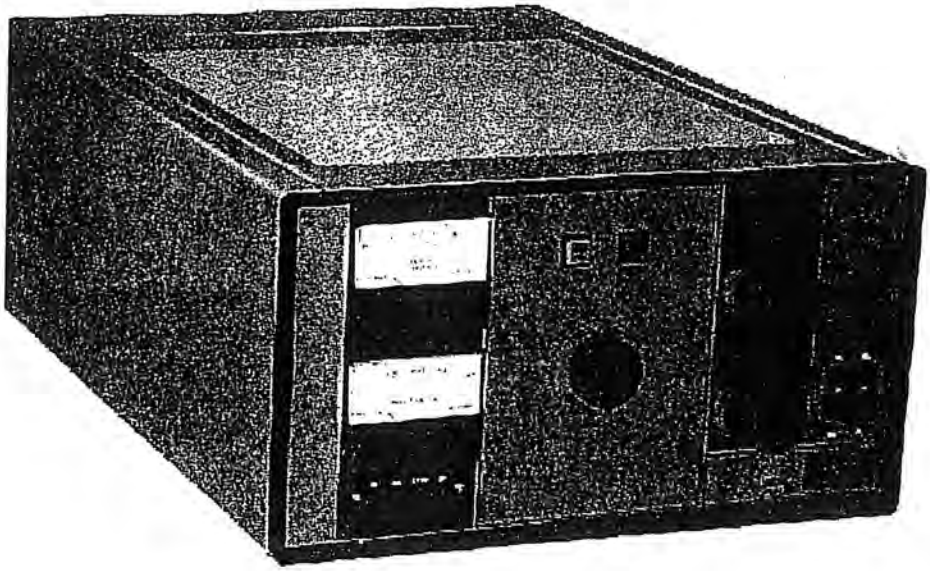
Operating and Technical Manual for

Henry 3KD Premier – 8877



RF Linear Power Amplifier – 1.8 to 30 MHz

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Version 1.0 – Dated March, 2000

LIMITED WARRANTY: Henry Radio warrants each new product to be free from defective material and workmanship. Henry Radio agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit which under normal installation, use, and service discloses such defect. The equipment or part must be delivered by the original owner to us intact for our examination, with all transportation charges prepaid to our factory, within 1 year from the date of sale to the original purchaser. Provided that our evaluation discloses, in our judgement, such a defect, Henry Radio will repair at no charge, or replace at their discretion, such defective part or equipment.

EXCLUSIONS: Henry Radio does not warrant any vacuum tube used in their equipment. These are warranted by the tube manufactuer. Warranty claims must include proof of the date of purchase. The warranty does not extend to damage or failure caused by transportation damage, misuse, neglect, accident, incorrect installation, acts of nature, or to equipment modified or repaired without our prior approval.

This warranty does not include incidental or consequential damages and the Henry Radio warranty disclaims any liability for any such damage. All implied warranties, if any, are limited in duration to the above stated 1 year.

Henry Radio reserves the right to make any improvements to its products which it may deem desireable without obligation to install such improvements in its previously sold products.

Radio Frequency Interference Statement

The operator must observe the following precautions in installing and operating this unit:

1. Operate the equipment in strict accordance with the manufacturer's instructions.
2. Plug the unit into a grounded wall outlet with the AC cord supplied with the unit without modification.
3. Always operate the unit with all factory installed covers in place.
4. Never modify the equipment in any way that would affect its specifications.
5. Always maintain the equipment in a satisfactory state of repair
6. Use a quality shielded RF coax cable on the input and output of the equipment.

User's Responsibility

The user has the ultimate responsibility to correct any problem arising from harmful radio frequency inter-ference from equipment under his control. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one of the following measures. All of these responsibilities and any others not mentioned are exclusively at the expense of the user.

** Change the orientation of the receiving device antenna. ** Change the orientation of the transmitting equipment ** Change the location of the equipment ** Change the equipment power source.

If these attempts are unsuccessful, install one or all of the following devices: *** Line isolation transformer *** Line filters *** Electromagnetic shielding *** Input/Output filters.

If necessary, the operator should consult the dealer, or an experienced radio/television technician for added sug-gestions. The user may find the following book, prepared by the Federal Communications Commission, to be helpful: "How to Identify and Resolve Radio-TV Interference Problems". The book is available from the U.S. Government Printing Office - Stock Number 004-000-00345-5.

Note: The operator of equipment causing RFI may be required to stop operating his equipment upon finding that the device is causing harmful interference and it is in the public interest to stop operation until the problem is corrected.

The Importance of Amplifier Tuning

A grounded Grid linear amplifier should be tuned so that most of the electrons emitted by the cathode reach the anode circuit. Electrons that fail to reach the anode are lost to grid current. This condition occurs when the amp-lifier is loaded too lightly – the result of setting the loading capacitor for too much capacitance during tune-up. As grid current rises and fewer electrons reach the anode, distortion increases and output power decreases. Thus, a triode amplifier can be tuned up with fair accuracy by simply applying maximum drive power and quickly adjusting the amplifier's TUNE and LOAD controls for maximum power output. After the amplifier has been tuned for maximum output, a slight increase in linearity can usually be secured by increasing the amplifier's loading – that is, by decreasing the loading capacitance – until the output power decreases by a few percent. Note, however, that this small improvement in linearity is seldom detectable in practice because the IMD performance of tube amplifiers is usually significantly better than the IMD performance of the bipolar output transistors that many modern exciters employ.

Electrons are negatively charged. Positive charges attract them. The more positive the charge, the stronger the attraction. The 0 V potential of a grounded control grid is more positive than the negative charge of an electron leaving the cathode of a vacuum tube. This causes excessive current to flow in the control grid circuit unless the tube anode is substantially more positive than the control grid throughout the anode voltage cycle.

The output of a grounded grid RF amplifier tube appears at the tube anode as RF AC superimposed on the DC anode supply. As a rule of thumb, successful attraction of most of the cathode's electrons requires that the instantaneous anode voltage not fall below about +200 to +300 V (relative to the grounded grid) during the lowest point of its downward voltage swing (that is, during the anode current peak). Loading the amplifier too lightly – that is, adjusting the amplifier's LOAD control for too much loading capacitance – causes the minimum anode voltage to fall below this level. The result is a dramatic increase in grid current and distortion, and a reduction I peak output power. Loading the amplifier too heavily – that is, adjusting the amplifier's LOAD control for too little capacitance – also causes the output power to decrease, because the amplifier's output network is not adjusted to the impedance transformation ratio necessary for maximum power transfer between the amplifier and its load.

Reprinted from March, 1989 QST – Richard L. Measures, AG6K

Section 1. Specifications

Type of Equipment:	A single stage, RF linear power amplifier, using ceramic triode operating in a grounded grid circuit, operating between 1.8 and 30 MHz for communications or test applications
Type of Emission:	SSB, AM, FM, CW, RTTY or Pulse.
Output Power:	1500 watts PEP, 1000 watts CW.
Gain:	Better than 13 dB (20 times drive).
Tube Complement:	3CX1500A7 (8877).
Drive Power:	50 to 100 watts nominal
Metering:	0-1 amp plate current. 0-40 ma grid current. 0-4000 VDC plate voltage.
Plate Voltage:	3800 to 4200 VDC nominal (subject to input AC mains).
Duty Cycle:	Continuous at rated output.
Cooling:	Built-in forced air cooling.
Dimensions:	9.5" high x 17.25" wide x 22.75" deep.
Weight:	90 pounds (100 pounds shipping).
AC Mains:	3 wire single phase, 208-250 VAC, 50/60 Hz, 15 amps. 2 wire single phase, 208-250 VAC, 50/60 Hz (optional).
Frequency Coverage:	1.8 to 30 MHz (subject to FCC regulations).
Input/Output Impedance:	50 ohms unbalanced with SWR not to exceed 2:1.
Noise Level:	Better than 40 dB below single tone carrier at 1000 watts.
Harmonic and Spurious Output:	Better than 50 dB down.
3rd Order IMD:	Better than 35 dB down at full output.
Antenna Relay:	Built-in DC relay system capable of QSK operation.
Relay Keying:	Each amplifier requires a shorting relay contact to ground during transmit to key the amplifier (300 ma approximate). An optional microamp switching modification is available.
Controls:	Band Switch, Standby/Operate Buttons, Grid Current/HV Buttons, TUNE Control, LOAD Control, On/Off Circuit Breaker.
Tank Circuit:	Pi-L type circuit.
Protection Circuits:	Circuit Breaker, HV shorting switch, AC fuse, Cathode fuse, tube warmup circuit.
Rear Panel Connectors:	BNC(f) RF Input, UHF(f) RF Output, RCA Relay Control, RCA ALC Control, Ground Stud.
Power Supply:	Full bridge HV rectifiers with oil-filled filter capacitor.
Cabinetry:	All aluminum cabinetry with double shielded RF chassis.

Made in the U.S.A.

All specifications subject to change without notice.

