

Golden Tube Audio SE-40



Golden Tube Audio SE-40

VERSION 1.3

Please help improve the accuracy of this manual by providing your feedback to the forum.

Document kept: http://groups.yahoo.com/neo/groups/golden_tube/info

Golden Tube Audio SE-40

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Golden Tube Audio SE-40

Preface

This service manual is an open source collaboration effort of the members of the Golden Tube community group at http://groups.yahoo.com/neo/groups/golden_tube/info

This manual is a collection of contributions from various forum members edited and consolidated into on handy guide to assist in the self-support of maintaining the highly regarded Golden Tube Audio SE-40 amplifier manufactured by the now defunct Solo Electronics of Hayward California in the 1990's.

Though the best efforts of the community were involved in making this manual and reviewing and editing it's contents, it is possible errors or omissions herein could be present.

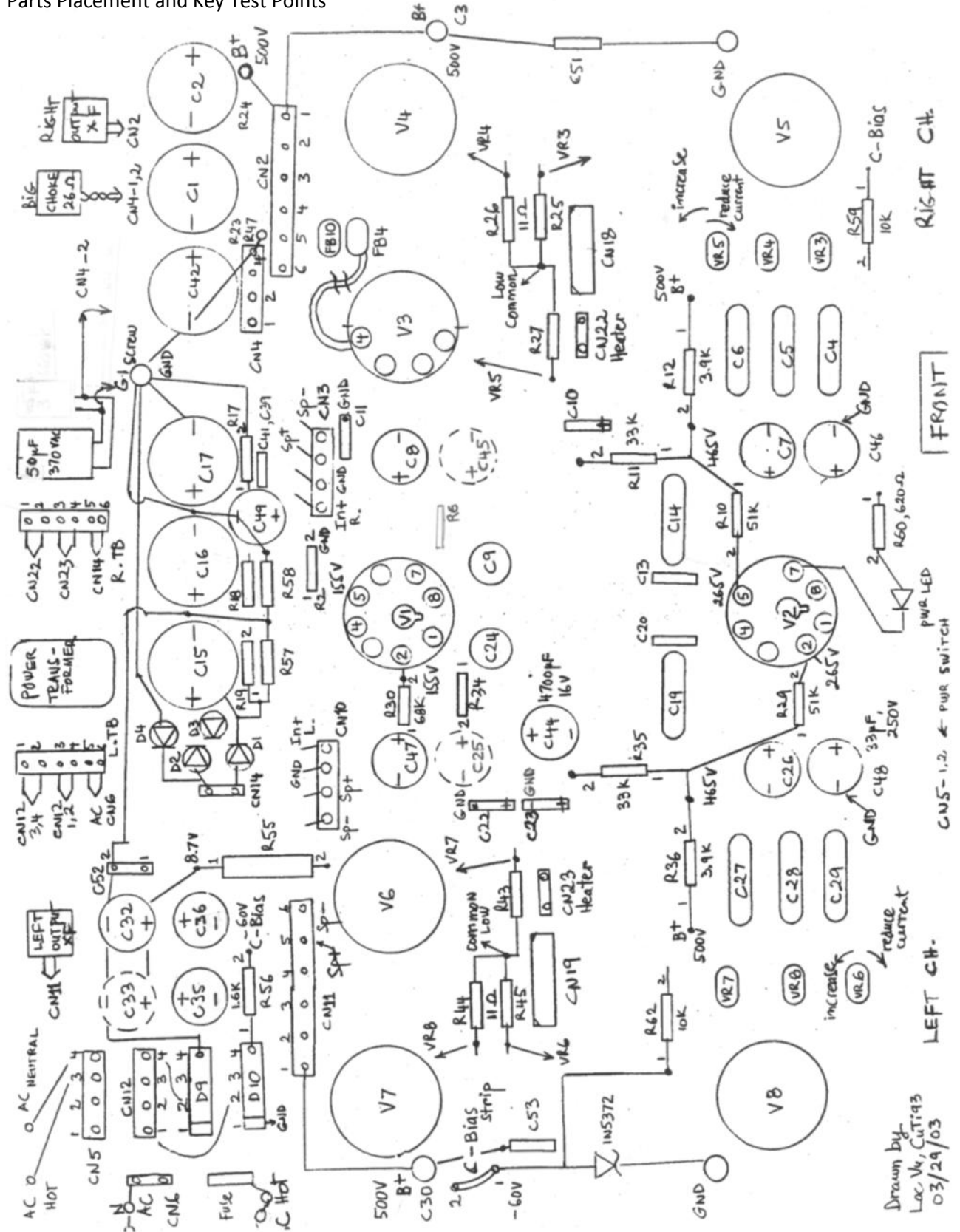
As always, proceed with caution and consult a certified technician experienced with tube electronics should you have any doubts or concerns about your own skill or ability. Even though audio tube technology is 100 years old, thousands of factory new tube audio gear is sold annually. Consult Ham radio shops, guitar shops, and specialty Hifi shops to locate a qualified technician in town.

