

SPECIFICATIONS

Power Input:	90 watts CW and controlled-carrier phone.
Output Impedance:	50 - 75 Ω .
Output Coupling:	Pi network (coaxial).
Band Coverage:	80, 40, 20, 15, and 10 meters.
Front Panel Controls:	METER Switch Function Switch DRIVE LEVEL CRYSTAL - VFO Switch (4 crystal positions) DRIVE TUNE BAND Switch FINAL TUNING FINAL LOADING
Tube Complement:	1 - 12AX7, Speech Amplifier 1 - 6DE7, Controlled-Carrier Modulator 1 - 6CL6, Crystal Oscillator 1 - 6CL6, Driver 1 - 6146, Final Amplifier
Power Requirements:	117 volts AC, 50/60 cycles, 225 watts.
Cabinet Size:	13-3/4" wide x 11-1/2" deep x 6-1/2" high.
Net Weight:	23 lbs.
Shipping Weight:	28 lbs.

INTRODUCTION

The HEATHKIT Model DX-60 Transmitter was designed as a versatile and economical transmitter for General and Novice Class amateur operation. It features up to 90 watts input, controlled carrier phone operation, four switched crystal positions, and provisions for the use of a VFO. Panel controls allow for CRYSTAL or VFO, and PHONE or CW operation.

Front panel controls consist of the BAND switch, DRIVE TUNE control, DRIVE LEVEL control, CRYSTAL - VFO switch, FINAL TUNING control, FINAL LOADING control, and Function

switch. The illuminated meter face is calibrated to indicate both grid drive and plate current. A slide switch, directly below the meter, enables the operator to rapidly check grid drive or plate current. The MIKE and KEY jacks are on the front panel for easy accessibility.

An accessory power socket is provided on the rear chassis apron. At this socket, 300 volts at 50 ma DC and 6.3 volts AC are available for VFO operation. Switched 117 volt AC power is also available for antenna relay operation.

CIRCUIT DESCRIPTION

The DX-60 Transmitter has seven basic circuits. These are shown on the Functional Block Diagram. While reading the Circuit Description, we suggest that you follow the circuit on the Block and Schematic Diagrams.

OSCILLATOR

Oscillator tube, stage V1, operates as a modified Pierce crystal oscillator. This oscillator can be operated at the fundamental frequency of either an 80 or 40 meter crystal. When the DX-60 is used with a VFO, V1 operates as a buffer stage. The plate circuit of V1 is untuned for 80 meter operation, and is slug tuned by coil L1 for operation on 40 through 10 meters. The output of V1 is capacitively coupled to driver stage V2 through capacitor C6.

