
knight
6/10 METER LINEAR AMPLIFIER
GRID MA
LOAD
PLATE
PLATE MA
MODEL T-175
OPERATE
STANDBY
GRID MA
REL POWER
TRANSMIT
GRID BIAS
POWER
OFF

Jim Fisk WIDTY
RFD 1, Box 138
Rindge, N.H. 03461

# Knight-Kit T-175 6/10-Meter Linear Amplifier


With the tremendous band openings on six and ten that are due this winter and next, a little extra power will help in getting through the QRM to work that new country or state. If you're presently getting along with a one- to ten-watt peanut whistle such as the Knight-Kit TR-106, the T-175 linear amplifier is ideal. It is particularly useful with small transistor transmitters where you want a little more zap.

In addition to operation as a grounded-grid linear amplifier on AM, SSB and CW, it may also be plate modulated for high-level AM operation. It will run 120 watts on AM linear *and* plate-modulated AM, 150 watts on CW and 300 watts PEP on single sideband. Drive requirements for AM are one to four watts, seven watts on CW and up to 15 watts PEP on SSB. These requirements fall right in with several low-power transmitters and transceivers currently on the market.

Although the T-175 linear is not a band-switching unit, it may be used on either six or ten meters by simply wiring in the proper final coil during construction. By using a coil which is designed specifically for the band in use, efficiency is considerably increased over a bandswitching arrangement where design compromises must be made.

When I first built the amplifier, I put in the ten-meter coil so I could run some comparisons with a popular five-band 300-watt sideband transceiver. With about 10 watts of SSB drive, I could load the T-175 up to the same power output as the transceiver. The DX stations I worked couldn't tell the difference when I switched from one unit to the other. A quick check with the scope showed no flattopping or distortion

when driven with the low-power exciter, but when drive exceeded about 15 watts, some distortion was discernible (on sideband).

Linear AM operation is much more critical than sideband, but when the T-175 is tuned up according to the instruction manual and the grid bias is properly adjusted, there is no distortion. Of course, there is no problem at all with CW operation and when plate modulated with an external 60-watt modulator, excellent results (and reports) are obtained.

After extensive testing and signal comparisons on ten, I pulled out the ten-meter coil and put in the six-meter coil. I had been running a low-power transverter for local contacts on six, and the extra power afforded by the T-175 was a welcome addition. DX stations I had called in vain during previous openings often came back after the first call. Since I live in a channel 2 fringe area, I was a little concerned with possible TVI problems, but even with no low-pass filters installed I didn't experience any difficulty until I got above about 52.5 MHz; TVI problems above this point in the band were quickly eliminated with a Drake low-pass filter.

The circuit of the T-175 linear amplifier is quite straight forward—two horizontal deflection tubes (6JE6A's) are connected in parallel grounded grid. With class-B operation, excellent performance is obtained on AM, SSB and CW. A fan is included to keep things on the cool side and a pi network is used to couple into coaxial lines from about 25 to 150 ohms.

One extremely nice feature of this amplifier is the built-in relay amplifier (12AT7). With this tube in play, no external switching is required to turn the linear on when you go to transmit. A small amount of rf energy is picked off the input, rectified and filtered. and fed to the 12AT7 grid. Normally this tube is cut off, but when transmitting, the rectified rf signal turns it on and picks up the relay in its plate lead. This relay connects the driver to the grid circuit of the power amplifier, connects the antenna to the output pi network and turns on the fan.

If you want to operate the exciter barefoot, you simply put the control switch on standby. This disconnects B+ from the relay amplifier, thereby preventing the control relay from being activated. In this configuration, the driving signal bypasses the power amplifier and is connected directly to the antenna. The relay amplifier is also used for

## Knight-Kit T-175 Specifications

| | |
|---|---|
| **Frequency range:** | Two coils provided; 27-30 MHz and 50-54 MHz. |
| **Power input:** | 120 watts AM linear or plate-modulated AM; 150 watts CW; 300 watts PEP SSB. |
| **Drive requirements:** | 1-4 watts AM; 7 watts CW; 15 watts PEP maximum SSB. |
| **Input impedance:** | 50 ohms nominal. |
| **Output impedance:** | 50 or 70 ohm coaxial line. SWR less than 3:1. |
| **Tube lineup:** | Two 6JE6A output amplifiers; 12AT7 relay amplifier. |
| **Power supply:** | Silicon rectifiers. Fullwave voltage-double high-voltage supply. Halfwave voltage-double bias supply. |
| **Features:** | Meters on front panel for plate current *and* grid current/relative power. Forced air cooling during transmit. |
| **Power requirements:** | 110-130 Vac, 60 Hz, 220 watts maximum, 45 watts on standby. |
| **Size and weight:** | 5½ x 13⅛ x 11 inches. 20 pounds. |

CW operation, but above 12 WPM, the relay is too slow to follow the dots and dashes, and it must be continuously activated by a simple resistor substitution.

Construction of the T-175 linear amplifier is very straight forward and you shouldn't run into any difficulty if you follow the excellent instruction manual. All of the parts are clearly labeled and the hookup wire is provided in precut lengths. Proper layout on six meters can sometimes be a problem, but in the T-175 no trouble was experienced within stability or parasitics. The design is simple, efficient and trouble free.

During the time I have been using this linear amplifier on the air, all the signal and audio reports have been excellent. When running AM linear, some of the operators I have worked have been quite surprised to find that I was *not* using high-level plate modulation. Television interference complaints, even on six meters, have been nil and the extra power available has aided immeasurably in adding states to my six-meter list.

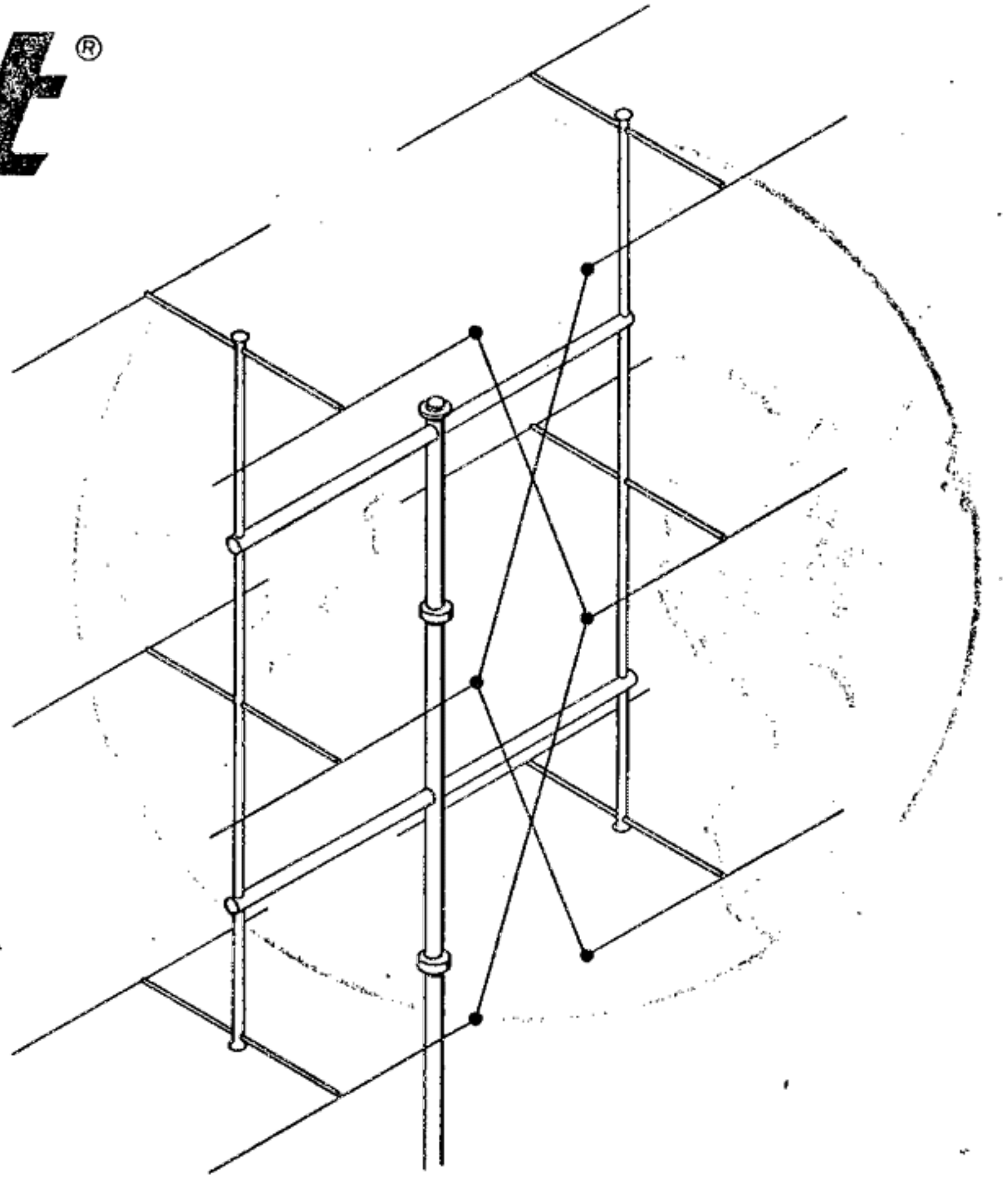
If you're doodling along with low power on six or ten, here's an easy and economical way to really work out. A few evenings work and a good antenna, and you'll have one of the best signals on the block. And, when you add up the cost of the parts in the T-175, it would be pretty hard to come up with a comparable homebrew linear for the same price. At $99.95 it's a darn good investment.

Oh yes, it will work on the 11-meter class-D citizens' band too, but don't do it in the United States, it's highly illegal!