Section 2. Features

ALC Circuit:	A built-in, adjustable ALC feedback system to prevent over-drive to the 8877 tube.
Metering:	Two front panel meters to monitor HV, grid current, and plate current.
Controls:	Band Switch, LOAD Control, TUNE Control, Meter Switch, Standby/Operate Switch, Primary Fuse, Cathode Fuse and Circuit Breaker On/Off Switch.
Rear Panel Connections:	RF Input – BNC(female), RF Output – N(female), ALC Feedback Jack – RCA(female), Relay Control Jack – RCA (female).
Relay Keying:	A built-in 13.8 vdc supply activates the antenna relay into the transmit mode when the relay control jack is shorted to ground. The approximate current drain is about 1/2 amp. If a low current control system is required, please order the optional microamp switching box.
Protective Devices:	High voltage shorting switch on the RF chassis, AC Mains Fuse, Cathode Fuse, Airflow Switch on blower, Tube warm-up circuit.
Power Supply:	Conservatively rated components guaranty superb dynamic regulation in the high voltage supply and reliable, trouble-free performance. An oil-filled filter capacitor is used for long term reliability. The diode HV rectifiers are rated at 1.2 amps and 15 KV.
Standby Operation:	The 3KD Premier – 8877 allows "barefoot" operation by leaving the amplifier in the STBY (Standby) mode. In standby, the amplifier is bypassed with your transceiver directly connected to your antenna.
Antenna Relay:	Your new amplifier uses a high quality coaxial type antenna relay system allowing QSK and RTTY operation.
Cabinets:	The all aluminum alloy cabinets provide double RF shielding in the RF chassis to minimize cabinet radiation and leakage.
Tank Circuit:	The Pi-L output plate circuit uses silver flashed components and a multi-turn variable inductor to insure the cleanest, most efficient output.

Section 3. Introduction

Your new Henry 3KD Premier – 8877 communications power amplifier is a single stage highly linear device designed about a rugged ceramic/metal triode tube. Henry Radio a long history of many similar designs, dating back to the early 1960's. The design is simple, employing a grounded-grid design to insure years of reliable operation. The amplifier is completely self-contained and uses only the highest quality RF, DC and AC components available today. All you need to drive your new amplifier is an HF transceiver capable of supplying at least 50 watts of output, an AC mains capable of 15 amps of electricity, and a 50 ohm antenna system capable of handling the amplifier's high power output.

Your new amplifier uses a single 8877 (3CX1500A7) ceramic/metal triode, which should supply about 13 dB of gain (20 times the drive power), making it easy to drive to full output with most HF transceivers sold today. It should delivery 1500 watts PEP output and 1000 watts CW output into a 50 ohm load with about 50 watts of drive. This desk model uses a moderate duty power supply for legal operation in the United States. FCC regulations require that amplifiers sold in the United States can not be operated above 25 MHz. Amplifiers for export, and for valid non-amateur users, will be supplied with output capability to 30 MHz.

This design employs a unique rotary tank inductor not found in any other line of production amplifiers. Your amplifier can be used for AM, FM, SSB, CW, RTTY or pulse operation. The approximate instantaneous bandwidth (without retuning) of your amplifier is 200 KHz. Your unit should be able to tune to any frequency between 1.8 to 30 MHz.

Your amplifier is shipped from the factory with the tube installed, so after connecting your AC power, the amplifier is ready to operate.

CAUTION

Please read this instruction manual carefully before operating your new amplifier. Power amplifiers can be damaged by overdrive or out-of-resonance operation!

CAUTION

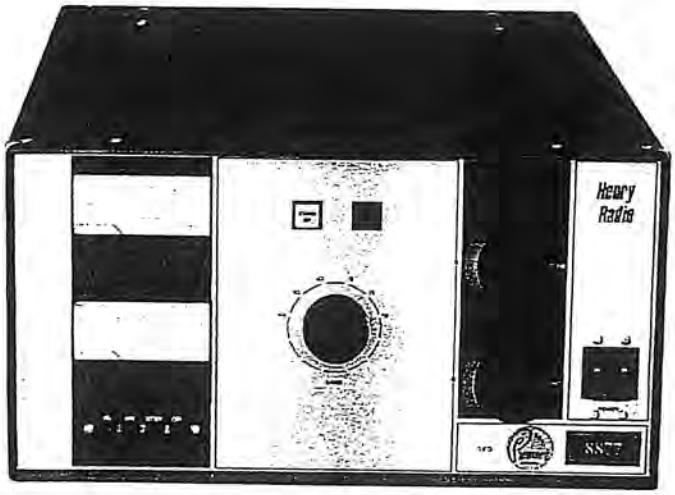
There are dangerous high voltages present inside the amplifier when it is plugged in and turned on! Never remove any covers when the unit is plugged in.

CAUTION

Always use good judgment and extreme caution when ever you service any amplifier. Henry Radio recommends that any required service be performed by our factory or another qualified shop.

CAUTION

The voltage from the high voltage power supply can be LETHAL! Always turn off and unplug the amplifier before working inside the power supply or RF chassis.



Section 4. Installation

Section 4.1 UNPACKING

When you first receive your amplifier, you must carefully inspect the shipping box, packing material, and amplifier for any obvious or hidden shipping damage. If you see any sign of shipping damage, save the box and packing material, and contact the transportation company immediately. In any case, it is wise to save the box and packing material because they are expensive to replace, and are useful in protecting your amplifier if you decide to ship or move it to another location.

Carefully remove the amplifier from its packing. Your new Premier is packed in a single box and is ready to operate as soon as you install the AC power plug. You must provide an AC plug that matches the 220 VAC outlet at your operating position, and you must install it correctly before the amplifier will operate.

The following accessories should be included with your new amplifier:

- Instruction Manual
- N(female) Coax Connector
- Relay Control Cable
- ALC Feedback Cable
- Warranty Card
- Drive Cable
- Set of Replacement Fuses

Section 4.2 OPERATING LOCATION

You may locate your amplifier in any reasonable location, keeping in mind the following thoughts. Allow adequate air flow through the amplifier, up from the bottom through the top. Never restrict the air flow by placing it too close to a wall, or by laying items on the cabinet.

You will require a location with an appropriate 220 VAC AC mains outlet – approximately 15 amps. Try to avoid environmental extremes of dust, moisture and heat, and you will keep your equipment running and looking like new for many years.

Section 4.3 CABLING

All of the following cables must be connected before you operate your new amplifier.

AC MAINS POWER CABLE – The amplifier is equipped with a three wire AC power cable that is factory wired to accept 230 VAC, 2 wire, 60 or 50 Hz single phase power. There are other factory options which can be supplied by special order only.

The three wires in the power cable are black, white and green. This is called a two wire system because only the black and white wires carry power. The green wire is ground. The green wire is chassis ground and is used as the neutral for all 230 VAC single phase plugs.

White – 230 VAC

Black – 230 VAC

Green – Ground – Neutral

Connect the black and white wires to the hot pins on your socket. We do not supply an AC power plug because there is no standard AC power socket used in the world for 230 VAC operation.

CAUTION

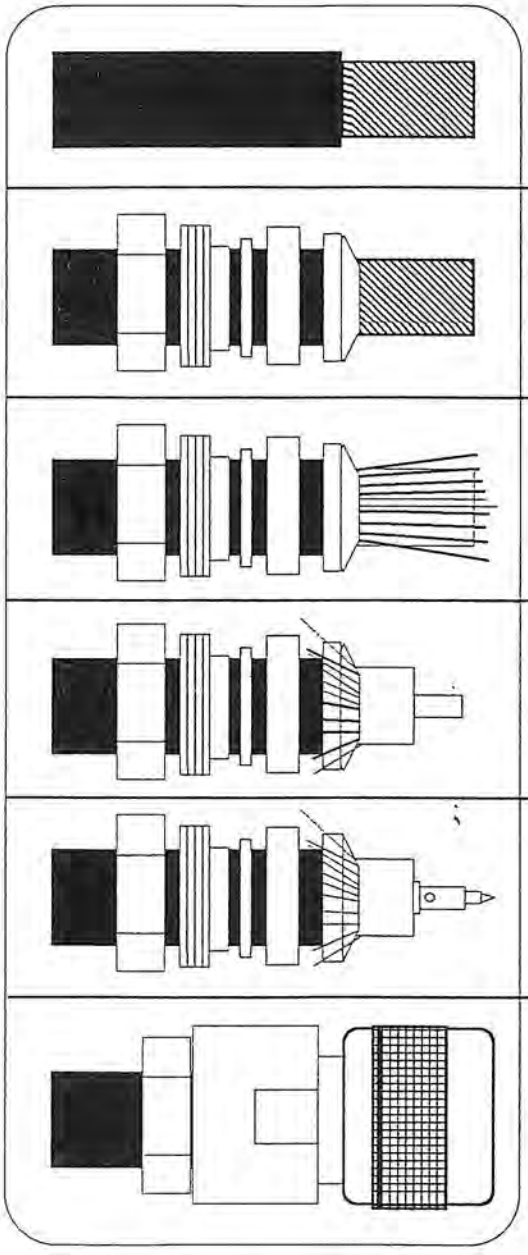
You will damage your amplifier if the green wire is connected to 230 VAC! Make sure that the green wire is connected to the neutral terminal.

ANTENNA COAX – Use only RG8/U, RG213 or 9913 type coax to connect your amplifier to an antenna or dummy load. An N type coax connector is included in the accessory package. Prepare the cable as described in the drawing on the next page. This connector mates with the RF OUTPUT connector on the back of your amplifier.

CAUTION

Never operate your amplifier unless it connected to a resonant antenna, or to a 50 ohm dummy load capable of handling the amplifier's full ouput.

Figure 4.1. Connector Installation



Cut off the end of the cable as straight and squarely as possible. Strip the jacket back 5/8"

Slide the nut (N), washer (W), gasket (G) and clamp busing (B) over the braid and jacket.

Comb out the braid back to the jacket.

Fold the braid back over the bushing, trim the dielectric back 1/4" from the end of the cable and trim the braid to a 1/8" length behind the bushing.

Tin the center conductor, slide the center pin over the center conductor and solder the pin through the hole. The shoulder of the pin should rest against the dielectric.

Press the plug body over the center pin. Slide the gasket, washer and nut into the plug body and then screw the nut into the plug body. Tighten the nut securely.

Note: There flat spots on the plug body so that you can grip it with a wrench to tighten the nut.

