

# VAC PA35/35 TRIODE POWER AMPLIFIER

## Operating Instructions

DO NOT OPEN THIS UNIT - NO USER SERVICEABLE PARTS INSIDE. DO NOT REMOVE THE BOTTOM PLATE. LETHAL VOLTAGES ARE PRESENT WITHIN THE CHASSIS. DO NOT EXPOSE TO MOISTURE OR OPERATE IT IF WET.

VACUUM TUBES BECOME HOT ENOUGH TO CAUSE SERIOUS BURNS. NEVER TOUCH A TUBE WHEN THE UNIT IS ON. IT MAY TAKE SEVERAL MINUTES FOR THE TUBES TO COOL DOWN AFTER THE UNIT IS SWITCHED OFF.

DO NOT PLUG INTO AC UNTIL ALL CONNECTIONS ARE COMPLETED.

### Introduction

The VAC PA35/35 is a single chassis wide-band variable-feedback triode stereo amplifier rated at 35 watts per channel. It is to be operated only from the voltage visible on the configuration card located under the fuse. Please contact VAC or your dealer if the voltage in your area does not agree with the label. The fuse is a slow blow type of the size noted on the back of the chassis. A tube cage is available as an option.

The input circuit of the PA35/35 is derivative of the Williamson design, which was first published in England in 1947, and was the mainstay of the original high fidelity movement. Notable features of this circuit include a direct-coupled input amplifier and phase splitter, resulting in low phase shift, and inherent precise balance of the phase splitter (if properly executed) at all frequencies and levels, resulting in excellent push-pull balance, stability, and low distortion.

The output stage operates pentode versions of the EL34 with all grid elements, except the control grid, tied to the anode, thus securing the electrical and physical characteristics of single grid triodes.

Premium parts are employed throughout, including 14 pound 22 section bifilar-wound ultra-wideband output transformers, polypropylene and polystyrene signal capacitors, high current rectifiers, low ESR power supply, and proprietary wiring. The quality of parts and layout allows the use of very little feedback for high sonic purity and low distortion.

## Unpacking

Each tube socket on the amplifier is covered by a small round sticker. The color of this sticker corresponds to the color of the sticker on a tube. Fit each tube into the matching socket, first *removing* the sticker from the tube and socket. The bias levels for the output tubes have been factory set, but should be checked during the installation procedure.

## Installation

### Physical requirements:

- 1) Provide adequate ventilation - allow at least 3 inches above and 1 inch to each side.
- 2) Do not place in a completely enclosed cabinet.
- 3) Do not stack other equipment on top of the VAC units.
- 4) Do not operate on carpet or any other surface that might block air flow.
- 5) The chassis and power transformers will become hot in normal use.
- 6) Do not allow the chassis of the VAC components to touch any metal parts, such as the frame of an equipment rack. This might create a parallel ground path that will degrade the sound of your system.

### Electrical connections:

- 1) Complete all installation steps before plugging the amplifier into the AC mains supply.
- 2) Connect signal inputs to the power amplifiers. Single ended interconnect cables equipped with RCA phono plugs provide the input to each channel.
- 3) Connect loudspeakers between the appropriate pair of binding posts on the back of the power amplifiers. Most popular speaker cables can be accommodated by the output posts. Output impedance matching is available for loads of 2, 4, or 8 ohms. Connect one lead of the speaker cable to the "G" position, and the other to either 2, 4, or 8. The "G" terminal is at ground potential, and the amplifier does not invert phase.
- 4) Do not connect two amplifier outputs to each other.
- 5) Connect the AC cord to the power source indicated by the voltage configuration card under the fuse (100 volts AC, 120 volts AC, 220 volts AC, or 240 volts AC at 50 or 60 Hertz).
- 6) Follow the BIAS procedure described in this manual to set the idle current. Also, read the section entitled INSTALLING NEW OUTPUT TUBES.

## Operation

It is suggested that you begin listening with the feedback control (front left of chassis) set to "A" (zero feedback) and the audio ground switch (rear panel) set to "Normal."

Continuous operation is not recommended. If the amplifiers will not be auditioned for a few hours it is best to turn them off. This avoids undue stress to the EL34 output tubes.