. . . W1DTY

knight®

# T-175 6/10 METER LINEAR AMPLIFIER



# OPERATOR'S MANUAL

# SPECIFICATIONS

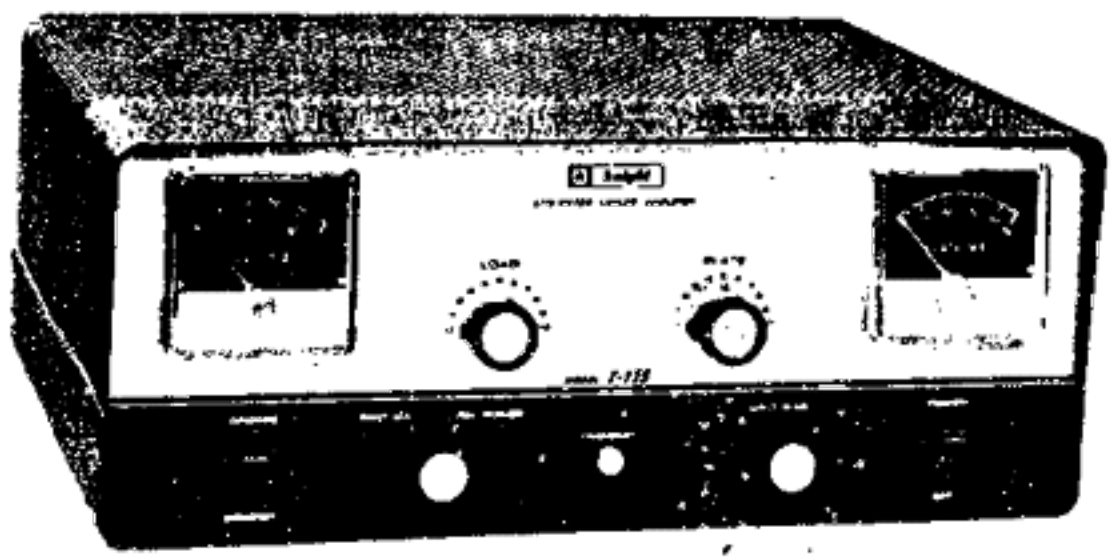
| | |
|---|---|
| **FREQUENCY RANGE:** | 6, 10, and 11* meter bands (6m and 10/11m coils supplied.)<br>27–30 mhz; 50-54 mhz |
| **INPUT IMPEDANCE:** | 50 ohms nominal |
| **DRIVE REQUIREMENTS:**** | AM Linear: 1 to 4 watts.<br>AM Plate Modulated: 1 to 4 watts.<br>CW: 7 watts.<br>SSB: 15 watts PEP max. |
| **PLATE POWER INPUT:***** | AM Linear: 120 watts max.<br>AM Plate Modulated: 120 watts max.<br>CW: 150 watts max.<br>SSB: 300 watts PEP max. |
| **CLASS OF OPERATION:** | $B_2$ Grounded Grid. |
| **OUTPUT IMPEDANCE:** | 50 to 70 ohm Pi matching network. VSWR 3:1 or less. |
| **PRIMARY INPUT:** | 110-130 VAC, 60 hz, 220 watts max., 45 watts standby. |
| **METERS (2):** | Plate Current and combination Grid Current/Relative Power. |
| **COOLING:** | Forced air (FAN) during transmit. Thermal radiators on Plate caps. |
| **POWER SUPPLY:** | Fullwave voltage doubler high voltage supply. Halfwave voltage doubler bias supply. |
| **TUBE COMPLEMENT:** | (2) 6JE6A output amplifiers. (1) 12AT7 relay amplifier. |
| **SIZE:** | 5½ x 13⅛ x 11" (HWD) |
| **WEIGHT:** | 20 lbs. |

*Illegal in the United States.

**50Ω, 5-watt swamping resistor supplied for operation with higher power exciters.

***Actual input depends on input drive level.

## CONTROL FUNCTIONS



**Meter, GRID MA** — monitors the amount of current to the grids of the two output tubes. Also serves as a relative power output indicator, which is used during loading and adjusting the amplifier.

**LOAD** — matches the output of the linear to the antenna. It can be used to match antenna impedances of 30 to 90 ohms, providing the VSWR is 3:1 or less.

**PLATE** — is used to resonate the plate circuit of the linear at the exciter operating frequency.

**OPERATE/STANDBY** — in the OPERATE position, the linear is ready to operate when the exciter is functioning. In the STANDBY position, the exciter operates in the "barefoot" mode.

**GRID MA/REL POWER SWITCH** — in the GRID MA position, reads the current on the grids of the two output tubes. In the REL POWER position, the relative output power can be read.

**GRID BIAS** — varies the grid voltage applied to the two output tubes.

**POWER/OFF** — turns the power on and off.

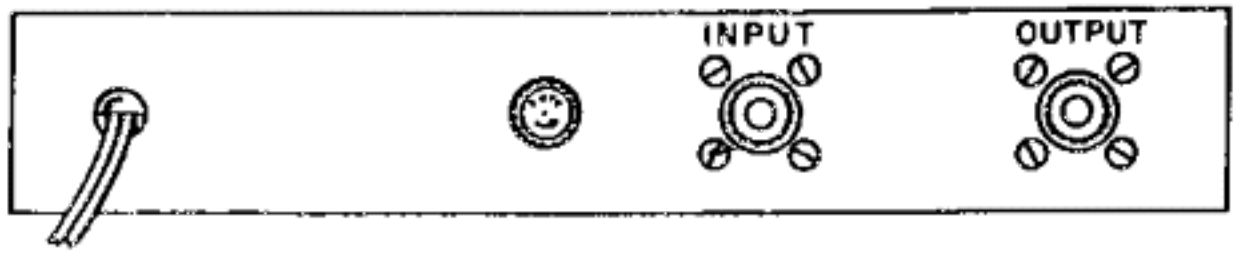
Meter, PLATE MA — monitors the plate current of the two output tubes.

### FUNCTIONS ON THE REAR OF THE CHASSIS

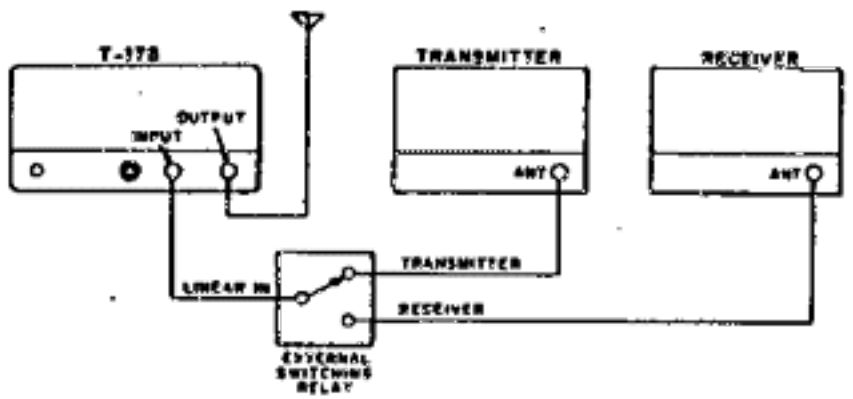
**FUSE:** The fuse used in your linear amplifier is a 2-amp, slo-blo type. If replacement is necessary, use only an exact replacement.

**INPUT:** Attach the coaxial cable from your transceiver to this connector.

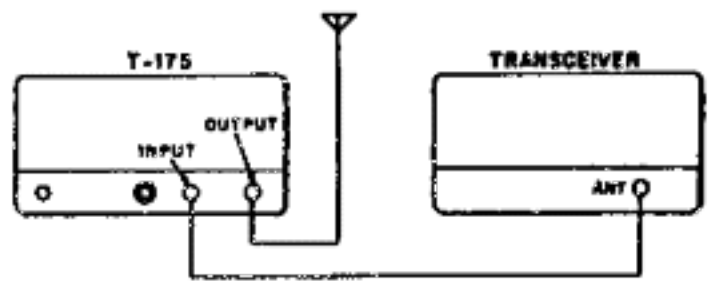
**OUTPUT:** Attach the coaxial cable from your antenna system to this connector.



# OPERATIONAL CONSIDERATIONS




USING THE T-175 WITH A SEPARATE TRANSMITTER/RECEIVER




USING THE T-175 WITH A TRANSCEIVER

Although the T-175 is simple to tune up, requiring only adjustments of the plate tuning and loading as indicated by the two meters, certain precautions must be observed if maximum performance is to be realized.

The T-175 requires from 1 to 4 watts drive power for linear operation. If the maximum drive power is available (4 watts) from the exciter, care must then be exercised that the linear is not overloaded, resulting in non-linear operation. If the drive power is less than 4 watts, though, the full output power from the exciter can be used for proper linear operation.

Proper operation does not occur with maximum RF output. The unit will deliver the specified power output when tuned as instructed. The quality of the signal will be good, too. But more RF output can be obtained by improper tuning which results in a distorted, non-linear signal.

In addition to AM linear operation, the unit can be used for CW and Single Side Band operation. Tune-up for these modes is not as critical as for AM linear operation. The significant difference is that tune-up in these modes is for maximum RF output.

Serious damage can occur to your linear amplifier if you operate without a load. Do not use an antenna as a load on 6 or 10 meters unless you are a licensed amateur radio operator. A shielded dummy load is recommended for tune-up procedures. This will minimize the interference on the air. Keep all inter-connecting cables short. ⇒ MIN. 3 FT

This unit is illegal for Class D, 11 meters (CB) operation in the United States.

## CHANGE IN METER READINGS WITH A CHANGE IN DRIVE POWER

| GRID CURRENT (Ma) | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|
| PLATE CURRENT (Ma) | 115 | 125 | 135 | 145 | 150 |
| PLATE CURRENT (Linear)Ma | 130 | 145 | 155 | 170 | 175 |
| RELATIVE POWER | 7 | 8.5 | 9 | 10 | 10.5 |
| APPX CARRIER POWER OUT (Watts) | 20 | 26 | 30 | 36 | 40 |

## ...ION

Your linear is designed so that you can operate your exciter without the inconvenience of disconnecting it from the linear:

☐ Turn the exciter power on, or place the STANDBY/OPERATE switch in the STANDBY position.

☐ Turn the linear power off.

☐ Tune-up your exciter in the prescribed manner. If your exciter is known to be good but you do not get output power to the antenna, then check the wiring of the K-1 relay in the linear.

## AM LINEAR OPERATION

This amplifier requires an exciter which is capable of delivering from 1 to 4 watts drive power for both tune-up and AM operation. If your exciter's minimum output is greater than the specified drive power, then its output must be controlled by the addition of a swamping resistor which is included with your unit. See dotted line (R-7) on the schematic.

☐ Place the linear OPERATE/STANDBY switch in the STANDBY position.

☐ Set the POWER/OFF switch to the POWER position.

☐ Allow the linear to warm up for 1 minute. CAUTION: the plate current should not rise above 30 ma. If it does, disconnect the power immediately and inspect for a wiring error.

☐ Set the GRID BIAS control to approximately its mid-range position. NOTE: The adjustment is not critical.

☐ Set the linear PLATE and LOAD controls to 5.

☐ Set the GRID MA/REL POWER switch to the REL POWER position.

☐ Tune-up your transceiver in the prescribed manner.

☐ Set the linear OPERATE/STANDBY switch to the OPERATE position.

☐ Activate the transceiver TRANSMIT switch and adjust the PLATE and LOAD controls on the linear for a maximum reading on the REL POWER meter.

☐ If the REL POWER indication exceeds 11 (eleven), adjust the transceiver LOAD and PLATE tuning controls until the meter reads 11. In reducing the output of either the transceiver or linear, the PLATE control must always be peaked afterwards.

NOTE: If you are unable to make the above adjustment, then the swamping resistor R-7 must be used.

☐ Record the REL POWER reading. For simplicity, lets say it is 10.

☐ Now rotate the linear LOAD control clockwise and peak the PLATE control until there is a 10% reduction in the REL POWER meter reading (9 in our example).

☐ Turn the GRID MA/REL POWER switch to the GRID MA position and record the grid current on the GRID MA meter. Record, also, the reading on the PLATE MA meter. Future tune-up will be much easier if you keep these readings in mind.

☐ You are now ready for AM linear operation.

## CW OPERATION

If you use a keyer for CW and your operating speed is greater than 12, you must energize the K-1 relay. This can be accomplished by substituting a 270 Ω resistor for R-3.

☐ Tune the amplifier in the same manner as for AM linear, following steps 1 through 9.

☐ The REL POWER reading will depend on the amount of drive power from the exciter. Under no conditions should the linear be driven to more than 75 watts output (210 ma). At 75 watts, the grid current may be greater than 20 ma.

☐ You are now ready for CW operation.

## SSB OPERATION

Tune-up for SSB should always be performed while using a modulation scope. Many helpful hints are contained in the ARRL Amateur Radio Operators Handbook.

## HIGH LEVEL RF AMPLIFIER

The T-175 can be used as a high-level, plate modulated RF amplifier. 60 watts of audio power will be required with the plate current limited to 150 ma.