You can damage your amplifier if you operate into a load greater than 2.0 to 1. A 2:1 SWR means that the reflected power equals 10% of the forward power. Measure your antenna's SWR with a wattmeter or SWR meter before you operate your amplifier. With the amplifier off, or in the STBY mode, you can measure your load SWR with the power of your transceiver to avoid any damaging mistakes which may occur if you operate at high power into a high SWR.

DRIVE CABLE – The RG58 type drive cable which is supplied in you accessory package connects your transceiver's output connector to the RF INPUT connector on the back panel of the amplifier. The cable has a

has a UHF connector at the transceiver's end and a BNC connector at the amplifier's end. If your system uses different connectors, you will have to use an adaptor or make a new drive cable.

ALC (Automatic Level Control) Cable – Your accessory package includes an ALC cable with an RCA (male) plug on each end. The ALC jack on the amplifier will mate into this cable, but you may have to cut off the connector on the other end to interface it to your transceiver. All modern transceivers have ALC feedback capabilities at one of their accessory connectors. You will have to find this feature in your transceiver's manual so that you can find which connector is used to accept this feedback signal. If your transceiver does not have provisions for ALC voltage feedback from an amplifier, no connection is necessary.

RELAY CABLE – The amplifier must be keyed by your transceiver to switch into the transmit mode. The RELAY CONTROL jack (RCA female) on the back of your amplifier must be shorted to ground to key the amplifier. A cable with RCA connectors on each end is supplied for this purpose. Few modern transceivers use RCA connectors any longer, so you will probably have to cut the connector off of one end of the cable and interface it into the correct relay control terminal on your transceiver. You will have to study your transceiver's manual to locate where this terminal is located. It is typically on an ACCESSORY connector.

The keying current which the amplifier passes through your transceiver's keying contact is about 250 ma (approximate). If your transceiver is not designed to handle this current, you must purchase an optional relay box which reduces the current flow through the transceiver to less than 1 ma.

Your amplifier has a built-in relay power supply to provide the switching voltage to the antenna relays.

CAUTION

Never apply any voltage to the RELAY CONTROL jack of your amplifier.

SECTION 4.4 TRANSFORMER TAPS

Your amplifier was supplied from the factory wired for a 230 VAC power source. If the AC mains at your operating location are near 230 VAC, then you should not have to make any adjustments.

However, if your operating position power is too low or too high, you will have to adjust transformer taps on the HV transformer and the filament transformer so that your amplifier operates correctly.

HV TRANSFORMER – The part number of the HV transformer is 140300A. It is supplied with dual primaries for applications where 110 VAC operation is possible. This amplifier draws too much power for 110 VAC operation, so you must leave the primary windings wired for 230 VAC operation.

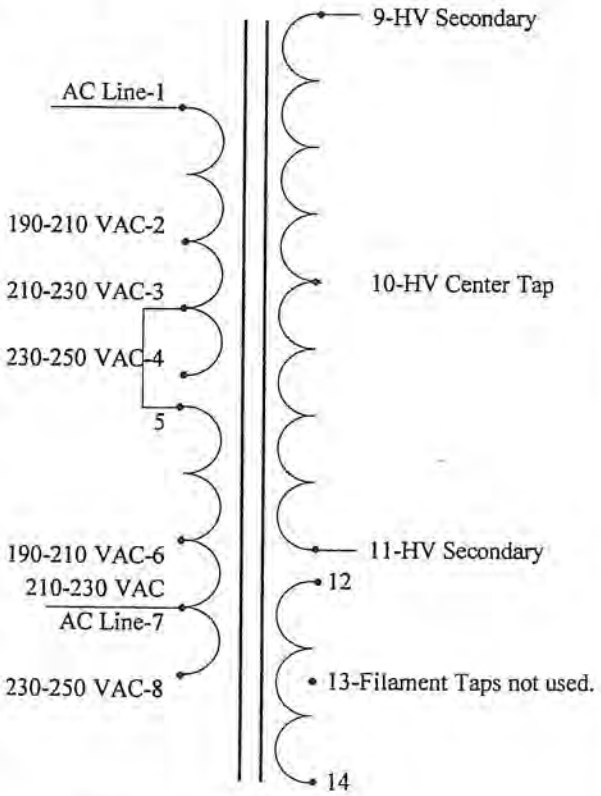


Figure 4.2.
140300A HV Transformer
Tap Connectons

FILAMENT TRANFORMER – The part number of the filament transformer is 111600. This transformer has tap adjustments so that you can keep the filament voltage to the 8877 at 5.0 VAC as the factory recommends.

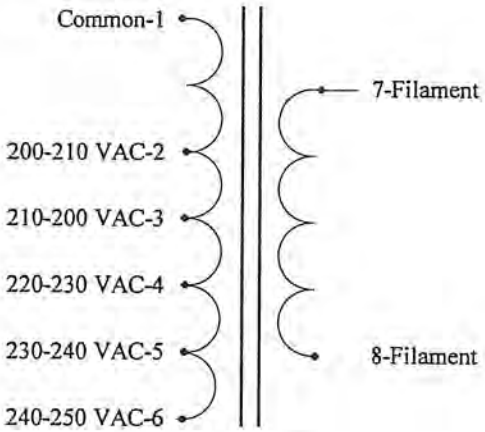


Figure 4.3.
111600 Filament Transformer
Tap Connectons

RELAY SUPPLY TRANSFORMER – The relay supply transformer does not have taps. Even under the worst AC mains conditions, there is still sufficient voltage to activate the relays. No retapping is necessary.

Section 5. Operating Controls and Connections

SECTION 5.1 FRONT PANEL CONTROLS

ON/OFF POWER SWITCH – This is a circuit breaker which switches the amplifier on and off and also protects the equipment against short circuits. When the switch is turned off, the transceiver is connected directly to the antenna.

MULTIMETER AND STANDBY SWITCHES – These four push-buttons are located below the multimeter and serve four different functions. Two of the buttons control the reading on the multimeter. The IG button makes the multimeter read grid current on a 0 to 400 ma scale. The HV button makes the multimeter read plate voltage on a 0 to 4,000 VDC scale. The STBY button opens the relay supply voltage so that the amplifier can't be keyed. The transceiver is connected directly to the antenna in the standby mode. The OP button reconnects the relay circuit allowing your transceiver to key the amplifier.

DIAL LIGHTS – The dial lights come on as soon as you switch your amplifier on. They illuminate the TUNE and LOAD dials.

LOAD CONTROL – This knob is used to match the amplifier's output network to the antenna or dummy load. There is a calibration table in the back of the manual which shows LOAD settings which were determined for different frequencies during factory testing. A dial setting of 0 corresponds to a minimum loading (capacitor plates full unmeshed), and a dial setting of 100 corresponds to maximum loading (capacitor plates fully meshed).

TUNE CONTROL – This knob is used to adjust the rotary inductor which is used as the tank coil. There is a calibration table in the back of the manual which shows TUNE settings which were determined for different frequencies during factory testing. This control must be used to tune your amplifier to resonance whenever you change frequency.

BANDSWITCH – The BAND switch selects the tuned input section appropriate for the frequency of operation and selects the appropriate capacities in the Pi and L circuits at the output of the amplifier.

CAUTION!!!

Never turn the BAND switch when the amplifier is keyed. You will damage many expensive components in your amplifier. This could lead to a large repair bill.

The rotary coil design of your amplifier gives it a very broad tuning range. The recommended switch settings versus frequency are listed below:

Band Switch	Operating Frequencies
160	1.8 to 3 MHz
80	3 to 5 MHz
40	5 to 10 MHz
20	10 to 17 MHz
15	17 to 24 MHz
10	24 to 30 MHz

PLATE CURRENT METER – The plate current meter monitors the anode current of the amplifier on a scale from 0 to 1 amp.

STANDBY LIGHT – This light comes on when you have your amplifier on and in the standby mode, as selected by the STBY button. In the standby mode, the amplifier will not be keyed when you key your transceiver.

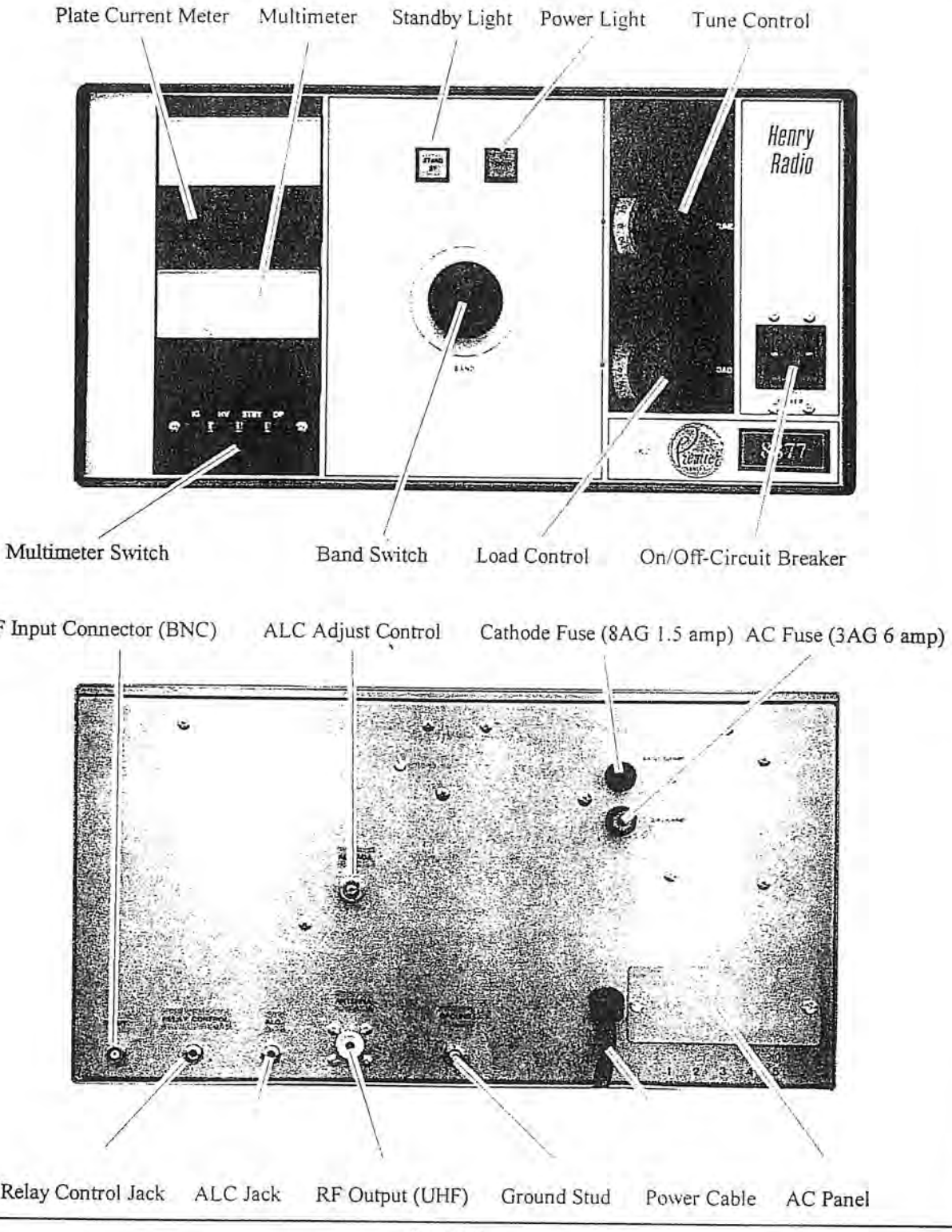
POWER LIGHT – This light comes on when you have your amplifier on and in the power mode, as selected by the OP button. In the operate mode, the amplifier will be keyed each time you key your transceiver.

