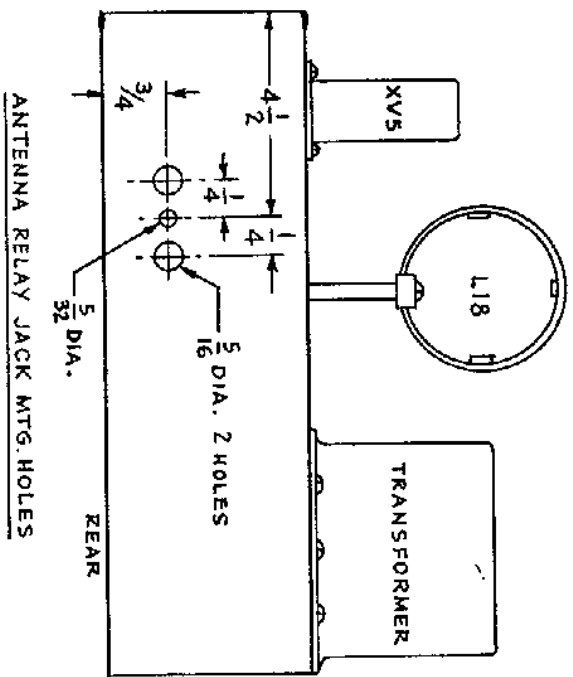
This modification enables the operator to have push-to-talk phone operation on the Challenger, and also provides control of an antenna relay. In CW position, the relay is actuated by the Operate switch. It involves enlarging 1 hole and drilling 5 new ones. Dress all leads as shown on back of sheet.

New Parts Needed:

- 1 - Relay, Potter Brumfield KA14D, 110 volt DC coil, 3PDT or equivalent
 - 1 - 47K 2 watt resistor
 - 1 - 22K 2 watt resistor
 - 1 - Mic connector, Amphenol PC2F or equiv. (Use PC2M on mic. cord).
 - 1 - Ceramic connector, Female, E.F.J. #126-105 (available from distributor or E. F. JOHNSON Co. \$.50 ppd.)
 - 1 - Ceramic connector, Male, E.F.J. #111-99
 - 6' - Insulated wire
 - 1 - 4-40 x 3/8 screw, nut and lockwasher
1. () Unsolder C-27, .001 mfd. capacitor from terminal 1 of J4. Remove the two screws holding J4 and discard J4. Enlarge this hole to 5/8" or size necessary to accommodate the particular jack you are using for the push-to-talk mic. Install jack in hole and secure. Drill 3 holes for relay jack and 2 holes for relay as per sketch. Mount the relay in position indicated. Mount relay jack as indicated.
 2. () Unsolder the resistor combination R25, 26, 27 from terminal 2 of SW3a. Connect the end just unsoldered to pin 3 of XV3. Connect a wire from pin 3 of XV3 to terminal 8 of relay. Solder at both ends.
 3. () Remove the jumper from terminal 2 of SW3A to terminal 4 of SW3A. Connect a wire from terminal 4 of SW3A to terminal 11 (coil connection) of the relay. Solder at terminal 4 only.
 4. () Remove jumper from terminal 12 of SW3A to terminal 12 of SW3B. Connect a jumper from terminal 12 of SW3A to terminal 3 of SW3B. Solder both ends.
 5. () Remove jumper from terminals 8, 9 and 11 of SW3A. Remove the black wire from terminal 8 and connect to terminal 11 of SW3A. Connect a jumper from terminal 8 of SW3A to terminal 12 of SW3A. Connect a wire from terminal 8 of SW3A to terminal 4 of relay. Solder both ends. Connect a wire from terminal 9 of SW3A to terminal 6 of the relay. Connect a wire from terminal 9 of relay to pin 5 of V6, 6AQS. Solder both ends.
 6. () Connect a wire from terminal 2 of TS7 to terminal 1 of relay jack. Solder both ends. Terminal 2 of the second terminal nearest the underside of top of the chassis.

Connect a wire from terminal 7 of the relay to ground lug on XV4, solder.