# CIRCUIT DESCRIPTION

The T-175 operates as a grounded-grid, class B, RF linear amplifier with 120-watts input power for AM linear operation and plate modulation, 150-watts input for CW and 300-watts PEP for single side band. The power supply and antenna change over relay are within a single enclosure.

A linear RF amplifier is distinct from a class C RF amplifier in that the linear amplifies the signal after it is modulated, not before. The output from the linear must, therefore, be proportional to the input, otherwise distortion will result.

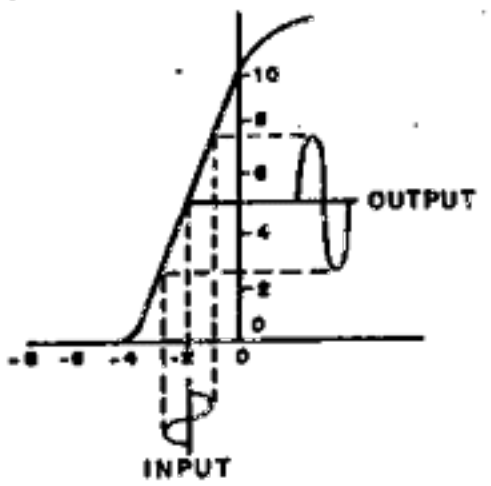
To illustrate, refer to the diagram below. The term linear comes from a graphical representation of the voltage/current relationship in a vacuum tube. If you plot this relationship on a graph, you will see that at a certain point an increase in grid voltage will not result in an increase in plate current, thus non-linear response. In the illustration below, the input signal is well within the linear capabilities of the tube, and the output signal is proportional to the input signal. The only difference being in magnitude.

Two things can cause non-linear response. The grid bias on the tube used in our illustration is 5 volts, but if the grid bias were changed to 2 volts, distortion would occur since the negative half of the output signal would swing below the linear capabilities of the tube. Additionally, non-linear response could occur if the input signal were too large. A large input signal could drive the negative and positive half of the output signal well beyond the linear capabilities of the tube, again resulting in distortion.

For proper linear operation, therefore, the amplifier must (1) never be loaded-up to its maximum capabilities—that is, with maximum current flow in the plate circuit; (2) equally important, the drive signal from the exciter must never be such that it over drives the linear.

## INPUT CIRCUIT

The two 6JE6A vacuum tubes, connected in parallel, operate in grounded-grid circuitry. RF drive from the exciter is applied through capacitor C-4 to the tubes cathodes which are connected to ground through a 7 uhy RF choke.




If the exciter output is greater than the specified drive requirements for the linear, the RF drive is then applied directly to resistor R-7, which limits the voltage delivered to the cathodes of the output tubes.

The low impedance of the input circuit presents a constant load to the exciter. This lessens the possibility of non-linear response due to poor exciter regulation. Also, this low impedance grid to ground circuit eliminates the need for neutralization and results in stable operation under all operating conditions.

A sample of the RF drive is taken from the input circuit and applied to the detector diode CR-1 and then fed into the grid of V-1, a relay amplifier. Relay K-1 is then energized only when the linear is in the OPERATE mode. During STANDBY mode the amplifier is run barefoot and the relay is not energized.

## OUTPUT CIRCUIT

The plate circuit of the two 6JE6A tubes is a conventional pi-network. High plate voltage is applied through the choke coil, RFC-2. The output circuit is isolated from this plate voltage by blocking capacitor C-7. If C-7 breaks down, though, RFC-3 will short the B+ to ground and blow the fuse, preventing B+ from appearing on the antenna. The PLATE tune capacitor (C-11) resonates the plate circuit of the transmitter final amplifier at the operating frequency. The load capacitor (C-12) permits matching loads from 50 to 75 ohms with a VSWR of 3:1 or less.

## METERING

A 0-250 ma DC meter connected in series with the high voltage line provides continuous plate current measurement. A separate 0-20 ma DC meter connected in parallel with a 51-ohm shunt resistor provides for continuous grid current monitoring or relative power output monitoring.

## GRID BIAS

The bias circuit is a half-wave voltage doubler which provides a small negative DC voltage to the grids of the two 6JE6A tubes. The grid bias is adjusted through R-13.

## POWER SUPPLY

The power transformer, T-1, has a single primary winding and two secondary windings. The filament winding provides a source of power for the three tube filaments and the biasing circuit.

The plate winding provides high B+ through the voltage doubler, CR-5 and CR-6, to the plates of V-2 and V-3. In addition, low B+ is applied to the plate of the relay amplifier, V-1.

# MAINTENANCE

*CAUTION: Your linear operates at high voltages which can cause injury to you if you are careless. You should, therefore, not operate it outside of the cabinet. But if you must do so, place some kind of protective paper over the braided wire attached to the tubes on top of the chassis.*

Under normal conditions, the T-175 will given many years of trouble-free service. Because the unit is ventilated by a fan, dust may accumulate on the switches and other associated components within the enclosure. The unit should, therefore, be removed from the cabinet and cleaned twice a year. Vacuuming is an acceptable method for cleaning.

Additionally, the relay contacts should be cleaned periodically. Even during normal operation the relay contacts may burn or pit. They should be cleaned with the finest grit sandpaper. Do not use emery or crocus cloth. After sandpapering the contacts, clean thoroughly with alcohol or a similar cleaning agent.

Twice a year a drop or two of light oil should be applied to both bearings of the fan motor.

## TROUBLESHOOTING

| SYMPTOM | SERVICE PROCEDURE |
|---|---|
| Arcing in plate tank components | Antenna mismatch. Try changing feedline length. |
| No plate voltage | Check wiring of T-1. Check polarity of CR-5 and CR-6. |
| Output distorted | Linear overdriven or underloaded. Review tune-up procedure. |
| Insufficient loading range | High VSWR reading |
| Fuse keeps blowing | Check C-19, 20, 21 and C-7. |
| Relay chatters | Input drive too low. Check V-1 and CR-1 for defect. |
| Tank circuit approaches resonance with C-11 fully open (min capacity) | Remove one turn from L-1. |
| Tank circuit approaches resonance with C-11 closed (max capacity) | Place a 5 pf capacitor in parallel with C-11. |

## TELEVISION INTERFERENCE

Operation on the amateur VHF bands results in the greatest frequency of TVI complaints, as compared to the more popular low frequency bands.

Even though you handled all TVI complaints to the satisfaction of your neighbors, you must remember that you will now be increasing your power by 10 times. If you have been operating without complaints, or have handled all the complaints prior to using the linear, the following hints will help you track down TVI problems if they occur.

Although 90% of all complaints are not the fault of the operator, the first basic rule for every amateur is to keep your own signal clean. Assuming your linear is built properly, the next solution in having a good clean signal is to use a low-pass filter at the output of the linear. Use a filter with a sharp-cut off frequency of 52 to 56 mhz.

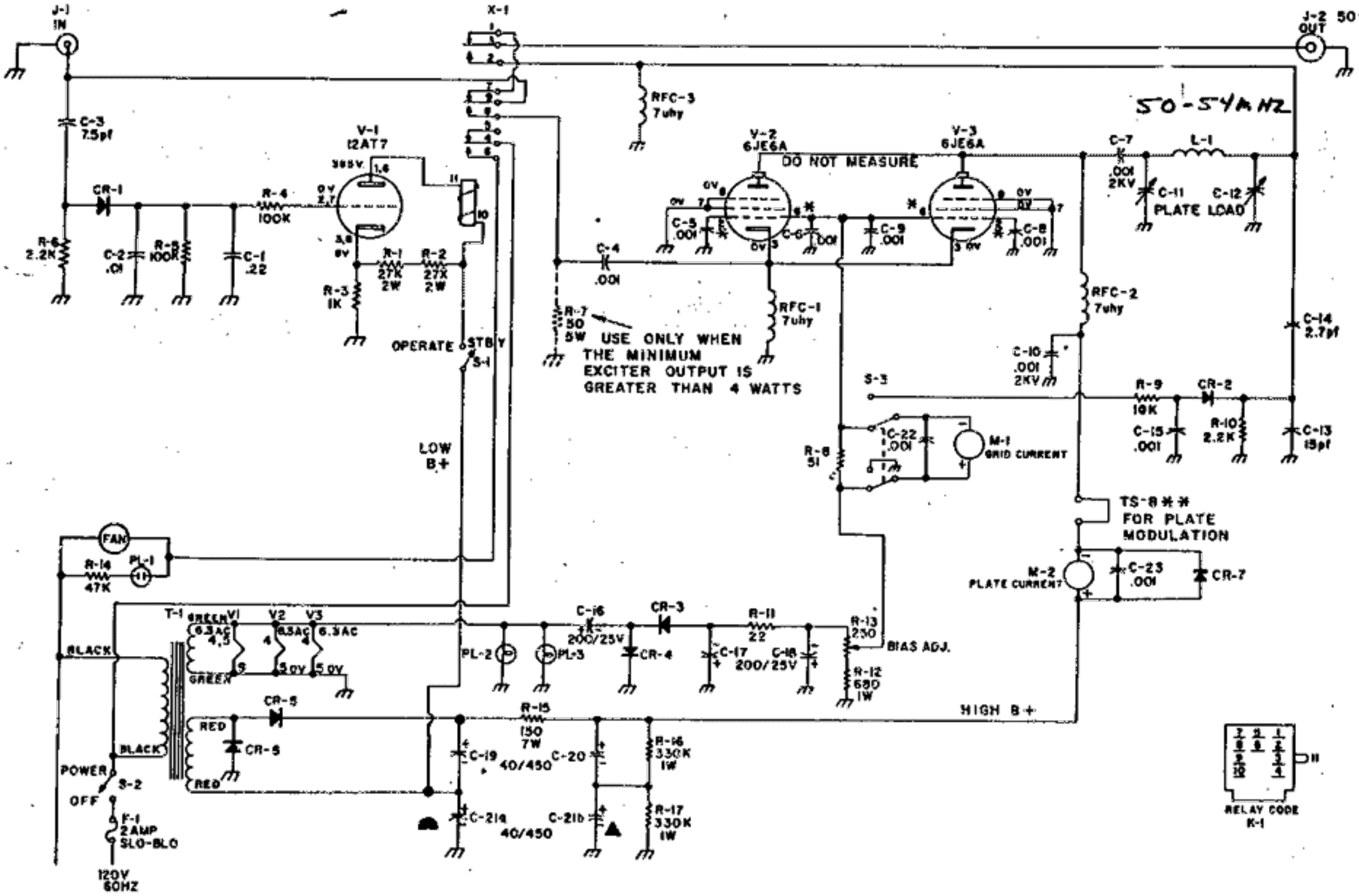
A non-technical aspect in your TVI hunt will be the relationship of you the operator to the complainant, who is probably not in an amiable frame of mind after being deprived of his favorite TV program. What to do? Explain to him, tactfully of course, that the problem is probably in his receiver. Ask him to help you conduct tests to determine the cause of the TVI. In fact, show him that your television set is not upset by your transmissions. Chances are he will be intrigued by your hobby and want to know more about it.

Design deficiencies in the front end of TV sets are the cause of most TVI complaints. Many TV manufacturers recognize this problem and will, upon request, send a high-pass filter to the owner without charge. If the owner prefers, suggest that he purchase a high-pass filter such as the Drake TV-300-HP or an equivalent filter.