SECTION 5.2 REAR PANEL CONTROLS

ALC ADJUSTMENT – This potentiometer controls the sensitivity of the amplifier's ALC feedback circuit. See section 6 for instructions on how to adjust the ALC feedback signal.

ALC JACK – This RCA type female socket is used to connect the amplifier's feedback signal to your trans-

Figure 5.1. Front and Back Panel Controls



ceiver. No connection is necessary if your transceiver does not have provisions for ALC feedback. If you don't use ALC, you must be careful not to overdrive the 8877. Always be careful of the grid current limitations for your amplifier.

RELAY CONTROL JACK – This RCA female socket is marked RELAY CONTROL and is used to feed the signal from the transceiver which keys your amplifier into the transmit mode. A matching cable is supplied in the accessory package to make this connection. When the center pin of this socket is shorted to ground, the amplifier is keyed.

CAUTION!!!

Never apply any voltage to the RELAY CONTROL socket. The amplifier has a built in power supply to provide all necessary switching voltages. You only need to supply a shorting contact to key the amplifier.

The switching current is about 250 ma. If your transceiver is unable to handle that level of current, you must purchase an optional relay interface box.

RF INPUT JACK – This is a BNC female type coax connector which accepts the drive cable supplied in the accessory package. The input of the amplifier is nominally 50 ohms. The drive cable connects to the output connector on your transceiver.

RF OUTPUT JACK – This is an N female type coax connector which feeds power out of the amplifier to your antenna or dummy load. Use only RG8/RG213 type, or better, coax cable to handle the RF power from the amplifier. Never operate your amplifier without a load, or into a load with an SWR of greater than 2:1 (where the reflected power is greater than 10% of the forward power). You will have to use an external RF wattmeter to make this measurement.

GROUND STUD – This threaded stud is supplied to connect the amplifier to a low resistance earth ground. This minimizes the risk of electrical shock and is important to minimize cabinet radiation and interference to telephones, televisions and other electronic devices.

AC FUSE – This is a 3 AG, 6 amp type fuse which is used to protect the non high voltage circuits of the amplifier, such as the blower, relay supply and filament. Never replace a blown fuse with one of greater current rating than specified.

CATHODE FUSE – This is an 8 AG, 1.5 amp type fuse which is used to protect the tube from excessive plate current. It will blow if there is short in the tube, or if the plate current is run too high for too long. Never replace a blown fuse with one of greater current rating than specified.

POWER CABLE – The power cable must be connected to a 230 VAC, 30 amp power source with a plug which you supply. The details of installation are discussed in Section 5.

FILAMENT TEST POINT – These pin jack connectors are provided as test points to monitor the filament voltage during setup. An external VOM or DVM may be plugged into this jack to monitor the filament voltage. The correct specified filament voltage for an 8877 is 5 VAC +/- .25 VAC.

AC PANEL – This removable panel accesses the terminal strip where the power cable connects to the amplifier. On some models it is used for jumpering 110 VAC or 220 VAC. Your amplifier is only designed to operate on 200 to 250 VAC.

Section 6. Operation

SECTION 6.1 PRELIMINARY SETTINGS

Set the BAND switch to the desired operating frequency as described in Section 5. With the amplifier off or the standby mode, adjust your transceiver for the desired frequency of operation and turn its output to zero. Set the TUNE and LOAD settings of the amplifier to their approximate operating frequency using the settings listed in the back of this manual, which were determined during factory final test. When the amplifier is turned off, or in the standby mode, the transceiver is connected directly to your antenna or dummy load. For tuning, your transceiver should be in a CW or FM mode to generate a carrier to tune the amplifier.

Use the ON/OFF circuit breaker to turn on the amplifier. The dial lights and blower should come on immediately. The 8877 tube requires a warm-up period, and the amplifier can not be switched into the transmit mode until that period has passed.

Key your transceiver to switch the amplifier into the transmit mode, but DO NOT apply any power yet. Check that the operating parameters of the tube are approximately as follows. Remember, the actual AC line voltage at the operating position will change these readings.

Grid Current:	0 ma
High Voltage:	3600-4000 VDC
Plate Current:	80-120 ma

If the tube parameters are out of the range shown above, you may need to adjust the transformer taps as described in section 5.

CAUTION!

Be careful during tuning to key your amplifier for only about 10 seconds at a time if the amplifier is not in resonance. You can damage the amplifier by operating it out of resonance for longer than 10 seconds.

SECTION 6.2 SSB TUNING

The easiest way to tune your amplifier requires a wattmeter between the amplifier and your antenna.

Step 1 – Set the BAND switch to the correct frequency range and adjust the TUNE and LOAD controls to the dial settings shown in the calibration settings in the back of this manual. Set the meter switch to IG to monitor the grid current.

Step 2 – Key your transceiver and slowly increase the drive to the amplifier until the PLATE CURRENT meter shows about 200 ma. If your preset calibrations are close enough to your operating frequency, you will see output on your wattmeter. Carefully adjust the TUNE and then the LOAD controls alternately for maximum power output, as shown on your wattmeter.

Step 3 – Increase the drive from your transceiver and repeat the tuning described in step 2 above. Continue this process until you reach 1500 watts output. This should occur with between 50 and 65 watts drive, depending on the band of operation.

SECTION 6.3 ALTERNATE TUNING METHOD

If you are attempting to tune the amplifier without using a wattmeter, you will have take the following approach.

Step 1 – Set the BAND switch to the correct frequency range and adjust the TUNE and LOAD controls to the dial settings shown in the calibration settings in the back of this manual. Set the meter switch to IG to monitor the tube's grid current.

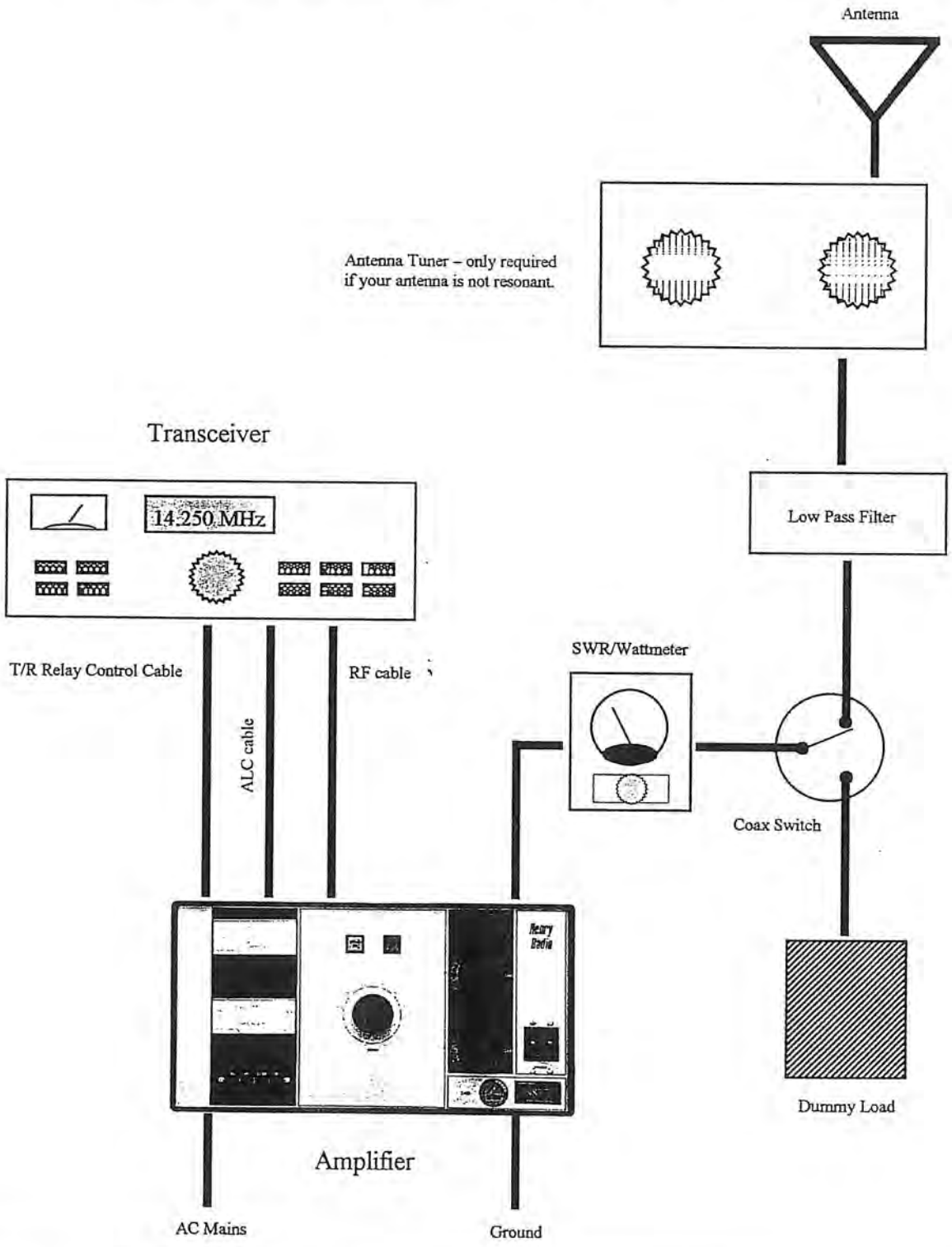
Step 2 – Key your transceiver and slowly increase the drive to the amplifier until the PLATE CURRENT meter shows about 200 ma. If the factory calibrations are close enough, you should see some output.