As with all high fidelity products, the sound characteristics of the VAC amplifiers change somewhat as they warm up. Best sound will be achieved after 15 minutes of operation, with subtle changes occurring for up to one hour. However, we advise against leaving the equipment on at all times because of the attendant acceleration of output tube wear. Life of the output tubes averages between 2,000 and 8,000 hours depending upon brand fitted and random variations within the tubes themselves.

Any time that the VAC Power Amplifier has not been used for a few weeks the sound may be different. This is also normal for high resolution audio equipment. Optimum sound should return after a few hours of operation, preferably with an audio signal.

Please note that although your VAC amplifiers have been run for 48 hours at the factory, they will continue to "break in" for approximately 150 hours. Also be aware that many components display the need for a new break in period after being transported in unheated cargo aircraft.

## Bias Adjustment

Your VAC Power Amplifier has been shipped with output tube bias preset. This should be checked when you install your amplifier, and periodically thereafter. It must also be set whenever an output tube is changed.

Adjustment of the output tubes is quite easy, and requires only a small screwdriver. On the front panel are four bi-color LEDs, each with an adjacent adjustment control. View the LEDs from directly in front, not from above or below. Adjust the LEDs to be green when the amplifier is not playing music. To set, turn the control clockwise until the LED just begins to change to an amber/red color, and then back the control off just slightly to restore the pure green color.

As music plays, the LEDs will vary from green to red. Check the bias if you ever see an LED stay red while music is not playing, or if an LED does not tend toward amber or red when music is playing.

Any tube that can not be adjusted to the correct bias point should be replaced. Any tube which requires constant readjustment should be replaced immediately. Never operate the amplifier with an LED that shows red when music is not playing.

When installing new tubes, set the bias controls counter-clockwise. Check the bias of both channels as the amplifier warms up - don't wait ten minutes.

Bias levels should be checked monthly to ensure optimum sound quality. It is not unusual for the bias to change with time, particularly when tubes are new. The greatest amount of drift occurs during the first 200 hours of a tube's life. The drift may change direction periodically, such that the bias control must be increased and later decreased, or vice versa. Check bias if the sound seems lacking in detail or dynamics.

### Tube Types

The input/splitter (frontmost) tube may be type 12AU7A/ECC82/E82CC or type 12BH7 (typically richer sound). The driver tube (next toward the back) is type 12AT7A. The output tubes are type EL34, pentode version only. *Some 6CA7/EL34 have been made as "beam power" tubes, and will damage the PA35/35, as will any output tube that internally ties pins 1 and 8.* Golden Dragon tubes are generally recommended and have been used extensively during the development of this amplifier. Please feel free to contact VAC if you require additional information or advice.

### Installing New Output Tubes

Replacement tubes are available from VAC and other sources. Output tubes are EL34 pentodes only. *Some 6CA7/EL34 have been made as "beam power" tubes, and will damage the PA35/35, as will any output tube that internally ties pins 1 and 8.* It is not necessary that they be matched pairs, although a slight improvement in measured performance may be achieved in this way. Make certain that each tube fits firmly in its socket. A tube that fits loosely may not make correct contact on all pins and might "run away" (read on). It is best not to mix brands of tubes.

ALL POWER MUST BE OFF. Remove the old tubes after they have cooled down (TUBES BECOME HOT ENOUGH TO CAUSE SERIOUS BURNS WHEN IN OPERATION AND MAY TAKE SEVERAL MINUTES TO COOL DOWN). Install the new tubes firmly and fully in the sockets, taking care to observe the direction of the locating ridge on the plastic center pin of each tube.

Follow the normal turn on procedure and begin the BIAS procedure. While doing this, keep an eye on the plate (the outermost metal structure) of the output tubes. SWITCH OFF IMMEDIATELY IF THEY BEGIN TO GLOW RED. This indicates that the tube is "running away", being destroyed rapidly by conducting excessive current.

Tubes may run away for several reasons:

- 1) The tube is not fully inserted in the socket.
- 2) The tube fits loosely in the socket and thus can not make correct contact. Such a tube is unusable and should be returned to its seller.
- 3) The tube is defective.
- 4) The bias is misadjusted.
- 5) There is a problem with the amplifier. Contact VAC or your dealer to arrange service.

In the event that trouble is encountered, try another tube. Stop if the problem persists and consult with your dealer or VAC.