## RESISTANCE CHART

| TUBE | PIN NUMBER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SYMBOL | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| V-1 | 60K | 100K | 1K | 0 | 0 | 60K | 100K | 1K | 0 |
| V-2 and V-3 | 0 | 1K | 0.5 | 0 | 0 | 1K | 0 | 0 | N/C |

N/C—no connection.
Resistance readings taken with a VTVM with respect to chassis ground. GRID BIAS control set fully counter-clockwise.




* VOLTAGE MAY VARY BETWEEN -10 TO -16-V, DEPENDING UPON THE GRID BIAS CONTROL SETTING

* * MEASURE B+ AT THIS POINT, 760-VOLTS

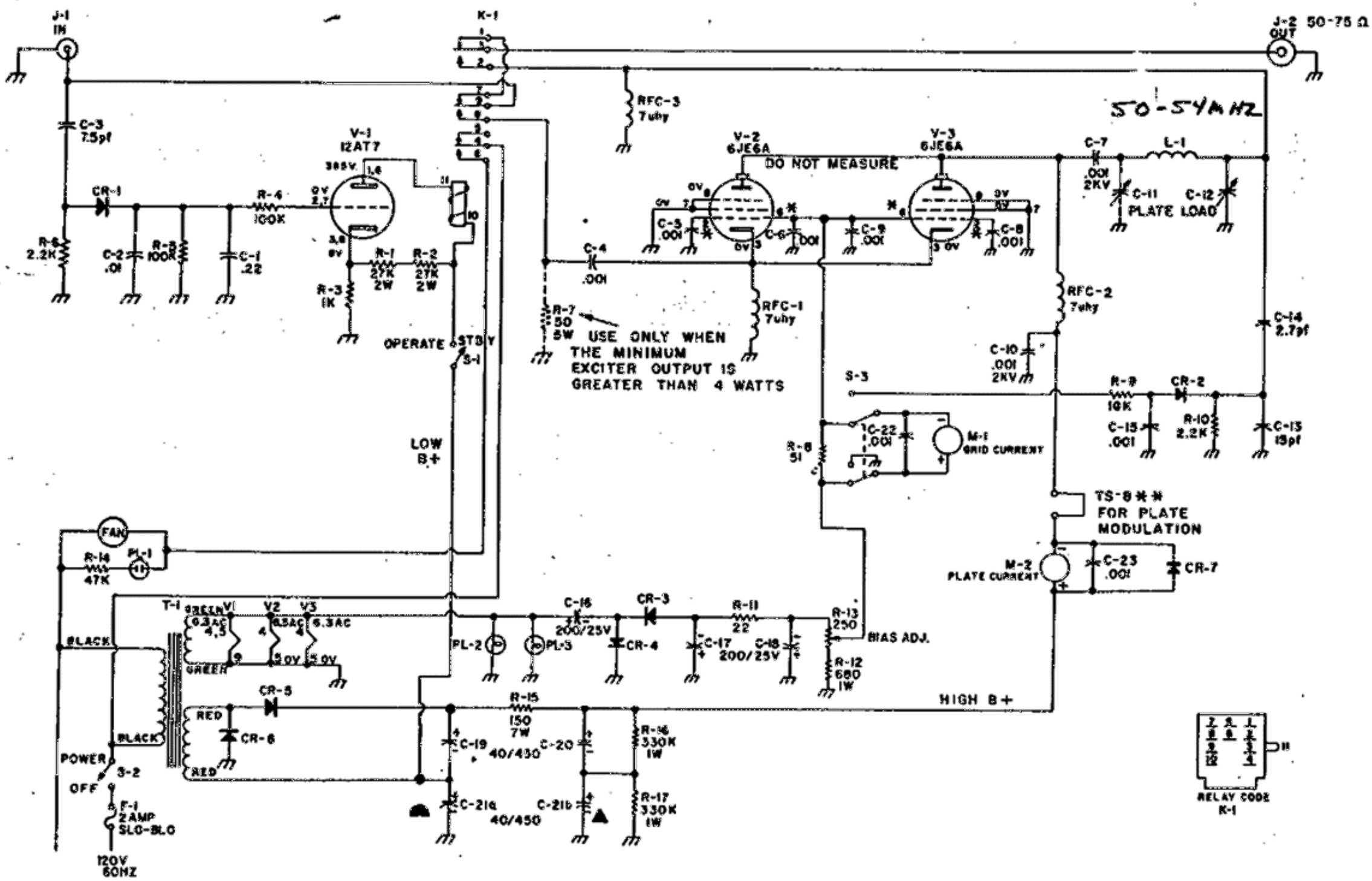
NOTES: UNLESS OTHERWISE STATED, ALL CAPACITORS ARE IN MFD ALL RESISTORS ARE IN OHMS ± 10%, 1/2 WATT

RELAY IS IN AN UNENERGIZED POSITION

S-3 IS IN THE GRID MA POSITION

VOLTAGES ARE ± 20%

# SCHEMATIC DIAGRAM FOR T-175 LINEAR AMPLIFIER




* VOLTAGE MAY VARY BETWEEN -10 TO -16-V, DEPENDING UPON THE GRID BIAS CONTROL SETTING

* * MEASURE B+ AT THIS POINT, 780-VOLTS

NOTES: UNLESS OTHERWISE STATED, ALL CAPACITORS ARE IN MFD ALL RESISTORS ARE IN OHMS ± 10%, 1/2 WATT

RELAY IS IN AN UNENERGIZED POSITION

S-3 IS IN THE GRID MA POSITION

VOLTAGES ARE ± 20%

# SCHEMATIC DIAGRAM FOR T-175 LINEAR AMPLIFIER

# PARTS LIST

### CAPACITORS

All capacitors are ceramic disc, 20% tolerance, 500-600 volt, unless otherwise specified. Given voltage ratings are the minimum allowable. Capacitors supplied may have a higher voltage rating.

| Symbol | Description | Part No. |
|---|---|---|
| C-1 | .22 μf, 250-volt, mylar | 209-083 |
| C-2 | .01 μf | 276-015 |
| C-3 | 7.5 pf, 10% NPO | 278-071 |
| C-4 | .001 μf | 276-016 |
| C-5 | .001 μf | 276-016 |
| C-6 | .001 μf | 276-016 |
| C-7 | .001 μf, 2KV | 278-016 |
| C-8 | .001 μf | 276-016 |
| C-9 | .001 μf | 276-016 |
| C-10 | .001 μf, 2KV | 278-016 |
| C-11 | PLATE, tuning | 286-108 |
| C-12 | LOAD, antenna | 286-109 |
| C-13 | 15 pf, 10% NPO | 296-028 |
| C-14 | 2.7 pf, 10% NPO | 296-024 |
| C-15 | .001 μf | 276-016 |
| C-16 | 200 μf, 25-volt, electrolytic | 209-057 |
| C-17 | 200 μf, 25-volt, electrolytic | 209-057 |
| C-18 | 200 μf, 25-volt, electrolytic | 209-057 |
| C-19 | 40 μf, 450-volt, electrolytic | 205-400 |
| C-20 | 40 μf, 450-volt, electrolytic | 205-400 |
| C-21 | 40/40 μf, 450-volt, electrolytic | 248-151 |
| C-22 | .001 μf | 276-016 |
| C-23 | .001 μf | 276-016 |

### COILS

| Symbol | Description | Part No. |
|---|---|---|
| L-1 | 6-Meters | 152-172 |
| L-2 | 10/11-Meters | 152-173 |
| RFC-1 | 7 μh choke | 162-191 |
| RFC-2 | 7 μh choke | 162-191 |
| RFC-3 | 7 μh choke | 162-191 |

### CONNECTORS

| | | |
|---|---|---|
| J-1 | INPUT, coaxial | 502-222 |
| J-2 | OUTPUT, coaxial | 502-222 |

### DIODES

| | | |
|---|---|---|
| CR-1 | germanium (equivalent type IN277) | 630-058 |
| CR-2 | germanium (equivalent type IN277) | 630-058 |
| CR-3 | Silicon 100 PIV, 750 ma | 623-054 |
| CR-4 | Silicon 100 PIV, 750 ma | 623-054 |
| CR-5 | Silicon 1000 PIV, 250 ma | 630-084 |
| CR-6 | Silicon 1000 PIV, 250 ma | 630-084 |
| CR-7 | Silicon 100 PIV, 750 ma | 623-054 |

### FUSE

| | | |
|---|---|---|
| F-1 | 2-amp, SLO-BLO, 3AG | 491-004 |

### LAMPS

| | | |
|---|---|---|
| PL-1 | Transmit neon lamp with clip | 542-000 |
| PL-2 | #47 bulb | 640-002 |
| PL-3 | #47 bulb | 640-002 |

### METERS

| | | |
|---|---|---|
| M-1 | GRID MA | 659-285 |
| M-2 | PLATE MA | 659-286 |

### RELAY

| | | |
|---|---|---|
| K-1 | 3 PDT (10K coil) | 195-057 |

### RESISTORS

Resistance in ohms. All resistors are ½-watt, 10% carbon composition, unless otherwise specified.

| Symbol | Description | Part No. |
|---|---|---|
| R-1 | 27K, 2-watt | 307-273 |
| R-2 | 27K, 2-watt | 307-273 |
| R-3 | 1K | 301-102 |
| R-4 | 100K | 301-104 |
| R-5 | 100K | 301-104 |
| R-6 | 2.2K | 301-222 |
| R-7* | 50, 5-watt, 5%, metallized film | 330-069 |
| R-8 | 51, 5% | 302-510 |
| R-9 | 10K | 301-103 |
| R-10 | 2.2K | 301-222 |
| R-11 | 22 | 301-220 |
| R-12 | 680, 1-watt | 304-681 |
| R-13 | GRID BIAS Control, 250-ohms, 1-watt | 392-240 |
| R-14 | 47K | 301-473 |
| R-15 | 150, 7-watt | 373-014 |
| R-16 | 330K, 1-watt | 304-334 |
| R-17 | 330K, 1-watt | 304-334 |

### SWITCHES

| | | |
|---|---|---|
| S-1 | DPDT, rocker, red; POWER/OFF | 437-152 |
| S-2 | DPDT, rocker, black; Operate/Standby | 437-150 |
| S-3 | Rotary; GRID MA/REL POWER | 437-166 |

### TERMINAL STRIPS

| | | |
|---|---|---|
| TS-1 | 2-terminal | 440-201 |
| TS-2 | 3-terminal | 440-303 |
| TS-3 | 6-terminal | 440-601 |
| TS-4 | 2-terminal | 440-201 |
| TS-5 | 3-terminal | 440-303 |
| TS-6 | 1-terminal | 440-101 |
| TS-7 | 4-terminal | 440-403 |
| TS-8 | 2-terminal | 440-205 |
| TS-9 | 3-terminal | 440-301 |
| TS-10 | 5-terminal | 440-501 |
| TS-11 | 4-terminal | 440-403 |

### TRANSFORMER

| | | |
|---|---|---|
| T-1 | Power transformer | 107-318 |

### TUBES

| | | |
|---|---|---|
| V-1 | 12AT7 | 611-013 |
| V-2 | 6JE8 | 614-353 |
| V-3 | 6JE8 | 614-353 |

### HARDWARE

| Description | Qty. | Part No. |
|---|---|---|
| Clip Nut | (2) | 534-105 |
| Lockwasher, #4 | (9) | 582-200 |
| Lockwasher, #6 | (37) | 582-300 |
| Lockwasher, #8 | (4) | 582-400 |
| Lockwasher, #10 | (2) | 582-500 |
| Lockwasher, ⅜" | (6) | 582-701 |
| Nut, 4-40 | (10) | 570-221 |
| Nut, 6-32 | (25) | 570-340 |
| Nut, 8-32 | (4) | 570-440 |
| Nut, ⅜"-32 | (8) | 570-840 |

*Not used in assembly. See operator's manual.