Step 3 – Adjust the TUNE and LOAD controls to find a dip, or low point, in the plate current reading.

Step 4 – Adjust the LOAD control to find a dip, or low point, in the grid current reading.

Step 5 – Readjust the TUNE control for a plate current dip again.

Figure 6.1 Typical Operating Configuration



Step 6 – Increase drive from your transceiver and repeat steps 3, 4 and 5 until your tube parameters reach the following values.

Grid Current:	10-15 ma
High Voltage:	3600-4000 VDC
Plate Current:	600-700 ma

Step 7 – When you have finished tuning your amplifier, write down the TUNE and LOAD dial settings for that frequency. You should be able to just set the controls to these values in the future when you are operating at that frequency.

SECTION 6.4 SSB OPERATION

After you have finished tuning the amplifier for resonance, switch your transceiver to the SSB mode and key it and speak into the microphone to excite the amplifier. The plate current and grid current readings for voice operation will be about 1/2 of the readings noticed during tune up. Because of the inertia in the meter movement, the meter's needle readings will not follow your speech patterns. To monitor your speech patterns, you will need to purchase a peak reading wattmeter or monitor the output on an oscilloscope.

SECTION 6.5 ALC ADJUSTMENT

The ALC circuit is designed to offer a feedback circuit to your transceiver to prevent overdrive and a resulting distortion from a high powered transceiver. If your transceiver does not put out more than 100 watts, you probably do not need to connect the ALC circuit.

Your amplifier was tested and shipped with the ALC control, located on the back panel, fully counterclockwise (off). If you plan to use the ALC circuit, you need to adjust it for your transceiver.

Tune your amplifier as described above. Supply enough drive from your transceiver to generate about 400 ma of plate current. Turn the ALC control until the grid current reading just begins to decrease. When you are finished, use the locknut on the control shaft to secure the control. If your transceiver is not capable of driving the amplifier beyond 400 ma of plate current, you do not need to connect the ALC line.

SECTION 6.6 CW OPERATION

The amplifier is tuned the same for CW as SSB. However, you should probably operate it at the following tube parameter readings:

Grid Current:	10 ma
High Voltage:	3600-4000 VDC
Plate Current:	450-500 ma

SECTION 6.7 OPERATING PRECAUTIONS

Please keep the following precautions in mind when you operate your amplifier. Following this advise will insure the amplifier's safe and reliable operation for many years.

The voltages inside the amplifier can be **LETHAL! NEVER** try to disable the protection or interlock circuits designed into the amplifier. **NEVER** operate your amplifier with any of the panels removed.

ALWAYS tune the amplifier to resonance at the operating frequency and load it into your antenna or dummy load before transmitting.

NEVER turn the BAND switch when you are transmitting.

NEVER operate your amplifier into a load with an SWR greater than 2:1 (reflected power more than 10% of forward power).

NEVER overdrive your amplifier. Excess output will shorten your useful tube and amplifier life.

Section 7. Troubleshooting and Maintenance

NOTE

Any time you have a problem with your amplifier, be sure to check that it is plugged in and that the fuses are good before continuing with further troubleshooting. **NEVER** use a higher value fuse than the one specified on the amplifier. You could cause extensive damage to your amplifier by using the wrong fuse.

SECTION 7.1 INPUT MISMATCH

SYMPTOM – High SWR between your transceiver and the amplifier.

Your amplifier has tuned inputs circuits which are switched with the BAND switch. Your input SWR should be better than 2:1. If for some reason you find that the reflected power from the amplifier is greater than 10 watts, you should try to make the following determinations.

If the problem exists only on one band, the likely cause is a defective or mis-tuned input circuit on only that band..

If the problem exists on all bands you will have to check the antenna relay and wiring to the relay, check for a bad piece of coax being used as the drive cable, or check the RF connectors to make sure they are not shorted.

SECTION 7.2 RELAY PROBLEMS

SYMPTOM – Reduced receiver sensitivity in your transceiver.

You will have to check the input and output relays and the wiring around them to make certain that they have not failed.

SYMPTOM – Resting plate current when the amplifier is not keyed.

Check first that the amplifier is not keyed in error. Remove the relay control cable and check that it is not bad. If the problem persists, even with the relay cable removed, check that there is not a short in the relay control jack or power supply. Also check that the relay which switches bias to the tube has not failed.

SYMPTOM – The amplifier will not key.

Check the relay control cable. Short the relay control jack directly to see if it will key without the cable or transceiver. Check that there is DC voltage at the relay control jack. If the relay supply fails, there will be no voltage at the jack, and the amplifier will not key. If your transceiver can not handle the approximate 250 ma of keying current, you will have to purchase an optional microampere relay interface box.

If there is no voltage present at the relay control jack, check the AC mains fuse, then the relay supply and its associated components.

SECTION 7.3 TUBE PROBLEMS

SYMPTOM – Excessive plate current readings.

This problem is usually caused by a bad tube, and the only cure is to replace the tube. The problem can be a partial short, causing out of tolerance plate current, or it can be a complete short, causing the circuit breaker to blow and the cathode fuse to open.

Excessive plate current can also be caused by a failure of the bias diode assembly and/or circuit. The bias diode can not be checked with a VOM. The only way to test this device is to remove it from the circuit, apply voltage across it with a 9 volt battery or power supply, and measure the current flow. If there is not current flow, the diode assembly must be replaced. A similar symptom can be seen if the resistor in parallel with the diode assembly has failed.

SYMPTOM – Negative grid current.

As described above, this symptom can be caused by a bad tube, or a failure in the bias diode circuit.

SYMPTOM – Grid to filament tube short.

A tube failure of this nature can cause your amplifier to show plate current when it is not keyed and can also

show negative grid current. You must replace the tube to solve this problem.

SYMPTOM: High voltage short.

A tube failure of this nature can cause the amplifier to show high plate current, even when it is not keyed. Other high voltage shorts in other parts of the RF chassis can cause the same symptom, so you must isolate the cause. If a high voltage short causes excessive plate current, the cathode fuse will blow.

SYMPTOM: Low output, or low gain.

The ceramic triode in your amplifier is capable of supplying many years of reliable operation, if you operate it within its normal operating parameters, and always tune for resonance before transmitting. Eventually, the filaments will lose emission and the tube will have to be replaced. When a tube begins to go soft, it will no longer provide full output, or normal amplifier gain.

SECTION 7.4 HIGH VOLTAGE PROBLEMS

CAUTION!
The high voltage in your amplifier can be LETHAL! Always disconnect the amplifier from the AC power source and turn off the amplifier's power switch before you work on the unit.

SYMPTOM: No plate current with excessive grid current.

This is a sure indication of a break in the high voltage line between the power supply and the tube. You must disconnect all power from the amplifier before tracing the circuit with an VOM.

SYMPTOM: High voltage short – circuit breaker blows immediately when you turn it on.

A high voltage short will usually cause the circuit breaker to trip off. Often, you can visually find the source of the short by looking for carbon traces from the arc. First, disconnect the high voltage cable from the RF chassis. If the short disappears, you will know that it is likely in the RF chassis and not the power supply. If the short continues after disconnecting the high voltage cable, the problem probably lies in the power supply itself.

If the short appears to be in the RF chassis or in the B minus return line, first remove the top cover from the RF chassis and check that the high voltage shorting (protection) switch is engaged and not shorting because it is out of alignment and then look for any visible signs of a short. Normal indications are burned components or carbon traces or discoloration on the chassis. If you can not find the source, you must use a VOM to trace the circuit from the high voltage connector to the blocking capacitor. If you can not find another cause, remove the tube from the socket and carefully reconnect power to the amplifier. If the short disappears, the tube is the likely cause. Sometimes a short may only appear then the high voltage is turned on. If this event, you will have to physically unsolder components from the circuit until the short disappears. Realign the high voltage shorting switch when you are putting the chassis back together.

If the problem is in the power supply section, you will have to follow the strategy outlined above. Look for any charred or discolored parts or marks on the chassis. Next, use a VOM to see if there is any obvious short to ground. Finally, starting at the bleeder resistors, unsolder parts from the circuit until the short disappears.