Connect a wire from terminal 2 of the relay jack to terminal 2 of the relay. Connect a wire from terminal 3 of the relay to terminal 3 of TS7. Solder both ends. Terminal 3 is the third terminal nearest the underside of the chassis.
 7. () Connect a wire from terminal 2 of mic. jack to terminal 11 (coil connection) of relay. Solder both ends.
 8. () Connect a 47K 2 watt resistor between ground terminal on TS5 and terminal 10 (coil connection) of relay. Solder at ground end only.
 9. () Connect a 22K 2 watt resistor between terminal 1 of TS5 and terminal 10 (coil connection) of relay. Solder both connections.



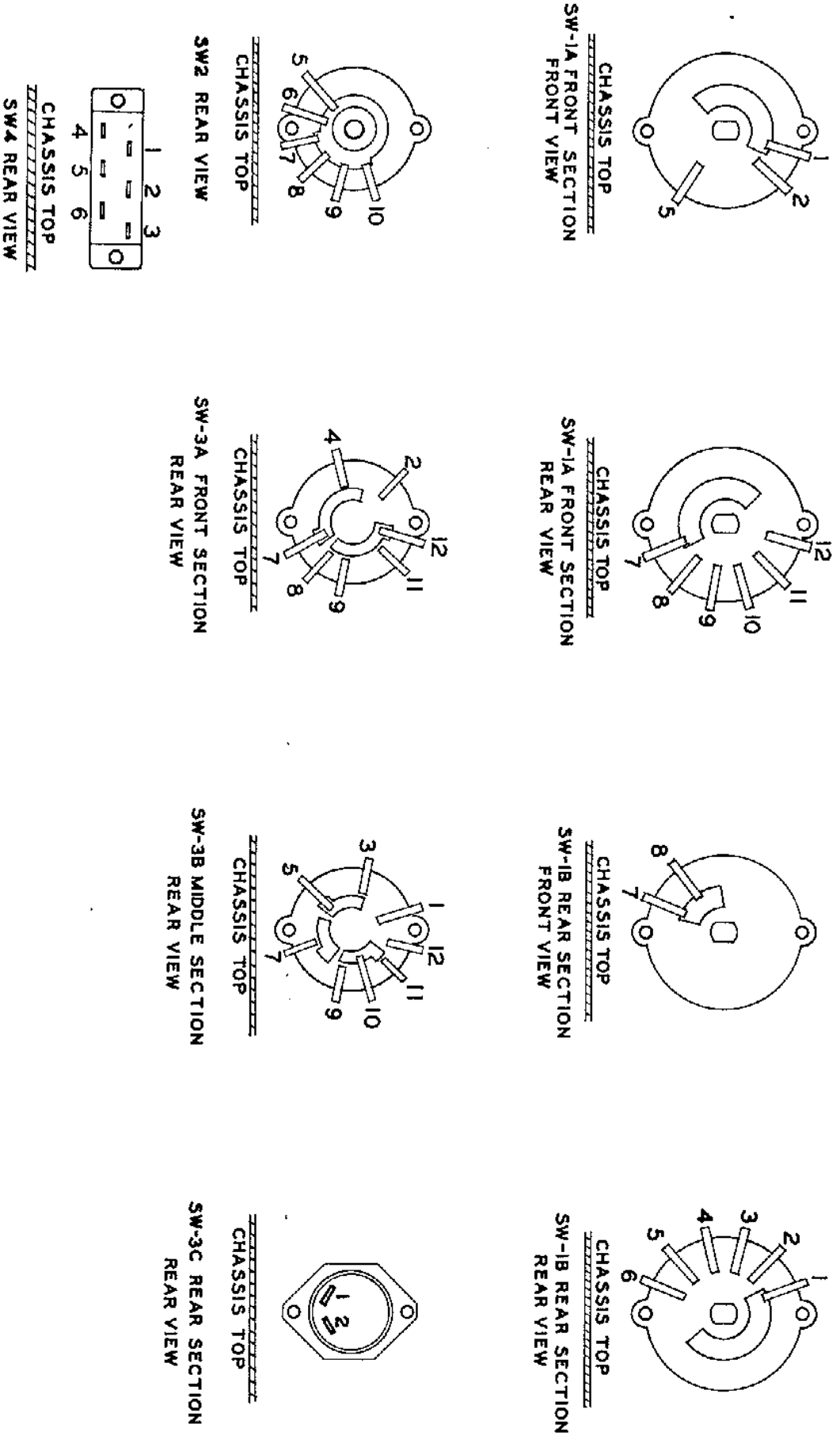


FIGURE 5.