### HARDWARE

| Description | Qty. | Part No. |
|---|---|---|
| Screw, 4-40 x ½" | (10) | 560-222 |
| Screw, #4 x ½" sheet metal | (8) | 562-295 |
| Screw, 6-32 x ⅜" | (2) | 560-341 |
| Screw, 6-32 x 5/16" | (28) | 560-343 |
| Screw, 8-32 x ⅜" | (2) | 560-344 |
| Screw, #6 x 5/16" sheet metal | (2) | 562-393 |
| Screw, 10-32 x ⅜" | (2) | 564-344 |
| Solder lug, large | (1) | 553-002 |
| Solder lug, small | (13) | 553-005 |
| Washer, flat, ⅜" | (2) | 580-702 |

### MISCELLANEOUS

| Description | Qty. | Part No. |
|---|---|---|
| Bracket, for fan motor | (1) | 470-872 |
| Bracket, for tuning capacitors | (1) | 470-873 |
| Bushing, ⅜-32 x ¼" | (2) | 470-166 |
| Bushing, line cord | (1) | 880-031 |
| Case top | (1) | 702-126 |
| Case bottom | (1) | 702-127 |
| Ceramic standoff, ⅜" | (1) | 940-051 |
| Ceramic standoff, 2" | (1) | 940-052 |
| Chassis | (1) | 463-852 |
| Clip for tube plate connection | (2) | 501-193 |
| Fan | (1) | 685-009 |
| Fuse holder | (1) | 492-200 |
| Grommet, ⅛" | (1) | 830-001 |
| Grommet, 5/16" | (4) | 830-004 |
| Grommet, ⅜" | (2) | 830-002 |
| Heat-sink | (2) | 485-073 |
| Knob, with white dot | (3) | 765-074 |
| Knob, no dot | (1) | 765-085 |
| Lacing twine, 24" | (1) | 860-026 |
| Motor | (1) | 685-008 |
| Panel, front | (1) | 463-853 |
| Rubber feet | (4) | 831-001 |
| Shield, base | (1) | 511-054 |
| Shield, tube | (1) | 511-053 |
| Socket, 9-pin tube (small) | (1) | 501-190 |
| Socket, 9-pin tube (large) | (2) | 501-192 |
| Socket, lamp, with bracket assembly | (2) | 509-124 |
| Sponge rubber pad | (1) | 840-068 |

### WIRE, SOLDER, TUBING

| | | |
|---|---|---|
| Bare wire, 24" | (1) | 806-000 |
| Braided wire, 5" | (1) | 806-032 |
| Insulated hookup wire: | | |
| 2" red | (1) | 807-022 |
| 3" orange | (7) | 807-023 |
| 4" yellow | (2) | 807-024 |
| 5" green | (1) | 807-025 |
| 6" blue | (2) | 807-026 |
| 7" violet | (3) | 807-027 |
| 7" green (heavy) | (1) | 807-066 |
| 8" gray | (1) | 807-028 |
| 9" white | (3) | 807-029 |
| 10" brown | (1) | 807-021 |
| 12" white/red | (2) | 807-032 |
| 14" white/yellow | (3) | 807-034 |
| 14" Red (heavy) | (1) | 807-068 |
| Line cord | (1) | 802-004 |
| Shielded cable, 10" | (1) | 808-007 |
| Solder 20' | (1) | 951-020 |
| Tubing 18" | (1) | 812-001 |

# PARTS LIST

### CAPACITORS

All capacitors are ceramic disc, 20% tolerance, 500-600 volt, unless otherwise specified. Given voltage ratings are the minimum allowable. Capacitors supplied may have a higher voltage rating.

| Symbol | Description | Part No. |
|---|---|---|
| C-1 | .22 μf, 250-volt, mylar | 298-083 |
| C-2 | .01 μf | 278-015 |
| C-3 | 7.5 pf, 10% NPO | 278-071 |
| C-4 | .001 μf | 276-016 |
| C-5 | .001 μf | 276-016 |
| C-6 | .001 μf | 276-016 |
| C-7 | .001 μf, 2KV | 278-016 |
| C-8 | .001 μf | 276-016 |
| C-9 | .001 μf | 276-016 |
| C-10 | .001 μf, 2KV | 278-016 |
| C-11 | PLATE, tuning | 286-108 |
| C-12 | LOAD, antenna | 286-109 |
| C-13 | 15 pf, 10% NPO | 296-028 |
| C-14 | 2.7 pf, 10% NPO | 296-024 |
| C-15 | .001 μf | 276-016 |
| C-16 | 200 μf, 25-volt, electrolytic | 209-057 |
| C-17 | 200 μf, 25-volt, electrolytic | 209-057 |
| C-18 | 200 μf, 25-volt, electrolytic | 209-057 |
| C-19 | 40 μf, 450-volt, electrolytic | 205-400 |
| C-20 | 40 μf, 450-volt, electrolytic | 205-400 |
| C-21 | 40/40 μf, 450-volt, electrolytic | 243-151 |
| C-22 | .001 μf | 276-016 |
| C-23 | .001 μf | 276-016 |

### COILS

| Symbol | Description | Part No. |
|---|---|---|
| L-1 | 6-Meters | 152-172 |
| L-2 | 10/11-Meters | 152-173 |
| RFC-1 | 7 μh choke | 162-191 |
| RFC-2 | 7 μh choke | 162-191 |
| RFC-3 | 7 μh choke | 162-191 |

### CONNECTORS

| | | |
|---|---|---|
| J-1 | INPUT, coaxial | 502-222 |
| J-2 | OUTPUT, coaxial | 502-222 |

### DIODES

| | | |
|---|---|---|
| CR-1 | germanium (equivalent type IN277) | 630-058 |
| CR-2 | germanium (equivalent type IN277) | 630-058 |
| CR-3 | Silicon 100 PIV, 750 ma | 623-054 |
| CR-4 | Silicon 100 PIV, 750 ma | 623-054 |
| CR-5 | Silicon 1000 PIV, 250 ma | 630-084 |
| CR-6 | Silicon 1000 PIV, 250 ma | 630-084 |
| CR-7 | Silicon 100 PIV, 750 ma | 623-054 |

### FUSE

| | | |
|---|---|---|
| F-1 | 2-amp, SLO-BLO, 3AG | 491-004 |

### LAMPS

| | | |
|---|---|---|
| PL-1 | Transmit neon lamp with clip | 642-000 |
| PL-2 | #47 bulb | 640-002 |
| PL-3 | #47 bulb | 640-002 |

### METERS

| | | |
|---|---|---|
| M-1 | GRID MA | 659-285 |
| M-2 | PLATE MA | 659-286 |

### RELAY

| | | |
|---|---|---|
| K-1 | 3 PDT (10K coil) | 195-057 |

### RESISTORS

Resistance in ohms. All resistors are ½-watt, 10% carbon composition, unless otherwise specified.

| Symbol | Description | Part No. |
|---|---|---|
| R-1 | 27K, 2-watt | 307-273 |
| R-2 | 27K, 2-watt | 307-273 |
| R-3 | 1K | 301-102 |
| R-4 | 100K | 301-104 |
| R-5 | 100K | 301-104 |
| R-6 | 2.2K | 301-222 |
| R-7* | 50, 5-watt, 5%, metallized film | 330-069 |
| R-8 | 51, 5% | 302-510 |
| R-9 | 10K | 301-103 |
| R-10 | 2.2K | 301-222 |
| R-11 | 22 | 301-220 |
| R-12 | 680, 1-watt | 304-681 |
| R-13 | GRID BIAS Control, 250-ohms, 1-watt | 392-240 |
| R-14 | 47K | 301-473 |
| R-15 | 150, 7-watt | 373-014 |
| R-16 | 330K, 1-watt | 304-334 |
| R-17 | 330K, 1-watt | 304-334 |

### SWITCHES

| | | |
|---|---|---|
| S-1 | DPDT, rocker, red; POWER/OFF | 437-152 |
| S-2 | DPDT, rocker, black; Operate/Standby | 437-150 |
| S-3 | Rotary; GRID MA/REL POWER | 437-166 |

### TERMINAL STRIPS

| | | |
|---|---|---|
| TS-1 | 2-terminal | 440-201 |
| TS-2 | 3-terminal | 440-303 |
| TS-3 | 5-terminal | 440-501 |
| TS-4 | 2-terminal | 440-201 |
| TS-5 | 3-terminal | 440-303 |
| TS-6 | 1-terminal | 440-101 |
| TS-7 | 4-terminal | 440-403 |
| TS-8 | 2-terminal | 440-205 |
| TS-9 | 3-terminal | 440-301 |
| TS-10 | 5-terminal | 440-501 |
| TS-11 | 4-terminal | 440-403 |

### TRANSFORMER

| | | |
|---|---|---|
| T-1 | Power transformer | 107-518 |

### TUBES

| | | |
|---|---|---|
| V-1 | 12AT7 | 611-013 |
| V-2 | 6JE6 | 614-353 |
| V-3 | 6JE6 | 614-353 |

### HARDWARE

| Description | Qty. | Part No. |
|---|---|---|
| Clip Nut | (2) | 534-306 |
| Lockwasher, #4 | (9) | 582-200 |
| Lockwasher, #6 | (37) | 582-300 |
| Lockwasher, #8 | (4) | 582-400 |
| Lockwasher, #10 | (2) | 582-500 |
| Lockwasher, ⅜" | (6) | 582-701 |
| Nut, 4-40 | (10) | 570-221 |
| Nut, 6-32 | (25) | 570-340 |
| Nut, 8-32 | (4) | 570-440 |
| Nut, ⅜"-32 | (8) | 570-840 |

*Not used in assembly. See operator's manual.