DRIVER

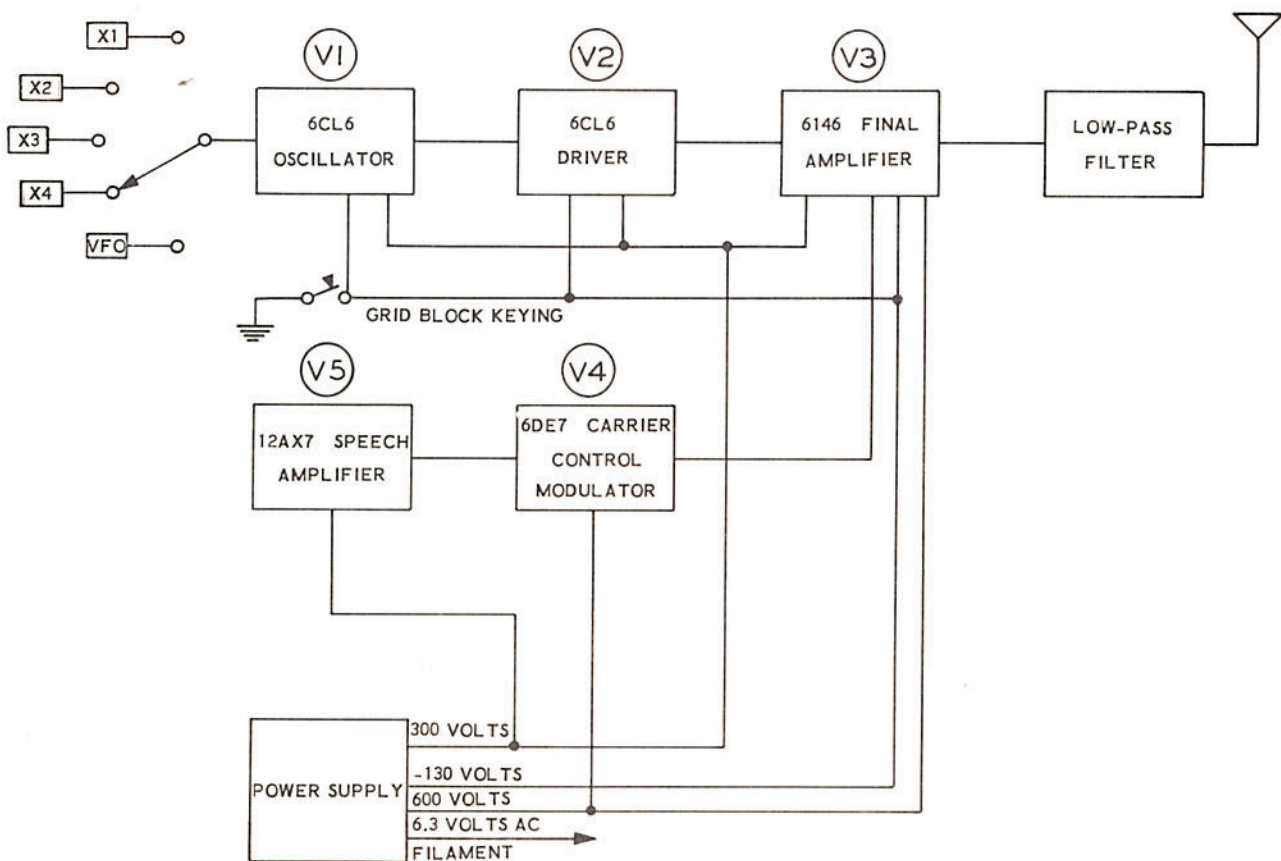
V2 is used as a driver stage. The plate circuit of V2 is tuned to the desired operating frequency by coil L2 and variable capacitor C11.

This stage operates straight-through on 80 and 40 meters, as a doubler on 20, as a tripler on 15, and as a quadrupler on 10 meters. The amount of output (drive) is adjusted by varying the screen voltage of V2 with DRIVE LEVEL control R6. Drive is capacitively coupled to the grid of final amplifier V3 through capacitor C13.

FINAL AMPLIFIER

Final amplifier tube V3 operates on all bands as a shunt-fed, straight-through, neutralized amplifier. The tank circuit consists of C22, L3, and C24. Variable loading capacitor C24 has three 450 μf sections to eliminate the necessity of switching fixed capacity into or out of the circuit when changing bands.

The output is applied to a low-pass filter consisting of L4 through L8, and C25 through C28. This low-pass filter has a cutoff point of approximately 34 mc and suppresses RF energy above this frequency. The output should be fed into an unbalanced 50 to 75 Ω lines.



BLOCK DIAGRAM

The cathode and grid currents of the final amplifier are measured with a 0-1 ma meter. The appropriate shunt, R10 and R11 for grid current, or R13 for cathode current, is selected by the METER switch, located on the front panel.

SPEECH AMPLIFIER

Speech amplifier V5 operates as a conventional resistance coupled audio amplifier. The plate of V5 is coupled to one-half of modulator tube V4 through capacitor C33.

MODULATION

Modulator tube V4 contains two dissimilar triodes, one having a power rating of 1.5 watts and the other 7 watts. The lower power section is used as a direct coupled driver to excite the higher rated section, which is actually the modulator. The cathode of the modulator section is coupled to the screen grid of V3, the final amplifier tube, through R32 and C35.