VIKING CHALLENGER VOLTAGE MEASUREMENTS

TABLE 3

* Read voltage at terminal 4 of TS4.
 ** Read voltage at pin 1 of XV3.
 # Read voltage at pin 1 of XV7.
 ## Read voltage at pin 1 of TS4.

LINE VOLTAGE 117 V. A. C.
 RF LEAD 50 ohms -
 OSCILLATOR VFO
 FINAL PLATE 7 MC 215 MA.
 50 MC 130 MA.

MEASURED WITH A 20K OHM/V METER FROM CHASSIS.
 VOLTAGE TOLERANCE, PLUS OR MINUS 20%.

TUBE	C. W.		PHONE		STANDBY
	KEY DOWN 7 MC. 50 MC.	KEY UP 7 MC.	7 MC.	50 MC.	
FINALS - - 6DQ6A					
*PLATE	580	650	625	625	680
#GRID	-36	-.45	-38	-25	-.49
SCREEN	105	10	53	60	0
DRIVER - - 6DQ6A					
**PLATE	580	650	625	600	680
GRID	0	0	0	0	0
SCREEN	180	200	180	180	215
CATHODE	37	53	38	80	55
CLAMPER - - 6AQ5					
PLATE	170	10.6	115	115	0
GRID	-36	-.45	0	0	0
SCREEN	105	100	175	185	185
CATHODE	0	0	13	13	13
AUDIO - - 12AX7					
1-PLATE	42	65	42	46	65
2-GRID	-.38	-.4	-.35	-.51	-.4
3-CATHODE	0	0	0	0	0
6-PLATE	75	165	75	75	160
7-GRID	0	0	0	0	0
8-CATHODE	.8	1.3	.8	.8	1.5
RECTIFIER - - 5U4GB					
PLATE	750AC	790AC	780AC	780AC	800AC
FILAMENT	590DC	650DC	595DC	595DC	680DC
JUNCTION OF R28-R29	190DC	320DC	190DC	215DC	345DC
OSCILLATOR - - 6DS5					
#PLATE	190	320	180	180	320
GRID	-2	-0	-2.5	-0	-0
SCREEN	120	320	125	145	320
CATHODE	3.5	4.8	3.6	4	53

E. servicing requires only substitution of known good tubes. In any case, the tubes should be tested first and eliminated as the source of trouble.

To service the equipment, make liberal use of current values, normal voltage readings and resistance measurements appearing in this manual.

Look first for the simple faults but remember that a component failure often produces a second collateral component failure and to restore normal operation both must be remedied.

TABLE 1

VIKING CHALLENGER TYPICAL DIAL SETTINGS

Oscillator VFO Freq. MC.	50 Ohm Resistive Load		Final Plate Current 80-10 Meters 215 MA. 6 Meters 150 MA.		
	Driver	Excitation	Plate	Coarse-Loading-Fine	
3.5	45	7	32	3	2
4.0	90	2	60	4	1
7.0	52	5	56	4	4
7.425	72	3	62	4	5
14.0	74	7	84	5	1
14.4	84	8	86	5	1
21	60	8	86	5	2
21.4	66	8	88	5	2
28	66	6	90	5	2
29.7	82	7	94	5	2
26.8	54	6	88	5	2
27.4	58	6	90	5	2
50	68	9	84	5	2
54	88	9	90	5	3

These settings are approximate and may vary with component tolerances and antenna impedances.