Follow the BIAS procedure described previously in this manual to set the idle current at 70 milliamperes per tube, checking the idle current at 1 minute, 30 minutes, 1 hour, and 2 hours.

### Replacement of Low Level Tubes

All power must be switched off. Allow tubes to cool down. Remove and replace with new tubes of the appropriate types, noting the location of holes in the socket and pins of the tubes.

Replacement tubes are available from VAC and other sources.

## Care of Chassis & Face Plate

VAC chassis are aluminum for superior electromagnetic performance. The finish is a tough textured powder coat paint. This finish is durable but can be scratched or chipped, just as that of a fine automobile may be damaged. Cleaning with a damp cloth WHILE THE AMP IS SWITCHED OFF AND UNPLUGGED should suffice.

## Tube Cages (Optional)

Perforated metal cages are planned as a future option to enclose the vacuum tubes. Mounting directions will be supplied with the tube cage kit.

## Need Help?

Please call us with any questions you may have. It is better to ask than to guess. Our telephone number is (USA) 919-596-1107. Our fax number is 919-596-2037.

Warranty

This amplifier is warranted for a period of thirty (30) days from the date of purchase. In addition, if the registration card(s) is received by VAC *along with a copy of your sales receipt* from an authorized VAC dealer within this thirty days, a service contract will be extended to cover your equipment for two (2) years (except tubes which are covered for 90 days). Receipt of your registration card will be confirmed in writing by VAC.

This warranty applies only to units sold to and operated by private individuals in the United States of America through authorized VAC dealers. For warranty information outside of the U.S. contact the importer of VAC equipment for your country. Units sold outside of the U.S. should still be registered with VAC.

Valve Amplification Company  
807 Bacon Street  
Durham, NC 27703  
Tel 919-596-1107  
Fax 919-596-2037

-----  
*Mail this form along with a copy of your sales receipt as soon as possible to:*

**REGISTRATION FORM**

VAC PA80/80

Name \_\_\_\_\_

Address \_\_\_\_\_

Telephone \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

Dealer name \_\_\_\_\_ Salesperson \_\_\_\_\_

" address \_\_\_\_\_

Purchase date \_\_\_\_\_ Serial Number \_\_\_\_\_

How did you first learn of VAC products? \_\_\_\_\_

Please provide any comments on VAC products or your dealer \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Tips & Advice

### A Word About Tubes in General

It is a truth that each brand of tube sounds different in a particular high resolution circuit. This is because no two manufacturers make a tube type in quite the same way, and the central tendencies of the performance parameters will differ slightly with each maker. To emphasize the point, examine the plate structure of any two 12AX7 from different manufacturers will probably find that they may not even the same shape and size. (Be careful here, as often a tube is made by a firm other than indicated on its label. In the heyday of tubes it was common to crossbrand between major labels, such as GE and RCA. Today many labels do not manufacture their tubes at all, including Gold Aero and RAM.)

This sonic variability may at first seem a liability, but further thought will reveal that it is an advantage, just like the ability to adjust VTA on a tone arm. The owner of a tube amplifier can select those tubes which sound like the real thing in his/her specific system. Of course, if the manufacturer you prefer is rare you may want to purchase a few spare tubes for the future.

How long should tubes last? It has long been known in professional circles (and probably now forgotten) that a tube such as the 12AX7 will display better performance characteristics after two years of continual operation than when it was new. In normal use it is not unusual for a low level tube to last 10 years or longer. Output tubes are another story, as they are continually providing significant amounts of current. Here the sound is your best guide. Certainly tubes should be replaced when the amplifiers can no longer meet specifications or when (if you have access to a tube tester) the tube's emission is significantly down or its transconductance is substantially out of specification. In normal use, output tubes will last at least 2 years and perhaps more than 10 years.

VAC will be happy to test tubes for concerned customers. For appropriate fees we can provide transconductance, idle current and/or a photographic record of the tube's plate family curves.

## TIPS & ADVICE

### A Word About Output Tubes

Your VAC Amplifier uses the EL34 in PENTODE VERSION ONLY. *Some 6CA7/EL34 have been made as "beam power" tubes, and will damage the PA35/35, as will any output tube that internally ties pins 1 and 8 (the cathode and suppressor grid).*

As long as the above requirement is met, feel free to experiment with different brands and types to customize the sound to your tastes.