After you have solved the short problem, check the cathode fuse on the RF chassis. It often blows during a high voltage short condition.

SYMPTOM: No high voltage meter reading.

The most likely cause for no meter reading is a blown cathode protection fuse. Otherwise the metering resistor network may have failed or the meter itself may be bad.

SECTION 7.5 BLOWER PROBLEMS

SYMPTOM: Blower is very noisy.

Your amplifier uses a squirrel cage type blower. The

reliability. Sometimes, during shipping, this type of blower can become unbalanced if the amplifier takes a severe blow. If that is the case, the blower may cause the whole amplifier to shake and cause excessive mechanical noise. The only solution to this problem would be replacement of the blower.

SYMPTOM: Blower does not run.

Check the AC mains fuse on the back of the amplifier. Check to see that the blower is getting AC. If the fuse is good, and power is getting to the motor, the blower has probably failed and must be replaced.

SECTION 7.6 OUTPUT PROBLEMS

SYMPTOM: Low output.

First, check your drive level and input SWR to the amplifier to insure that you are getting sufficient drive. When the amplifier is operating properly, you should see more than 20 times gain. Often low output happens because the drive is dropping off.

Second, check that the input and output cables are properly connected and have no shorts. You should be able to see this problem with the amplifier turned off.

Other problems that can reduce output are low plate voltage, low AC mains line voltage, low filament voltage or a bad tube.

SYMPTOM: High voltage is too low.

The most likely cause is your AC line voltage is too low, or that the power transformer is wired incorrectly. If the high voltage is a few hundred volts low, just wire the power transformer as described in Section 4.4. If the high voltage is about half of nominal, the power transformer is probably wired for 220 VAC and you are attempting to operate from 115 VAC, or the power plug was incorrectly wired to your AC mains.

SYMPTOM: High voltage is too high.

The most likely cause is your AC line voltage is too high, or that the power transformer is wired incorrectly. If the high voltage is a few hundred volts high, just wire the power transformer as described in Section 4.4.. If the high voltage is about double of nominal, the power transformer is probably wired for 115 VAC and you are attempting to operate from 220 VAC.

SYMPTOM: Filament voltage is too high or too low.

Low filament voltage will reduce tube output, and could damage the tube by contaminating the filament. High filament voltage will reduce the useful life of your tube and could result in premature tube replacement. The 8877/3CX1500A7 uses a nominal 5.0 VAC filament and should not vary more than plus/minus .25 VAC.

SECTION 7.8 OTHER PROBLEMS

SYMPTOM: Your amplifier will not turn on.

Either the circuit breaker on/off switch has failed or the AC mains power plug has been installed incorrectly. If the high voltage comes on, but the blower and pilot lights have not, check the AC mains fuse on the back panel.

SYMPTOM: Your ALC line is shorted.

A failure in the ALC circuit will keep you from driving your tube to full output. If you suspect this, simply remove the ALC cable from the amplifier and carefully drive the amplifier with no ALC feedback.

SECTION 7.9 CONTACTING THE FACTORY

If you have any questions concerning the operation or repair of your amplifier, you should write or e-mail the service department at Henry Radio with full details of the nature of your problem. If it ever becomes necessary to return the amplifier to the factory for repair, pack it properly, preferably in the original shipping material, and include a brief note explaining the problem. Insure the package for replacement cost. You may leave the tube in the amplifier when you ship it.

e-mail – henryradio@earthlink.net or

Section 8. Disassembling your amplifier.

NOTE

The description of this procedure uses screw number which are shown on Figure 8.1. Refer to the drawing as necessary.

CAUTION!

Unplug the amplifier from the AC line before starting this procedure.

REMOVE THE TOP PANEL – Remove screws 4, 5, 10 and 11 and lift the perforated, painted top panel of off the cabinet.

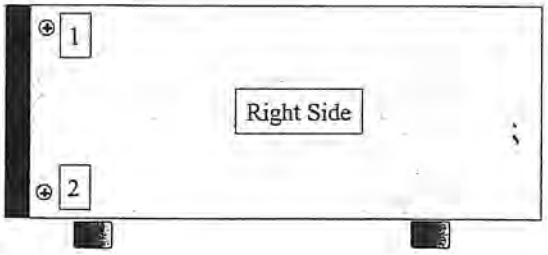
REMOVE THE BACK PANEL – Remove screws 13, 14, 15, 16, 31 and 32. Then remove a screw that is located in the top center of the rear bracket – not shown –

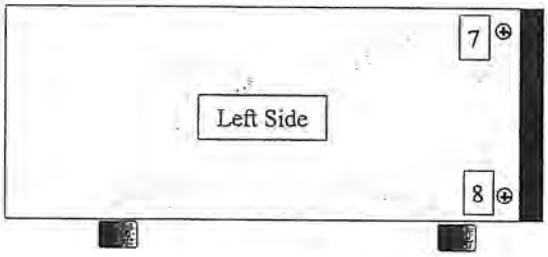
Figure 8.1. Disassembling your amplifier.

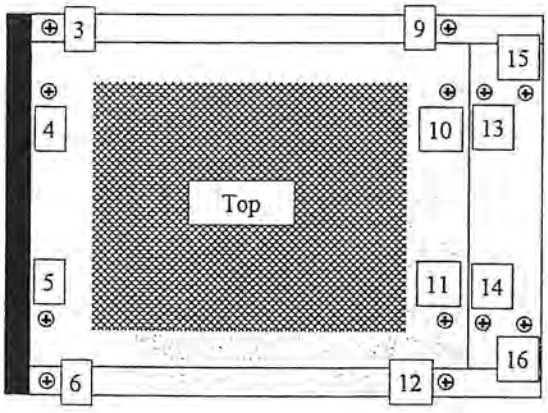
and the rear panel should come out. Some cables will still be attached.

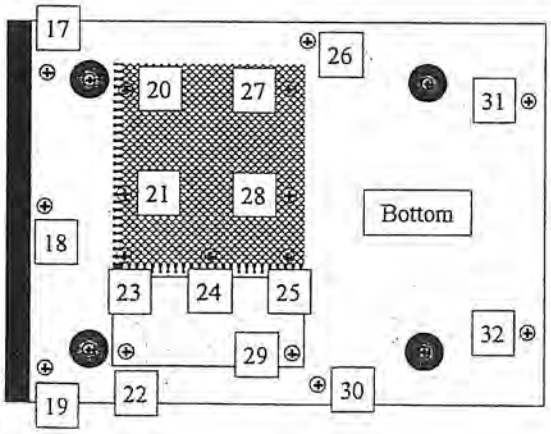
REMOVE THE FRONT PANEL – Remove screws 1, 2, 3, 4, 5, 6, 7, 8, 17, 18,19. Remove all the knobs by loosening the allen type set screw and sliding them off the shaft. Remove the screws holding the circuit breaker on the front panel and the panel should come out. If you need to fully remove it for any reason, you will have to unsolder the connecting wires.

REMOVE THE RF CHASSIS AND POWER SUPPLY – Remove screws 20, 21, 22, 23,24,25, 26, 27, 28, 29 and 30 and the base plate will slide out the back of the cabinet. You should now be able to reach all components and wiring.