### HARDWARE

| Description | Qty. | Part No. |
|---|---|---|
| Screw, 4-40 x ½" | (10) | 560-222 |
| Screw, #4 x ¼" sheet metal | (8) | 562-295 |
| Screw, 6-32 x ⅜" | (2) | 560-341 |
| Screw, 6-32 x ⅝" | (28) | 560-343 |
| Screw, 8-32 x ¾" | (2) | 560-344 |
| Screw, #6 x ⅝" sheet metal | (2) | 562-393 |
| Screw, 10-32 x ⅜" | (2) | 564-344 |
| Solder lug, large | (1) | 553-002 |
| Solder lug, small | (13) | 553-005 |
| Washer, flat, ¾" | (2) | 580-702 |

### MISCELLANEOUS

| Description | Qty. | Part No. |
|---|---|---|
| Bracket, for fan motor | (1) | 470-872 |
| Bracket, for tuning capacitors | (1) | 470-873 |
| Bushing, ⅜-32 x ¼" | (2) | 470-166 |
| Bushing, line cord | (1) | 880-031 |
| Case top | (1) | 702-126 |
| Case bottom | (1) | 702-127 |
| Ceramic standoff, ⅜" | (1) | 940-051 |
| Ceramic standoff, 2" | (1) | 940-052 |
| Chassis | (1) | 463-652 |
| Clip for tube plate connection | (2) | 501-193 |
| Fan | (1) | 685-009 |
| Fuse holder | (1) | 492-200 |
| Grommet, ⅛" | (1) | 830-001 |
| Grommet, 9/32" | (4) | 830-004 |
| Grommet, ⅜" | (2) | 830-002 |
| Heat-sink | (2) | 485-013 |
| Knob, with white dot | (3) | 765-074 |
| Knob, no dot | (1) | 765-085 |
| Lacing twine, 24" | (1) | 860-026 |
| Motor | (1) | 685-006 |
| Panel, front | (1) | 463-853 |
| Rubber feet | (4) | 831-001 |
| Shield, base | (1) | 511-054 |
| Shield, tube | (1) | 511-053 |
| Socket, 9-pin tube (small) | (2) | 501-190 |
| Socket, 9-pin tube (large) | (2) | 501-192 |
| Socket, lamp, with bracket assembly | (2) | 509-124 |
| Sponge rubber pad | (1) | 340-068 |

### WIRE, SOLDER, TUBING

| Description | Qty. | Part No. |
|---|---|---|
| Bare wire, 24" | (1) | 806-000 |
| Braided wire, 5" | (1) | 806-032 |
| Insulated hookup wire: | | |
| 3" red | (1) | 807-022 |
| 3" orange | (7) | 807-023 |
| 4" yellow | (2) | 807-024 |
| 5" green | (1) | 807-025 |
| 6" blue | (2) | 807-026 |
| 7" violet | (3) | 807-027 |
| 7" green (heavy) | (1) | 807-066 |
| 8" gray | (1) | 807-028 |
| 9" white | (3) | 807-029 |
| 10" brown | (1) | 807-021 |
| 12" white/red | (2) | 807-032 |
| 14" white/yellow | (5) | 807-034 |
| 14" Red (heavy) | (1) | 807-068 |
| Line cord | (1) | 802-004 |
| Shielded cable, 16" | (1) | 808-007 |
| Solder 20' | (1) | 931-020 |
| Tubing 18" | (1) | 812-001 |

# AMPEREX TUBE TYPE 12AT7/ECC81

The 12AT7/ECC81 [1] is a miniature twin triode designed for use as an oscillator mixer or amplifier in TV and FM receivers. A center-tapped heater permits operation of the tube from either a 6.3 volt or a 12.6 volt heater supply.

## GENERAL CHARACTERISTICS

### ELECTRICAL

| | | | |
|---|---|---|---|
| Cathode | Coated, unipotential | | |
| | Series | Parallel | |
| Heater Voltage, AC or DC | 12.6 | 6.3 | volts |
| Heater Current [2] | 0.15 | 0.3 | amps |

| Direct Interelectrode Capacitances | With Shield [3] | Without Shield | |
|---|---|---|---|
| Input (each section) | 2.3 | 2.3 | uuf |
| Output (section 1) | 1.15 | 0.45 | uuf |
| Output (section 2) | 1.45 | 0.35 | uuf |
| Grid to Plate (each section) | 1.6 | 1.6 | uuf |
| Heater to Cathode | 2.5 | 2.5 | uuf |

### MECHANICAL

| | |
|---|---|
| Maximum Overall Dimensions | |
| Length | 2 3/16 inches |
| Seated Height | 1 15/16 inches |
| Diameter | 7/8 inch |
| Mounting Position | any |
| Base | Samll button, 9 pin<br>RETMA #9A |

[1] The 12AT7/ECC81 is a direct, high-quality replacement for other brands of the 12AT7.

[2] When used in equipment which employs series-connected heaters, a current-limiting device must be inserted to limit the current when switching on.

[3] With external shield (RETMA #315) connected to cathode of section under test.

# 12AT7/ECC81

## MAXIMUM RATINGS (Each Section)

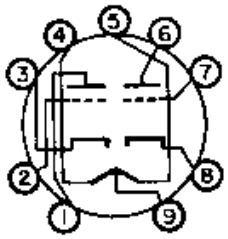
Design Center Values

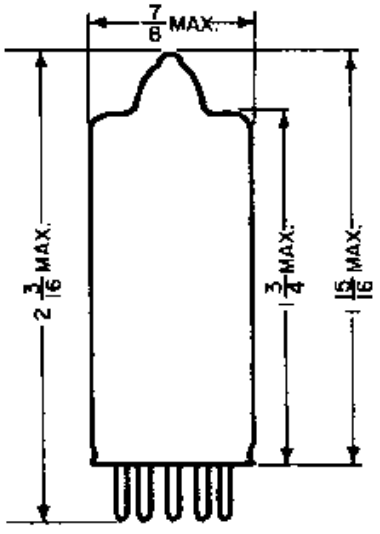
| | | |
|---|---|---|
| Zero Signal Plate Voltage | 550 | volts |
| Plate Voltage | 300 | volts |
| Plate Dissipation | 2.5 | watts |
| Cathode Current | 15 | mA |
| Grid Voltage | − 50 | volts |
| Grid Voltage (Grid Current = + 0.3 uA) | − 1.3 | volts |
| Grid Resistance[4] | 1 | megohm |
| Heater to Cathode Voltage | 90 | volts |
| Heater to Cathode Resistance | 20,000 | ohms |

## Typical Operating Conditions

### Class A Amplifier (Each Section)

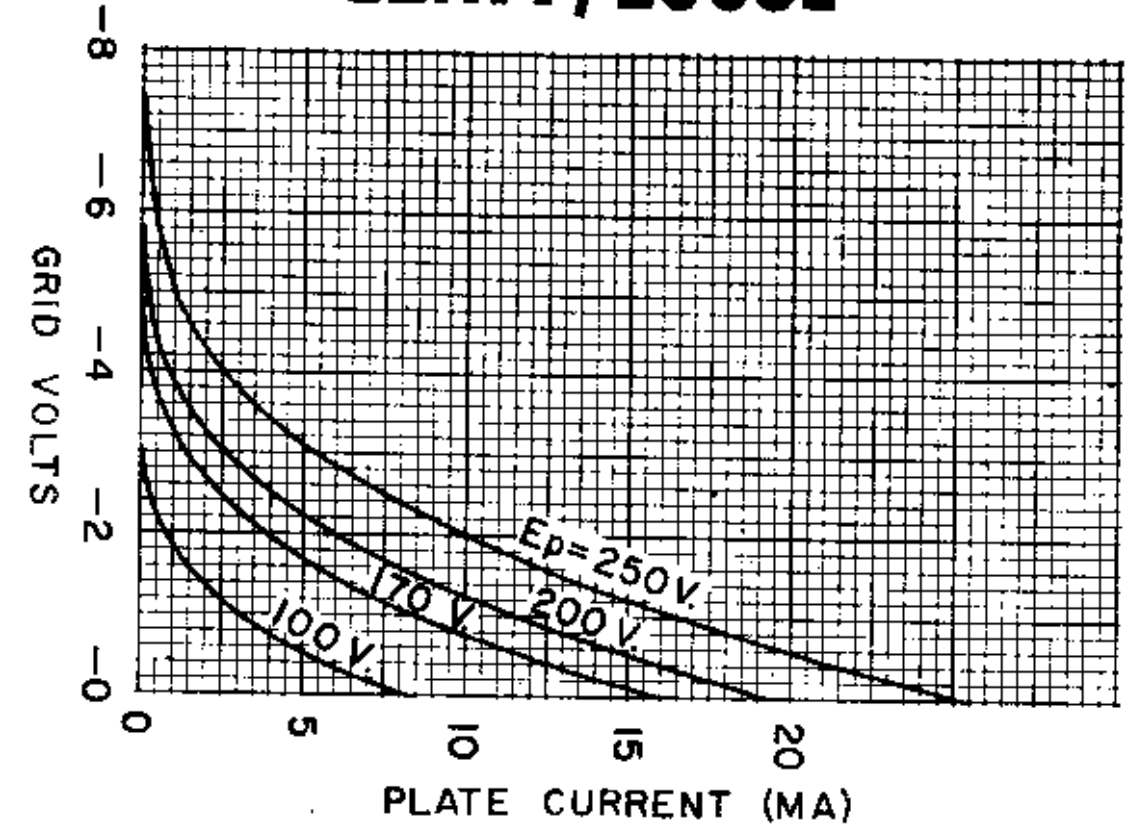
| | | | | | |
|---|---|---|---|---|---|
| Plate Voltage | 100 | 170 | 200 | 250 | volts |
| Grid Voltage | − 1.0 | − 1.0 | − 1.0 | − 2.0 | volts |
| Plate Current | 3.0 | 8.5 | 11.5 | 10.0 | mA |
| Transconductance | 3750 | 5900 | 6700 | 5500 | micromhos |
| Amplification Factor | 62 | 66 | 70 | 60 | |
| Plate Resistance | 16.5 | 11.0 | 10.5 | 11.0 | K ohms |




[4] With self bias.

# 12AT7/ECC81


GRID VOLTS
-8
-6
-4
-2
-0
0
5
10
15
20
PLATE CURRENT (MA)
Ep=250 V.
200 V.
170 V.
100 V.