V4 is so biased that with no audio signal the conduction of the tube is limited. This allows the screen voltage of V3 to remain at a low value, thus limiting the plate current of V3 to a low resting state.

With modulation applied, conduction in the modulator section of V4 increases, raising the screen voltage of V3. This results in an increase in final plate current with modulation producing a controlled-carrier effect.

POWER SUPPLY

The power supply section uses four silicon diodes in a voltage-doubler circuit. Filtering is accomplished by capacitors C36, C37, C38, and resistors R18 and R19.

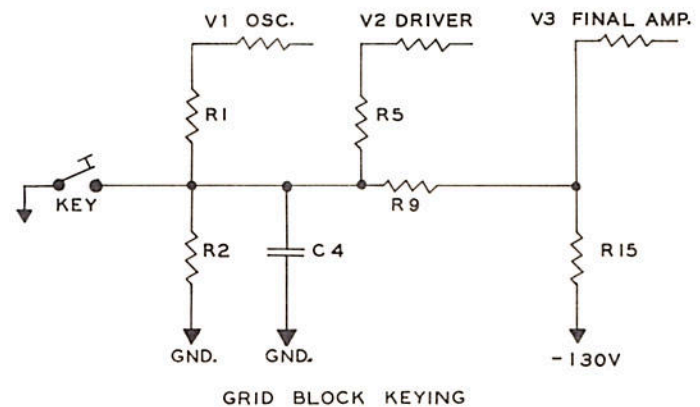
Bias voltage for grid block keying is developed by a silicon diode in a half-wave rectifier circuit.

A separate 6.3 volt, 4 amp winding for VFO filaments or other accessory equipment is available at the accessory power socket.

The line cord uses a fused plug for protection in the event of short circuits or transmitter overload.

GRID BLOCK KEYING

In order to explain grid block keying, it is necessary to consider key-up and key-down conditions. Refer to the following partial schematic diagram.



KEY-UP

A negative voltage is placed on the grids of tubes V1, V2, and V3. Since this bias voltage cuts these tubes off, there can be no transmitter output.

KEY-DOWN

Under this condition, R2 is shorted, removing the bias voltage from V1 and V2. At the same time the bias to V3 is reduced to operating level through resistor R9. Should drive accidentally be removed from the final amplifier, there is adequate fixed bias to protect the tube. The values of C4 and R2 were chosen to provide the most desirable waveform for CW operation.

OPERATION

NOTE: It should be noted that an Amateur Radio Operator and Station License is required to place this transmitter on the air. Information regarding licensing and amateur frequency allocations may be obtained from publications of the Federal Communications Commission or the American Radio Relay League.

ANTENNAS

The pi network output circuit of the DX-60 will match pure resistive loads of 50 to 75 Ω .

The simplest type of antenna that falls into this impedance range is the "dipole," constructed so that its length is 1/2 wave at the frequency of operation. The 50 to 75 Ω impedance range also covers other "home brew" antennas such as beams, verticals, and trapped antennas.

Much has been published on this subject of antennas and excellent articles can be found in the ARRL Handbook, Radio Handbook, and in most issues of CQ and QST magazines.

OPERATION WITH CRYSTALS

The DX-60 may be satisfactorily operated using the following crystals:

Band	Fundamental Crystals
80 meters	160 or 80 meter crystals
40 meters	80 or 40 meter crystals
20 meters	80 or 40 meter crystals
15 meters	40 meter crystals
10 meters	40 meter crystals

Pin spacing .486" Pin size .093 dia.