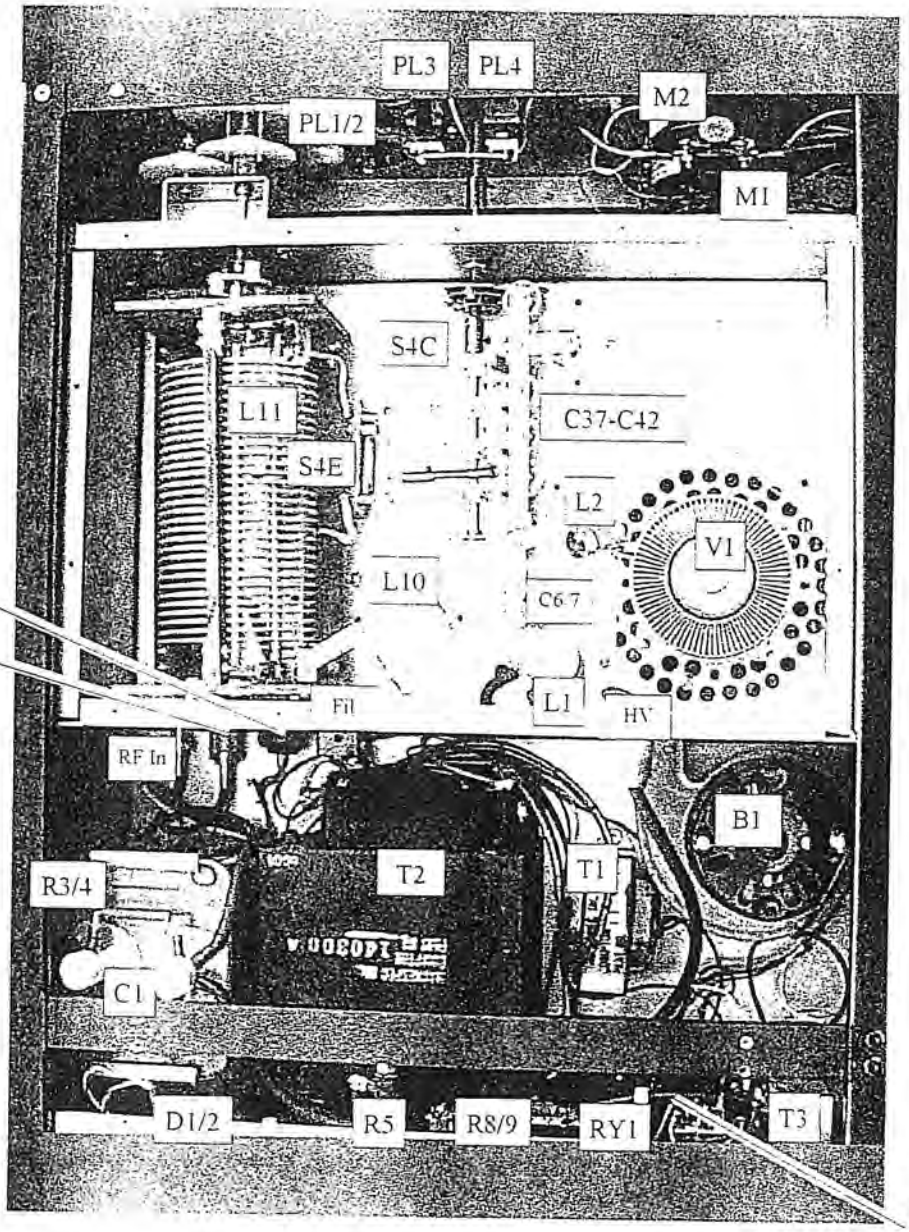




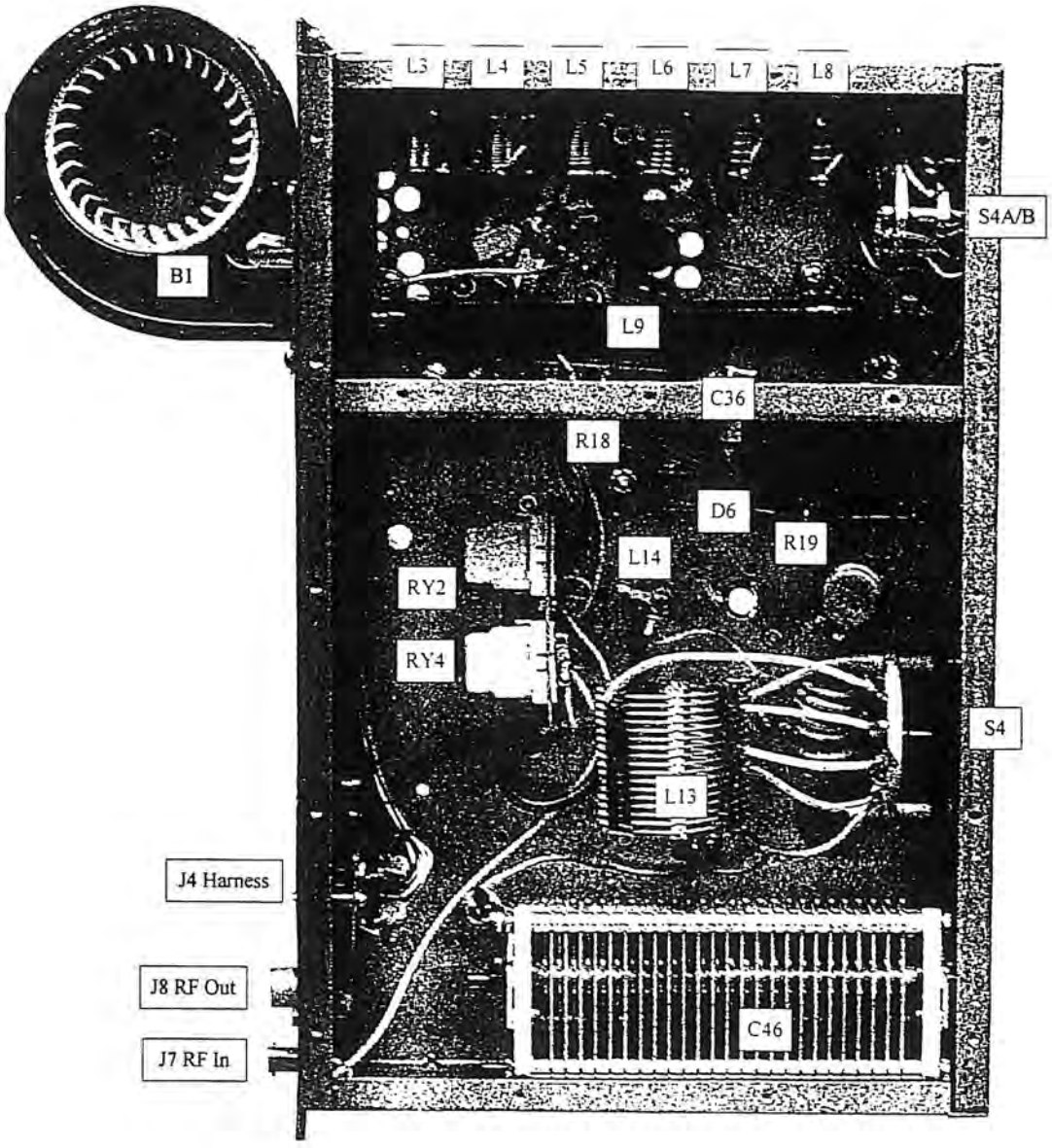




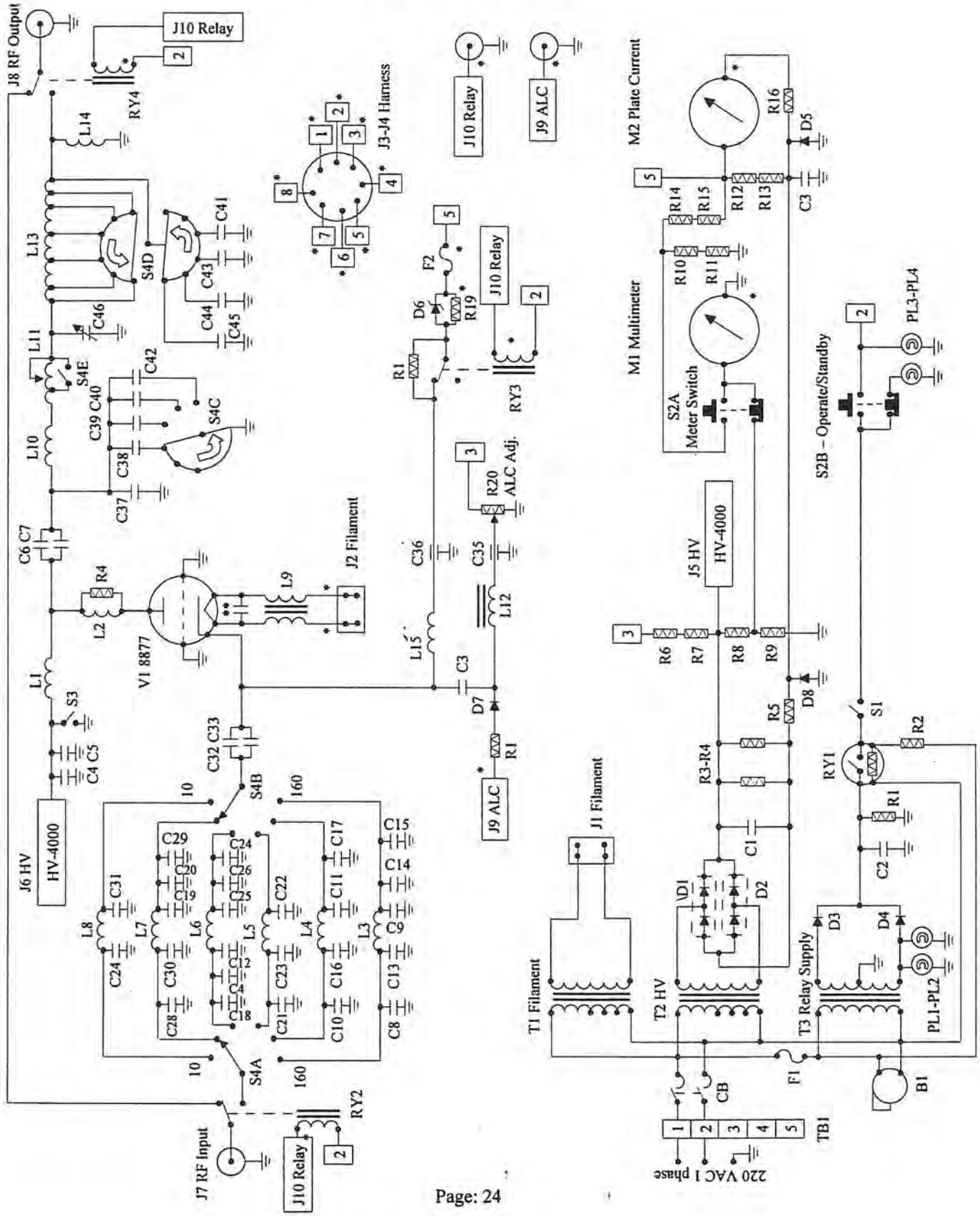
Section 9. Parts Layout – Top



Section 9. Parts Layout – Bottom



Section 10. Schematic



Section 11. Parts List

Schematic No.	Description	Part Number
B1	Blower: Squirrel cage style, 100 CFM.	Kooltronic KBB29-102M
C1	Capacitor: Oil filled, 25 mf, 5000 vdc.	Aerovox BD402EW025D01
C2	Capacitor: Electrolytic, 470 mf, 50 vdc.	Capacitor
C3	Capacitor: Ceramic disc, .05 mf, 16 vdc.	Capacitor
C4-C5	Capacitor: Ceramic disc, .0047 uf, 15 kv.	Sprague 150GAD47
C6-C7	Capacitor: Ceramic transmitting, 1000 pf, 7.5 kv.	High Energy HH58V102MA
C8-9-10-11-12	Capacitor: Dipped mica, 152 pf, 500 vdc, 5%.	Capacitor
C13	Capacitor: Dipped mica, 300 pf, 500 vdc, 5%.	Capacitor
C14	Capacitor: Dipped mica, 1000 pf, 500 vdc, 5%.	Capacitor
C15	Capacitor: Dipped mica, 820 pf, 500 vdc, 5%.	Capacitor
C16-17-18-19-20	Capacitor: Dipped mica, 200 pf, 500 vdc, 5%.	Capacitor
C21-22	Capacitor: Dipped mica, 430 pf, 500 vdc, 5%.	Capacitor
C23-24	Capacitor: Dipped mica, 100 pf, 500 vdc, 5%.	Capacitor
C25-26	Capacitor: Dipped mica, 110 pf, 500 vdc, 5%.	Capacitor
C27-28-29	Capacitor: Dipped mica, 75 pf, 500 vdc, 5%.	Capacitor
C30	Capacitor: Dipped mica, 91 pf, 500 vdc, 5%.	Capacitor
C31	Capacitor: Dipped mica, 210 pf, 500 vdc, 5%.	Capacitor
C32-C33	Capacitor: ********	********
C34	Capacitor: Dipped mica, 470 pf, 500 vdc, 5%.	Capacitor
C35-36	Capacitor: Feedthrough, 2000 pf, 300 vdc.	Tusonix 202M
C37-38	Capacitor: Ceramic transmitting, 25 pf, 7.5 kv.	High Energy HT50V250KA
C39-40-41	Capacitor: Ceramic disc, 175 pf, 2000 vdc, NPO – 2 pieces.	RMC CC175BKKAC89
C42-43	Capacitor: Ceramic disc, 175 pf, 2000 vdc, NPO – 3 pieces.	RMC CC175BKKAC89
C44	Capacitor: Ceramic disc, 175 pf, 2000 vdc, NPO – 5 pieces.	RMC CC175BKKAC89
C45	Capacitor: Ceramic disc, 175 pf, 2000 vdc, NPO – 10 pieces.	RMC CC175BKKAC89
C46	Capacitor: Air variable, 5000 vdc, 2000 vdc – LOAD control.	Henry 154-10J
CB1	Circuit Breaker: On/Off Switch, 230 VAC, 30 amp.	Heinemann AM2-A3-A30-2
D1-2	Diode: HV rectifier, 1.2 amp, 15 kv.	EMI 24050/120257
D3-4	Diode: Rectifier, 3 amp, 1000 piv.	********
D5	Diode: Rectifier, 1 amp, 400 piv.	1N4007
D6	Diode: Bias regulator assembly, 10 vdc, 1.2 amps.	EMI 12050
D7	Diode: Rectifier, 200 piv, 1 amp.	1N458

Schematic No.	Description	Part Number
D8	Diode: Rectifier, 100 PIV, 3 amps	1N4720
F1	Fuse: AC mains, 3 AG, 6 amps.	Fuse
	Fuseholder: 3AG type.	Littelfuse 342-875
F2	Fuse: Cathode protection, 8 AG, 1.5 amps.	Fuse
	Fuseholder: 8 AG type.	Littelfuse 372-001A
J1	Connector: Filament, 4 pin, female.	Cinch S404CCT
J2	Connector: Filament, 4 pin, male, chassis mount.	Cinch P404AB
J3	Connector: Harness interconnect, octal socket.	Amphenol 86S8
J4	Connector: Harness interconnect, octal plug.	Amphenol 86CP8
J5-6	Connector: HV, 5000 vdc, mica.	Millen 37501
J7	RF Connector: RF input, type BNC(f) chassis jack.	Connector
J8	RF Connector: RF output, type N(f) chassis jack.	Connector
J9-J10	Connector: ALC, RELAY, RCA female.	Switchcraft 3501FP
L1	Inductor: RF plate choke, 25 uh, 2 amps.	Henry 3KP-L1
L2	Inductor: Parasitic suppressor.	Henry 3KP-L2
L3	Inductor: Input coil, 160 meters, pi type, 20t, 20 ga.	Henry 3KP-L3
L4	Inductor: Input coil, 80 meters, pi type, 14t, 20 ga.	Henry 3KP-L4
L5	Inductor: Input coil, 40 meters, pi type, 12t, 18 ga.	Henry 3KP-L5
L6	Inductor: Input coil, 20 meters, pi type, 8t, 18 ga.	Henry 3KP-L6
L7	Inductor: Input coil, 15 meters, pi type, 5t, 18 ga.	Henry 3KP-L7
L8	Inductor: Input coil, 10 meters, pi type, 4t, 18 ga.	Henry 3KP-L8
L9	Choke: Filament, toroid wound.	Henry 3KP-L9
L10	Inductor: 10 meter coil, pi network.	Henry 3KP-L10
L11	Inductor: Roller type, 28 uh, TUNE control.	Henry 3KP-L11
L12	Choke: filament center tap type.	Henry 3KP-L12
L13	Inductor: Tapped output coil, L network.	Henry 3KP-L13
L14	Choke: Output protection.	Miller 4555
L15	Choke: .	