As with interconnects and speaker cables, each tube manufacturer's EL34 tends to have a distinct sound when used in VAC amplifiers. The PA35/35 was developed primarily using the Golden Dragon EL34.

### A Word About Low Level Tubes

The small tubes (Voltage Amplifier/Phase Splitter and Driver) in the VAC Amplifiers are type 12AU7. This tube is essentially the same as types 12AU7A, 5814, 6189, CV4003, ECC82, and E82CC. The quality of the tube used is by far more important than which of these (equivalent) types is used.

The preferred 12AU7A is the British/Chinese Golden Dragon. Acceptable alternate versions include the Brimar CV4003 (ladder plate version), Mullard CV4003 (very midrangy), generic Chinese 12AU7 (brighter), Sylvania 6189 (darker sound), the GE 12AU7A (slightly forward and grainy) and the Yugoslavian 12AU7 (cohesive and somewhat coarse).

Many classic tubes worth trying if you have access to them, such as those from Telefunken and Amperex, although a caution is in order, as we have recently seen East German EL34 relabelled "Telefunken West Germany." Tubes actually manufactured by RCA, Westinghouse, and Sylvania can be quite good, but the name on the tube doesn't always indicate who actually made it. Other names to watch for are Valvo, Mazda, Tung-Sol, Bendix, Mullard, Brimar, and Raytheon.

## TIPS & ADVICE

### A Word About Bias Levels

The output stage is designed to operate in rich Class AB<sub>1</sub>. For more technical information about classes of operation see VAC Technical Monograph 90-8.

Some designers erroneously market a lower operating point (as little as 26 mA @ 550 VDC) as "Class A<sub>1</sub>." Be assured that the VAC and its tubes are strong enough to handle the more demanding, richer bias level.



## TIPS & ADVICE

### A Word About Impedance Matching

We strongly suggest that you experiment with the three available impedance connections for the best sonic match with your system. Since no loudspeaker represents an unchanging impedance at all frequencies, it is impossible to assert with certainty which output tap is appropriate to use. In many systems an amazing difference in sound will exist between the various impedance taps.

Most loudspeakers vary away from their "nominal" impedance, which is why experimentation is essential. We often find that matching a speaker's minimum impedance is more important than matching its nominal (average) impedance.

If you bi-wire your system (run separate speaker leads from the amplifier to the high and low frequency transducers) you may discover that two different impedance taps work best. For example, with early Martin Logan Sequel II we find that the bass speaker is best matched with the 4 ohm tap, while the electrostatic panel is best controlled by the 2 ohm tap. To achieve this connection, the black leads of both speaker cables connect to "G", the red lead for the panel connects to "2", and the red lead for the woofer connects to "4". With later Sequels we use the 4 ohm connection for both drivers.

Contrary to popular misconception, no power is lost due to unused output taps.

## TIPS & ADVICE

### A Word About Triode Amplification

Triode amplification is the oldest form known. From the engineering perspective, the triode mode has the following characteristics:

- 1) Somewhat more distortion at low power levels
- 2) Somewhat less distortion at moderate power levels
- 3) Reduced maximum power output
- 4) Output impedance matching is less critical
- 5) Increased natural damping factor.

## TIPS & ADVICE

### A Word About Feedback

A control is provided by which controlled amounts of loop negative feedback may be introduced. The settings are as follows:

<u>Position</u>	<u>Comments</u>
A	no global feedback at all
B	1 dB negative feedback
C	2 dB negative feedback
D	3 dB negative feedback
E	4 dB negative feedback
F	5 dB negative feedback

A given amount of feedback reduces the sensitivity of the amplifier by that amount. For example, when switching from 0 dB to 2 dB of feedback, you will need to turn your preamplifier up 2 dB to achieve the same volume.

As small amounts of feedback are introduced, the sound will tend to tighten up and be more controlled. At the same time, the frequency response of the amplifier/loudspeaker combination will change. With dynamic speakers, 0 dB is often satisfactory, and excessive amounts will dry and brighten the sound too much. With highly reactive loudspeakers, such as electrostatics, more feedback may actually produce a more open, airy sound.

There is no "optimal" setting for this control in an engineering sense. While feedback improves static damping and lowers some forms of distortion, it also weights the relative balance of distortion components to a higher order. In other words, there's a little good and a little bad about feedback. Listen, and use the setting that provides the best overall subjective performance of your system.