NOVICE operation imposes restrictions on operating frequencies as follows:

Band	Frequency
80 Meters	3700-3750 kc
40 Meters	7150-7200 kc
15 Meters	21,100-21,250 kc

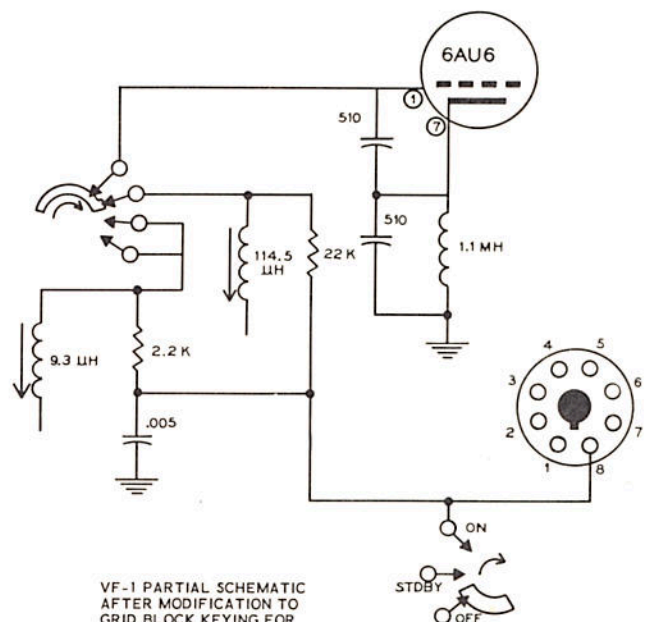
NOVICE power input is limited to 75 watts. In the operating instructions to follow, the final amplifier is loaded to 120 ma for novice operation, which is within the present Novice power limitation.