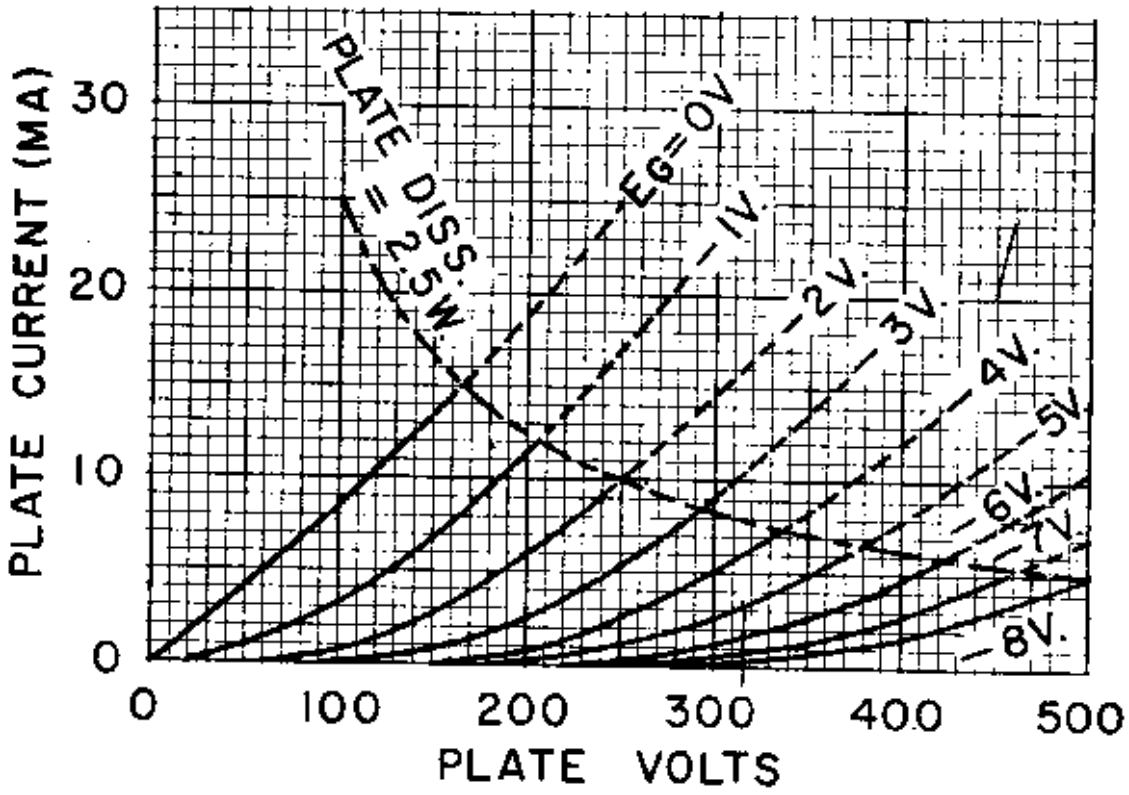
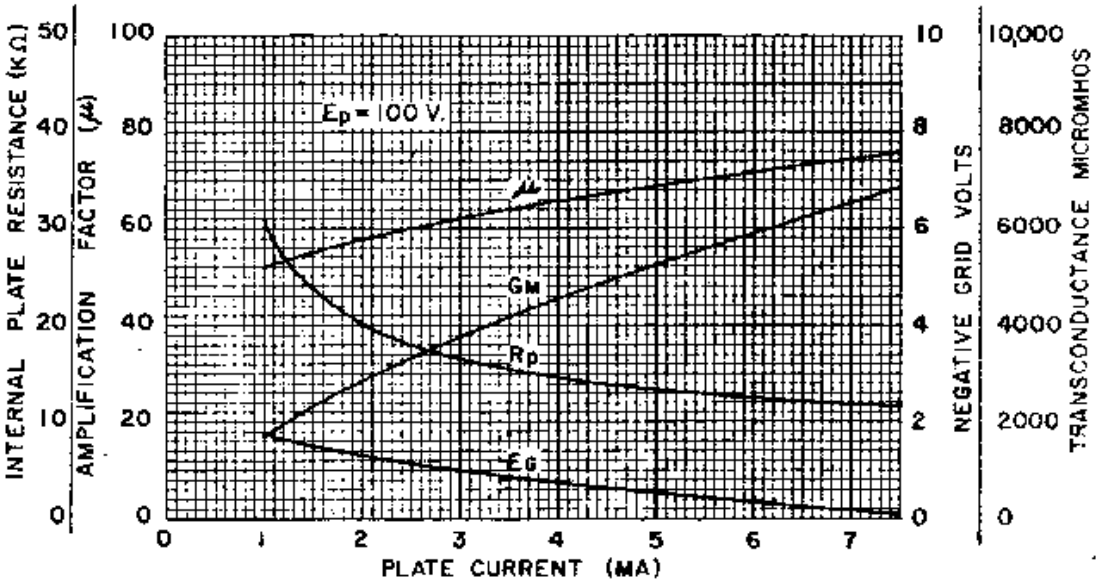
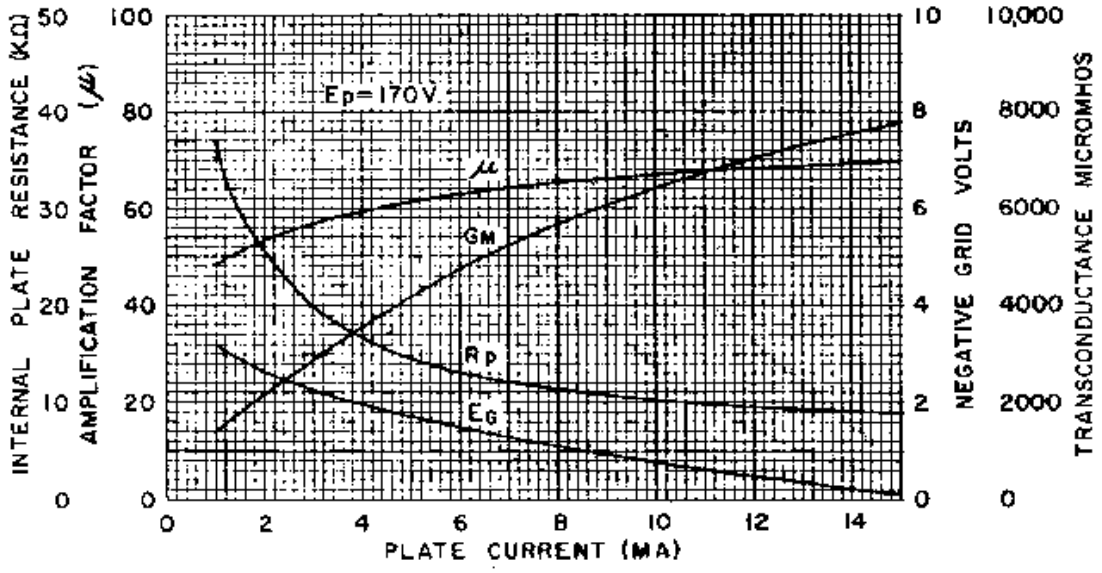


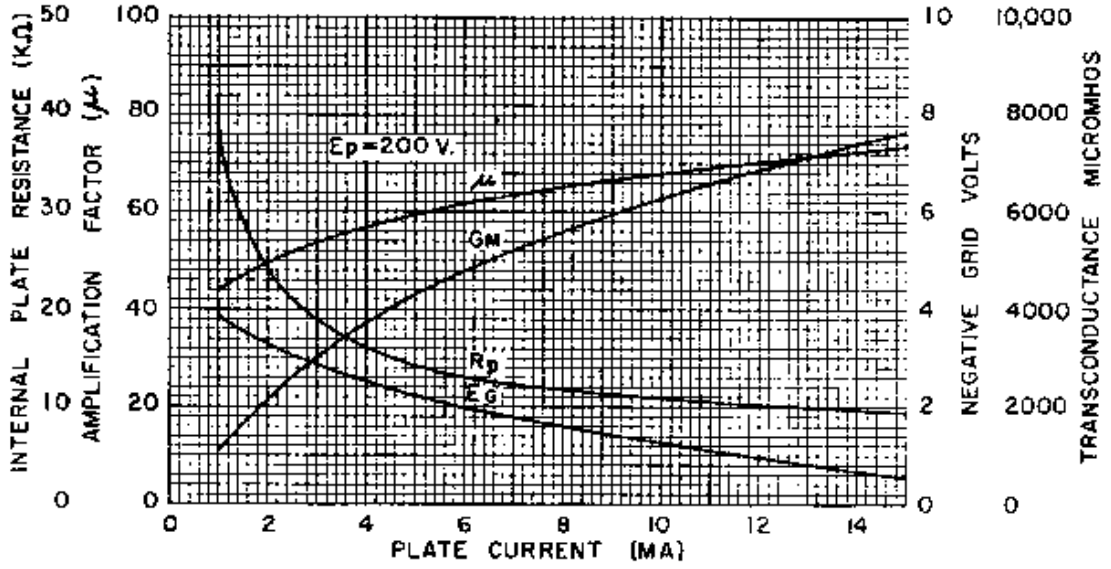
PLATE CURRENT (MA)
30
20
10
0
0
100
200
300
400
500
PLATE VOLTS
PLATE DISS. = 2.5 W.
EG=0V.
-1V.
-2V.
-3V.
-4V.
-5V.
-6V.
-7V.
-8V.

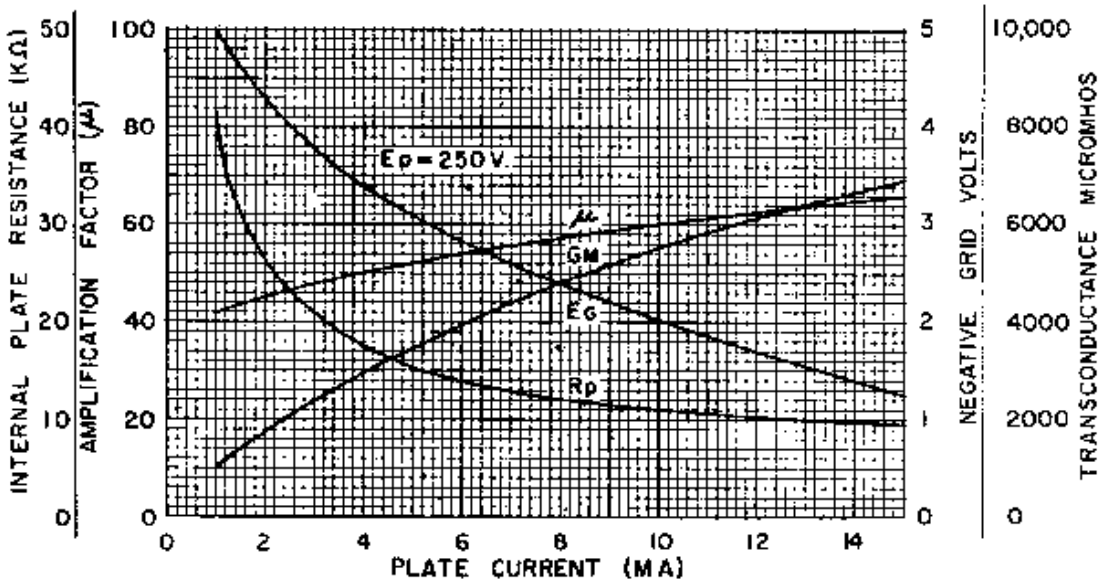
# 12AT7/ECC81


Ep = 100 V.
μ
GM
Rp
EG
INTERNAL PLATE RESISTANCE (KΩ)
AMPLIFICATION FACTOR (μ)
NEGATIVE GRID VOLTS
TRANSCONDUCTANCE MICROMHOS
PLATE CURRENT (MA)
0 10 20 30 40 50
0 20 40 60 80 100
0 2 4 6 8 10
0 2000 4000 6000 8000 10,000
0 1 2 3 4 5 6 7


Ep = 170 V.
μ
GM
Rp
EG
INTERNAL PLATE RESISTANCE (KΩ)
AMPLIFICATION FACTOR (μ)
NEGATIVE GRID VOLTS
TRANSCONDUCTANCE MICROMHOS
PLATE CURRENT (MA)
0 10 20 30 40 50
0 20 40 60 80 100
0 2 4 6 8 10
0 2000 4000 6000 8000 10,000
0 2 4 6 8 10 12 14

# 12AT7/ECC81


INTERNAL PLATE RESISTANCE (KΩ)
AMPLIFICATION FACTOR (μ)
NEGATIVE GRID VOLTS
TRANSCONDUCTANCE MICROMHOS
Ep=200 V.
μ
GM
Rp
EG
PLATE CURRENT (MA)


INTERNAL PLATE RESISTANCE (KΩ)
AMPLIFICATION FACTOR (μ)
NEGATIVE GRID VOLTS
TRANSCONDUCTANCE MICROMHOS
Ep=250 V.
μ
GM
EG
Rp
PLATE CURRENT (MA)