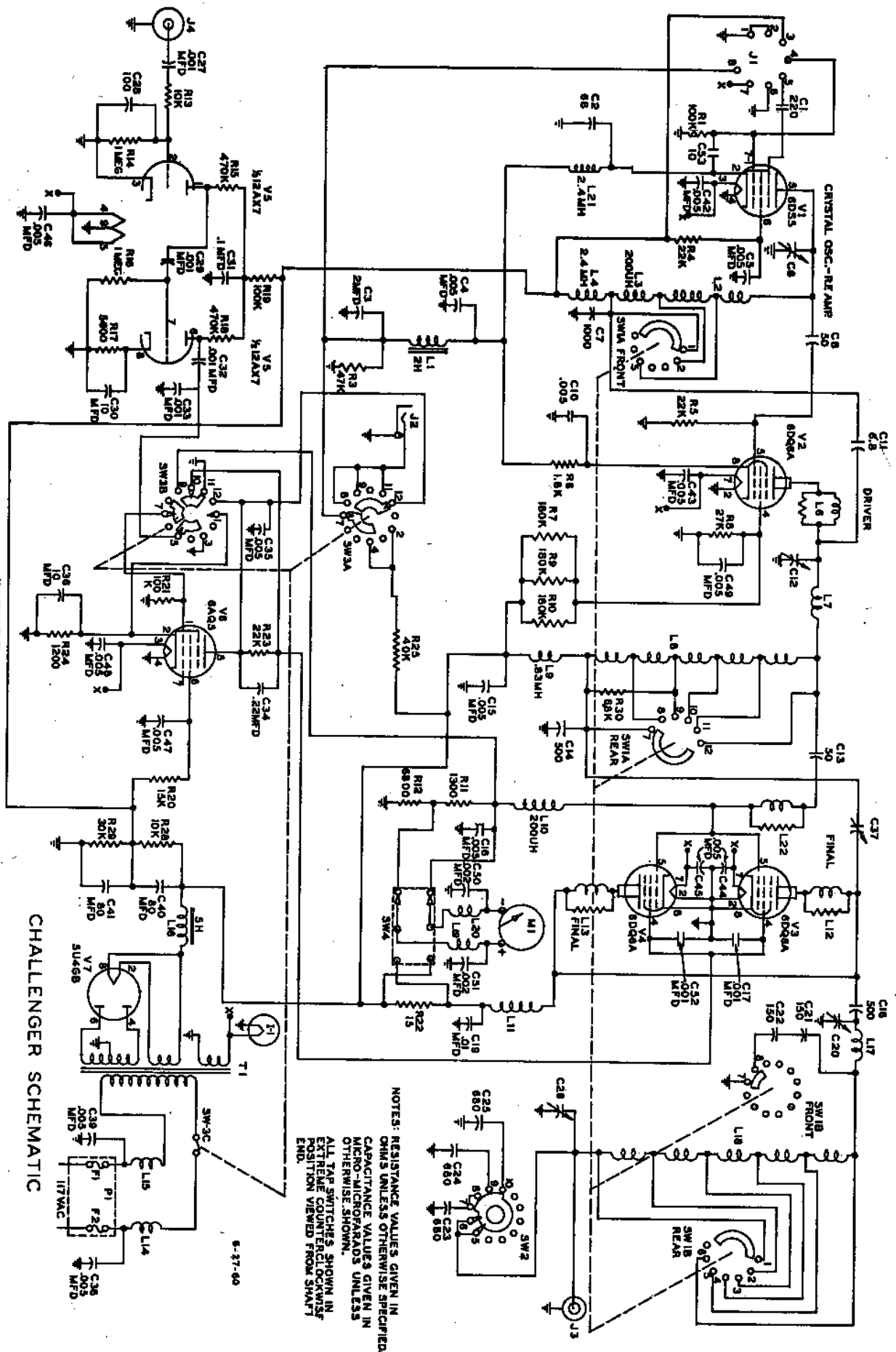


FIGURE F

CHALLENGER SCHEMATIC

NOTES: RESISTANCE VALUES GIVEN IN OHMS UNLESS OTHERWISE SPECIFIED.
 CAPACITANCE VALUES GIVEN IN MICRO-MICROFARADS UNLESS OTHERWISE SHOWN.
 ALL TAP SWITCHES SHOWN IN EXTREME COUNTERCLOCKWISE POSITION VIEWED FROM SWA17
 END.

5-27-60