CAUTION: Be sure to check the latest FCC regulations on frequency allocations and power input requirements. When ordering crystals be sure to stay well within amateur band edge limits and power input to avoid violations.

OPERATION WITH VFO

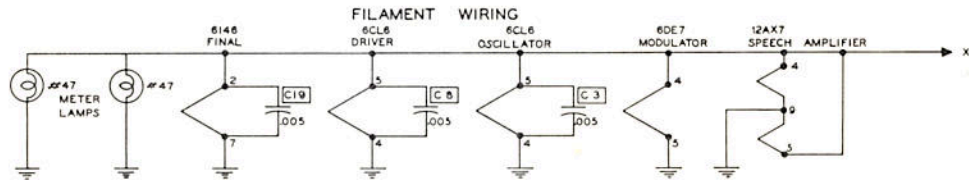
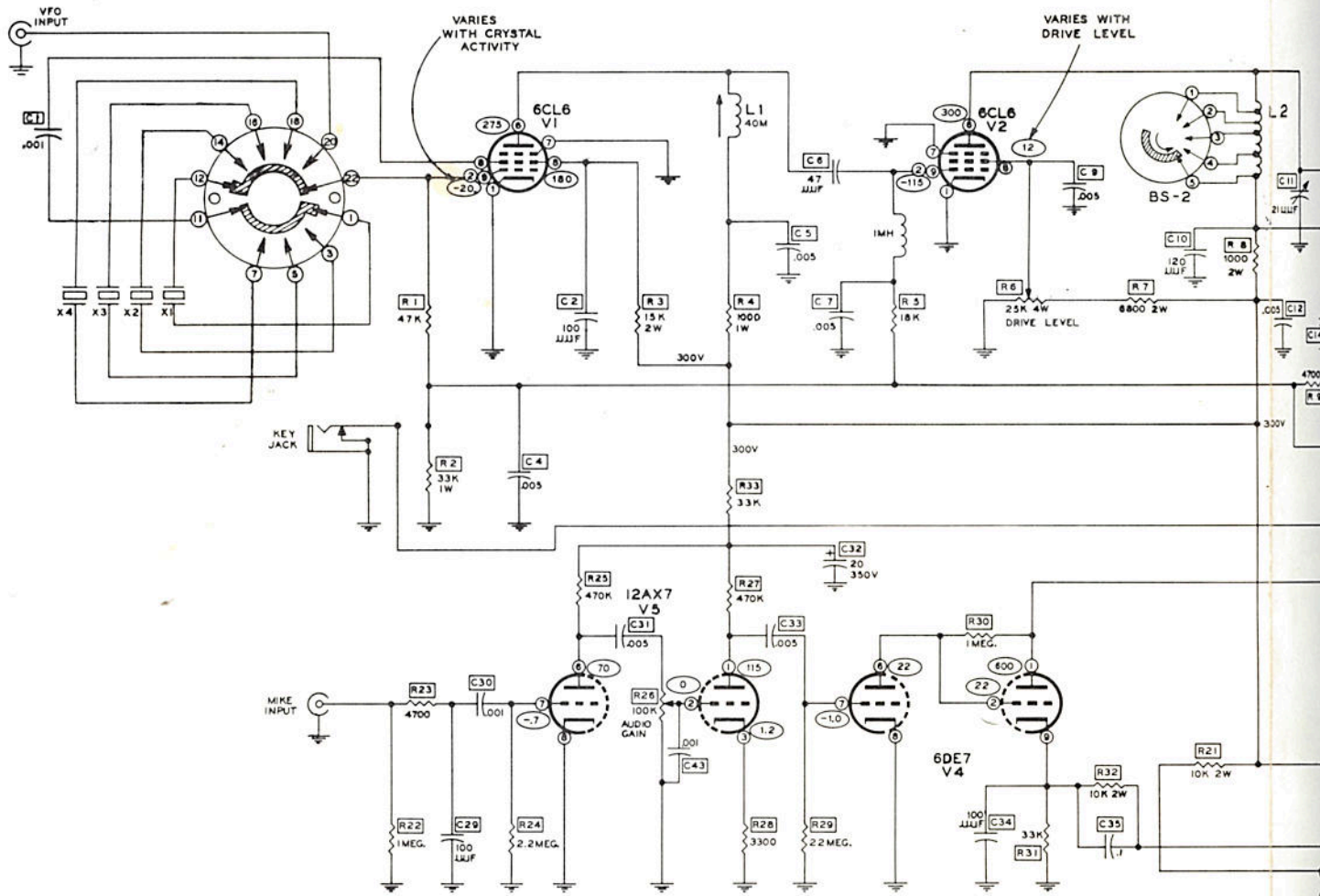
The accessory socket on the rear apron of the DX-60 makes available 6.3 V AC at 4 amperes, 300 V DC at 50 ma, and about -65 V DC key up for grid-block keying of an external VFO.