# RESISTANCE COUPLED AMPLIFIER TABLES

## Table A

| | Ebb = 100 Volts | | | | | | | Ebb = 250 Volts | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rb | 0.1 | | 0.27 | | | 0.47 | | 0.1 | | 0.27 | | | 0.47 | |
| Rcf | 0.27 | 0.47 | 0.27 | 0.47 | 1.0 | 0.47 | 1.0 | 0.27 | 0.47 | 0.27 | 0.47 | 1.0 | 0.47 | 1.0 |
| Rk | 1500 | 1800 | 3900 | 3900 | 4700 | 5600 | 6800 | 680 | 680 | 1800 | 1800 | 2200 | 3300 | 3900 |
| Ib | 0.54 | 0.51 | 0.23 | 0.23 | 0.22 | 0.150 | 0.141 | 1.62 | 1.62 | 0.69 | 0.69 | 0.65 | 0.41 | 0.40 |
| $Ec_1$ | −0.81 | −0.92 | −0.90 | −0.90 | −1.04 | −0.840 | −0.960 | −1.10 | −1.10 | −1.24 | −1.24 | −1.43 | −1.35 | −1.56 |
| Eb | 45.2 | 48.1 | 37.1 | 37.1 | 39.6 | 28.7 | 32.7 | 86.9 | 86.9 | 62.3 | 62.3 | 75.6 | 55.7 | 59.9 |
| Esig | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Eout | 3.0 | 3.0 | 2.8 | 3.0 | 3.1 | 2.95 | 3.0 | 3.90 | 4.10 | 3.55 | 3.70 | 3.65 | 3.50 | 3.60 |
| Gain | 30.0 | 30.0 | 28.0 | 30.0 | 31.0 | 29.5 | 30.0 | 39.0 | 41.0 | 35.5 | 37.0 | 36.5 | 35.0 | 36.0 |
| % Dist. | 1.9 | 1.7 | 1.9 | 1.7 | 1.4 | 1.8 | 1.4 | .54 | 1.0 | 1.0 | .92 | .79 | .89 | .75 |
| Esig(1) | 0.54 | 0.29 | 0.30 | 0.29 | 0.38 | 0.22 | 0.34 | 0.61 | 0.49 | 0.54 | 0.56 | 0.71 | 0.64 | 0.77 |
| Eout | 6.6 | 8.7 | 8.4 | 8.4 | 11.5 | 6.5 | 10.0 | 23.0 | 19.7 | 19.0 | 20.6 | 25.5 | 22.1 | 27.0 |
| Gain | 30.0 | 30.0 | 28.0 | 28.9 | 30.3 | 29.5 | 29.4 | 37.0 | 40.2 | 35.2 | 36.8 | 35.9 | 34.5 | 35.1 |
| % Dist. | 3.9 | 4.7 | 5.0 | 4.5 | 4.9 | 3.6 | 4.1 | 4.4 | 4.2 | 4.7 | 4.2 | 4.6 | 4.8 | 4.6 |

12AT7,6AQ8,6AB4,12AZ7
12DT8,6201,7690

# 6JE6A

## Beam Power Tube

**NOVAR TYPE**

**SPECIAL PLATE STRUCTURE[a]**

*For Color TV Horizontal-Deflection-Amplifier Applications*

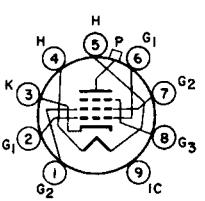
### ELECTRICAL

| | | |
|---|---|---|
| **Heater Characteristics and Ratings** | | |
| Voltage (AC or DC) | 6.3 ± 0.6 | V |
| Current at 6.3 V | 2.500 | A |
| Maximum heater–cathode voltage | | |
| Heater negative with respect to cathode: | | |
| Peak | 200 | V |
| Heater positive with respect to cathode: | | |
| Peak | 200 | V |
| DC component | 100 | V |
| **Direct Interelectrode Capacitances (Approx.)** | | |
| Without external shield | | |
| Grid No.1 to plate | 0.56 | pF |
| Input: G1 to (K, G3, G2, H) | 22 | pF |
| Output: P to (K, G3, G2, H) | 11 | pF |

### MECHANICAL

| | |
|---|---|
| **Operating Position** | Any |
| **Type of Cathode** | Coated Unipotential |
| **Maximum Overall Length** | 4.130 in |
| **Seated Length** | 3.500 to 3.750 in |
| **Diameter** | 1.438 to 1.562 in |
| **Dimensional Outline (JEDEC No. 12-116)** | See *General Section* |
| **Bulb** | T12 |
| **Cap** | Small (JEDEC No. C1-1) |
| **Base** | Large-Button Novar 9-Pin with Exhaust Tip (JEDEC No. E9-88) |
| **Basing Designation for BOTTOM VIEW** | 9QL |

Pin 1 – Grid No.2
Pin 2 – Grid No.1
Pin 3 – Cathode
Pin 4 – Heater
Pin 5 – Heater
Pin 6 – Grid No.1
Pin 7 – Grid No.2
Pin 8 – Grid No.3
Pin 9 – Do Not Use
Cap – Plate




### CHARACTERISTICS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Plate Voltage** | – | 55 | 175 | – | 60 | 175 | V |
| **Peak Positive-Pulse Plate Voltage[b]** | 5000 | – | – | 5000 | – | – | V |
| **Grid-No.3 Voltage** | +30 | +30 | +30 | +30 | +30 | +30 | V |
| **Grid-No.2 Voltage** | 125 | 125 | 125 | 145 | 145 | 145 | V |
| **Grid-No.1 Voltage** | – | 0 | -25 | – | 0 | -35 | V |
| **Plate Resistance (Approx.)** | – | – | 5800 | – | – | 7000 | Ω |
| **Transconductance** | – | – | 9600 | – | – | 7500 | μmhos |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Plate Current | - | 580[c] | 130 | - | 710[c] | 95 | mA |
| Grid-No.2 Current | - | 40[c] | 2.8 | - | 55[c] | 2.4 | mA |
| Grid-No.1 Voltage (Approx.) for plate mA = 1 | -120 | - | -54 | -125 | - | -60 | V |
| Triode Amplification Factor (Triode connection: grid No.2 connected to plate at socket) | - | - | 3[d] | - | - | 2.8[e] | |

## HORIZONTAL-DEFLECTION AMPLIFIER

### Maximum Ratings, Design-Maximum Values

*For operation in a 525-line, 30-frame system*

| | | |
|---|---|---|
| DC Plate Supply Voltage | 990 | V |
| Peak Positive-Pulse Plate Voltage[f] | 7500 | V |
| Peak Negative-Pulse Plate Voltage | 1100 | V |
| DC Grid-No.3 Voltage[g] | 75 | V |
| DC Grid-No.2 (Screen-Grid) Voltage | 220 | V |
| Peak Negative-Pulse Grid-No.1 (Control-Grid) Voltage | 330 | V |
| Cathode Current | | |
| Peak | 1200 | mA |
| Average | 350 | mA |
| Grid-No.2 Input | 5 | W |
| Plate Dissipation[h] | 30 | W |
| Bulb Temperature (At hottest point on bulb surface) | 250 | °C |

### MAXIMUM CIRCUIT VALUES

| | | |
|---|---|---|
| Grid-No.1-Circuit Resistance | | |
| For grid-resistor bias operation[h] | 0.47 | MΩ |
| For plate-pulsed operation (Horizontal-deflection circuits only) | 10 | MΩ |

[a] Designed to minimize secondary-electron emission from plate and eliminate "knee" discontinuites in zero-bias region.

[b] Under conditions shown in footnote[e].

[c] This value can be measured by a method involving a recurrent wave form such that the maximum ratings of the tube will not be exceeded.

[d] Plate volts = grid-No.2 volts = 125; grid No.3 connected to cathode at socket; grid-No.1 volts = -25.

[e] Plate volts = grid-No.2 volts = 145; grid No.3 connected to cathode at socket; grid-No.1 volts = -35.

[f] This rating is applicable where the duration of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

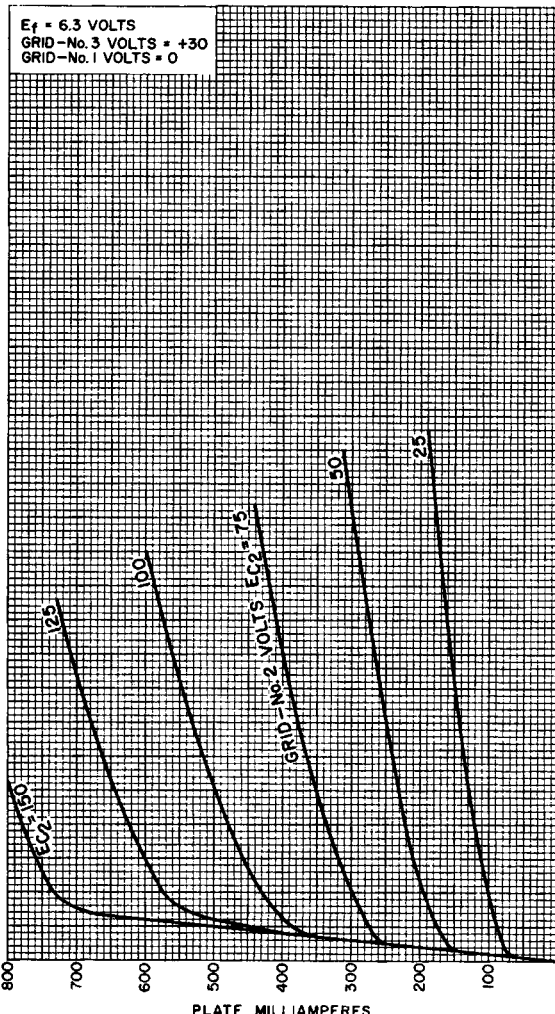
[g] In horizontal-deflection-amplifier service, a positive voltage should be applied to grid No.3 to reduce interference from "snivets", which may occur in both vhf and uhf television receivers, and to increase power output. A typical value for this voltage is 30 volts.

[h] An adequate bias resistor or other means is required to protect the tube in the absence of excitation.

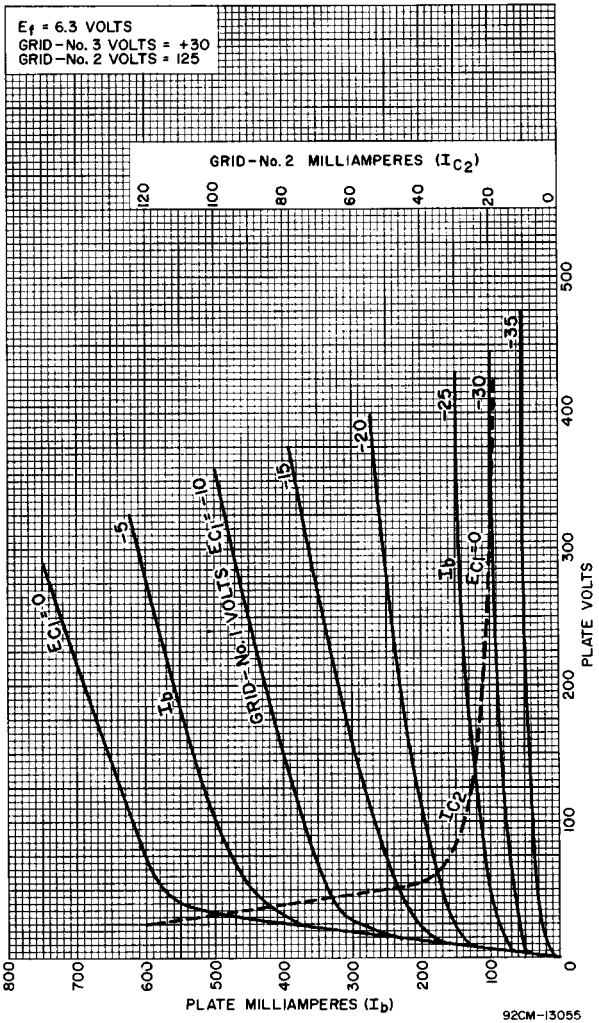


RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

## Average Characteristics



## Average Characteristics






RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.