For further information please read the Tips section entitled Tuning Your System.

### A Word About Grounding

The PA35/35 amplifier is designed to be used with a three prong power cable. The ground pin connects directly to the chassis, while the audio ground couples to the chassis as determined by the GROUND switch. In the "Normal" position, audio and radio frequencies ground information is referenced to the chassis, but DC is blocked. In the "LF" position, the time constant of the reference network is increased, coupling still lower frequencies. Each of these positions will sound different and may produce different noise floors. The correct setting depends on how the rest of your system is grounded. Try each, and use the setting that produces the best sonic performance. Retest the settings any time you change a component in your system or change any power wiring.

Please note that some power line "conditioners" or "enhancers" do unusual things with the power line grounds, and may thereby create noise and sound quality problems.

For further information please read the Tips section entitled Tuning Your System.

## TIPS & ADVICE

### Tuning Your System

The VAC PA35/35 offers great opportunities for fine tuning your system for best subjective reproduction. At first glance this may seem a bit intimidating, but it's actually quite easy to do. Let's go step by step from the beginning.

- 1) Start with the Ground switch at "Normal" and the Feedback control at "A." Connect the loudspeakers to the highest tap that encompasses the nominal impedance rating of your speakers. For example, if your speakers are 4 ohms, connect them to the "4-8" tap rather than the "2-4" tap.
- 2) Play several different recordings that you are familiar with to get used to the sound of the system.
- 3) Turn the Feedback controls to the next highest setting. Turn up the volume control on your preamp until the volume sounds the same as before. Listen again to several recordings. If the sound seems improved, then try the next higher Feedback setting. Stop when you find the setting that sounds best to you.

In general, very reactive loudspeakers such as electrostatics will require more feedback for open sound.

- 4) If you note too much hum and/or buzz through the speakers, try the Ground switch in the "LF" position. Select the position that sounds best (LF normally produces a "thicker" sound, "Normal" a lighter, playful sound) and does not introduce hum or buzz into the system.
- 5) Try the speakers on the next lower impedance tap, and select the tap that sounds best to you.
- 6) If you made changes in steps 4 or 5, then repeat steps 3, 4, and 5.

Finally, remember that the break-in time of high resolution audio equipment is infuriatingly long. The Renaissance sound will continue to season for at least 200 hours. Typically, the early sound of the amplifier will be less extended, dynamic, and coherent. Then the sound will improve noticeably, followed by a period of darker sound, finally giving way to the desired musicality. Patience, as they say, is a virtue.

## SPECIFICATIONS

The VAC System has been developed with the critical ear as the major arbiter of quality, with both conventional and unique measurements providing insight and guidance as necessary. The lack of emphasis on measurements is due to the fact that engineering's arsenal of equipment and techniques do not operate on the pattern recognition principals that control human perception of sound.

In the immortal words of Daniel von Recklinghausen, if it measures good and sounds bad it is bad. If it measures bad and sounds good you've measured the wrong things.

For those concerned with test bench performance, the following describes typical measured performance of a PA35/35 operated at 120 VAC, 60 Hz.

Power Output:	35 watts continuous average power at 1 kHz into 8 ohms connected to the 8 ohm tap, both channels driven @ 2% THD.
Frequency Response:	down 0.5 dB at 5 Hz and 64 kHz, ref 0 dB = 1 watt @ 1 kHz. down 3.0 dB at 3 Hz and 115 kHz, ref 0 dB = 1 watt @ 1 kHz.
Power Bandwidth:	down 0.5 dB at 12 Hz and 50 kHz, ref 0 dB = 35 watts @ 1 kHz. down 3.0 dB at 8.5 Hz and 85 kHz, ref 0 dB = 35 watts @ 1 kHz.
Distortion:	< .25% THD at 1 kHz 10 watts
Noise:	< 1.5 mv at the output, S/N ratio > 84 dB
Sensitivity:	varies with feedback setting
Negative Feedback:	0, 1, 2, 3, 4, 5 dB selectable
Absolute Polarity:	Does not invert signal polarity.
Fuse:	Slo-Blow type, 4A for 100 & 120 Volt configuration, 2A for 220 & 240 V.
Power consumption:	300 watts at idle, 516 watts with both channels driven to full power.
Dimensions:	18 " width x 15 " depth x 7.5 " height