M1	Meter: Multimeter, 0-400 scale, 0-1 ma movement.	Yokogawa 260300-M
M2	Meter: Plate Current, 0-1 scale, 0-1 ma movement.	Yokogawa 260300-P
PL1-2	Pilot Light: Dial lights, 18 vac.	Type 1829
	Pilot Light Holder	Smith 1931
PL3-4	Pilot Light: Standby and Power lights, 12 vdc.	Type 85

Schematic No.	Description	Part Number
	Pilot Light Holder	Dialco 554-001
R1	Resistor: Carbon, 470 ohms, 2 watt, 10%.	Resistor
R2	Resistor: Wirewound enamel, 6k ohms, 25 watts, 5%.	Resistor
R3-4-8	Resistor: Precision, 4M ohms, 7.5 watts, 1%.	Resistor
R5	Resistor: Wirewound enamel, 25 ohms, 25 watts, 5%.	Resistor
R6-7	Resistor: Precision, 2M ohms, 7.5 watts, 1%.	Resistor
R9	Resistor: Carbon, 10k ohms, 2 watts, 10%.	Resistor
R10-11-12-13	Resistor: Carbon, 0.1 ohms, 1 watt, 10%	Resistor
R14-15	Resistor: Carbon, 20 ohms, 1 watt, 5%.	Resistor
R16	Resistor: Carbon, 150 ohms, 1 watt, 5%.	Resistor
R17	Resistor: Carbon, 1000 ohms, 1 watt, 10%.	Resistor
R18	Resistor: Wirewound enamel, 20K ohms, 20 watts, 5%.	Resistor
R19	Resistor: Carbon, 220 ohms, 2 watts, 10%.	Resistor
RY1	Relay: Warmup delay, 90 second, 115 vac.	Amperite 115NO90B
	Relay Socket: 8 pin octal.	********
RY2	Relay: Input RF switching.	********
RY3	Relay: Bias swithing.	Guardian 1365PC
RY4	Relay: Output RF switching, coaxial type.	Tohtsu CX531N
S1	Switch: Airflow protection, mounted on blower.	********
S2A-B	Switch: Multifunction, pushbutton type.	Switchcraft 25S1623
S3	Switch: HV protection shorting switch.	Henry 3KP-S3
S4A-4B	Switch: Band switch, input section, 6 position rotary.	Centralab 2504
S4C-S4E	Switch: Band switch, output pi section, 6 position rotary.	Henry 3KP-S4C
S4D	Switch: Band switch, output L section, 6 position rotary.	Multitech R80
T1	Transformer: Filament, 200-250 VAC primary, 5 VAC sec.	Magnespec 111600
T2	Transformer: HV, 200-250 VAC primary, 4000 VAC sec.	Magnespec 140300A
T3	Transformer: Relay Supply, 230 VAC primary, 12 VAC sec.	Magnespec 118800
TB1	Terminal Board: AC mains input, 5 terminal.	********
V1	Electron Tube: Ceramic metal triode, 8877.	3CX1500A7/8877
	Tube Socket: Metal ring type.	Johnson 122-0247-202
	Chimney: Teflon	Henry

All Specifications and Part numbers are subject to change without notice.

Section 12. Tube Specifications

8877 – 3CX1500A7

The 3CX1500A7/8877 is a high-mu air cooled ceramic power triode electron tube. It is a pin based, plug-in type tube requiring a minimum of 90 seconds warm-up, operating in a grounded grid circuit.

Filament: Oxide Coated – 5.0 VAC +/-0.25 VAC, 10.5 amps nominal.

Frequency of Maximum Rating: 250 MHz.

Dimensions: 4.02" long x 3.38" diameter.

Weight: 1.6 pounds.

Operating Position: The tube may be operated in any position.

Maximum Operating Temperature: 250 degrees C.

Maximum DC Plate Voltage: 4500 VDC.

Maximum DC Plate Current: 1 amp.

Maximum Grid Current: 25 ma.

Maximum Plate Dissipation: 1500 watts.

Maximum Grid Dissipation: 30 watts.

Air Flow Required (for 1500 watts dissipation): 35 CFM at .41" pressure drop at sea level.

Section 13. Tune and Load Settings

The following table contains the factory calibrated dial settings and related meter readings for your amplifier. These settings are determined by tuning into a 50 ohm non-reactive dummy load. If you are tuning up into an antenna, or the line voltage at your operating location is different from the test position, the settings will vary.

Model:	Serial Number:
3KD PREMIER 230VAC	

Section 12.1 Factory Calibration Data – CW Operation.

Frequency	TUNE	LOAD	Grid Current	Plate Current	Drive Power	Output Power
28.5	20	120				
24.9	22	130				
21.2	30	140				
18.1	40	140				
14.2	50	170				
7.2	70	150				

Section 12.2 Factory Calibration Data – SSB Operation.

Frequency	TUNE	LOAD	Grid Current	Plate Current	Drive Power	Output Power
3.850	120	100				
1.900	170	170				

Section 12.3 User Calibration Data.

Frequency	Mode	TUNE	LOAD	Grid Current	Plate Current	Drive Power	Output Power