Grid-block keying of the VFO used is recommended to be compatible with the keying system used in your DX-60. The HEATHKIT HG-10 VFO is designed to match the DX-60. To use the HG-10 VFO, just plug its power cable into the accessory socket of the DX-60 and plug the RF cable into both units. If the older HEATHKIT VFO, Model VF-1, is used, the following partial schematic shows the necessary modifications for this conversion. One 2-lug terminal strip is included with the DX-60 for VFO modification if needed.

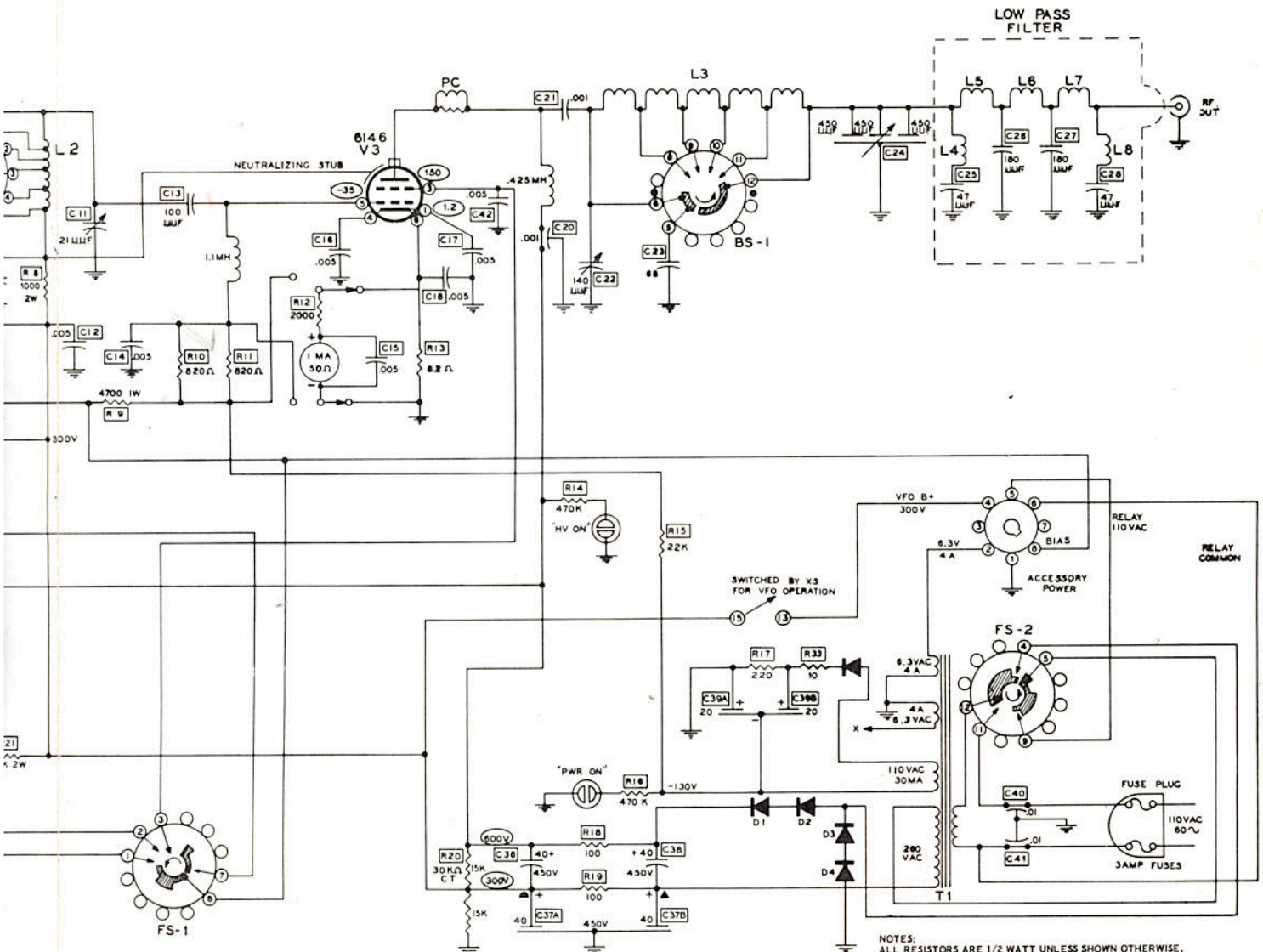


VF-1 PARTIAL SCHEMATIC AFTER MODIFICATION TO GRID BLOCK KEYING FOR USE WITH DX-60

IF A KEY IS USED IT MUST BE PLUGGED INTO THE DX-60. NORMAL CW OPERATION IS OBTAINED WITH THE VF-1 IN STDBY. TO SPOT, TURN THE DX-60 FUNCTION SWITCH TO TUNE AND KEY. TURNING THE VF-1 TO "ON" DUPLICATES KEYING OR REMOVAL OF THE KEY FROM THE DX-60 KEY JACK. THIS MUST BE DONE FOR AM OPERATION.



AMATE
MOI



NOTES:
 ALL RESISTORS ARE 1/2 WATT UNLESS SHOWN OTHERWISE.
 ALL CAPACITOR VALUES IN μ F UNLESS SHOWN OTHERWISE.
 ALL RESISTOR VALUES ARE IN OHMS (K = 1,000 OHMS, MEG = 1,000,000 OHMS).
 ALL VOLTAGE READINGS ARE DC FROM POINT INDICATED TO CHASSIS GROUND.
 (EXCEPT AC VOLTAGES ON POWER TRANSFORMER WINDINGS.)
 READINGS WERE TAKEN WITH 11 MEGOHM INPUT VTVM.
 ALL VOLTAGES TAKEN IN PHONE POSITION.
 SWITCHES VIEWED FROM REAR.
 BAND SWITCH SHOWN IN 80 METER POSITION.
 FUNCTION SWITCH SHOWN IN OFF POSITION.



AMATEUR TRANSMITTER

MODEL DX-60