Document Control

Version Published	Date	Change Control
1.0	09-10-2013	First version follow draft review
1.1	09-10-2013	Added Sovtek Tube Specification section
1.2	09-23-2013	Edited Tube Cross-ref section for clarity; within Reference section added Parts suppliers
1.3	09-27-2013	Selectively edited for grammar and clarity, resolved a broken link, replacement tube cross-reference chart

SE-40 Original Parts Diagram

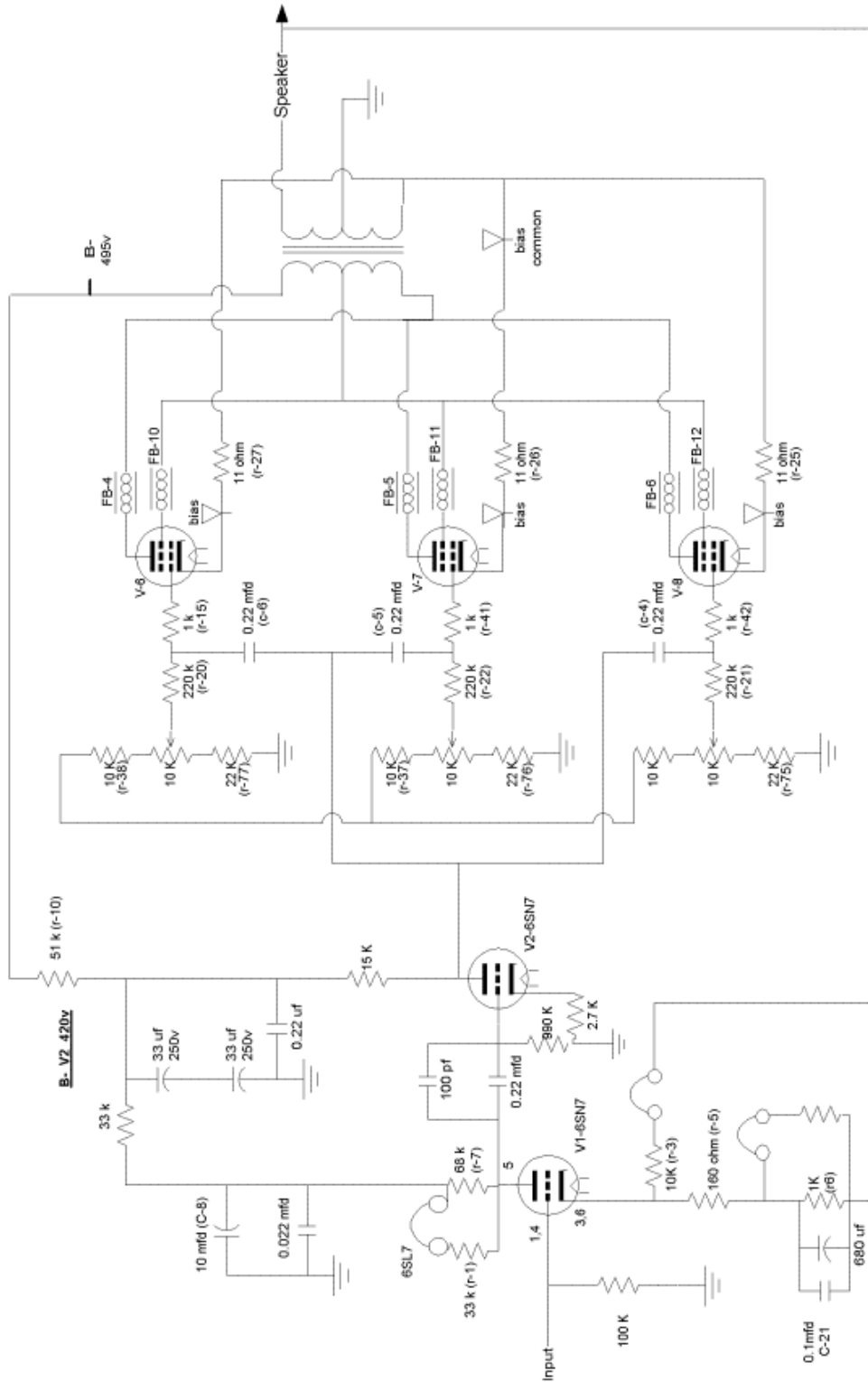
Parts Placement and Key Test Points



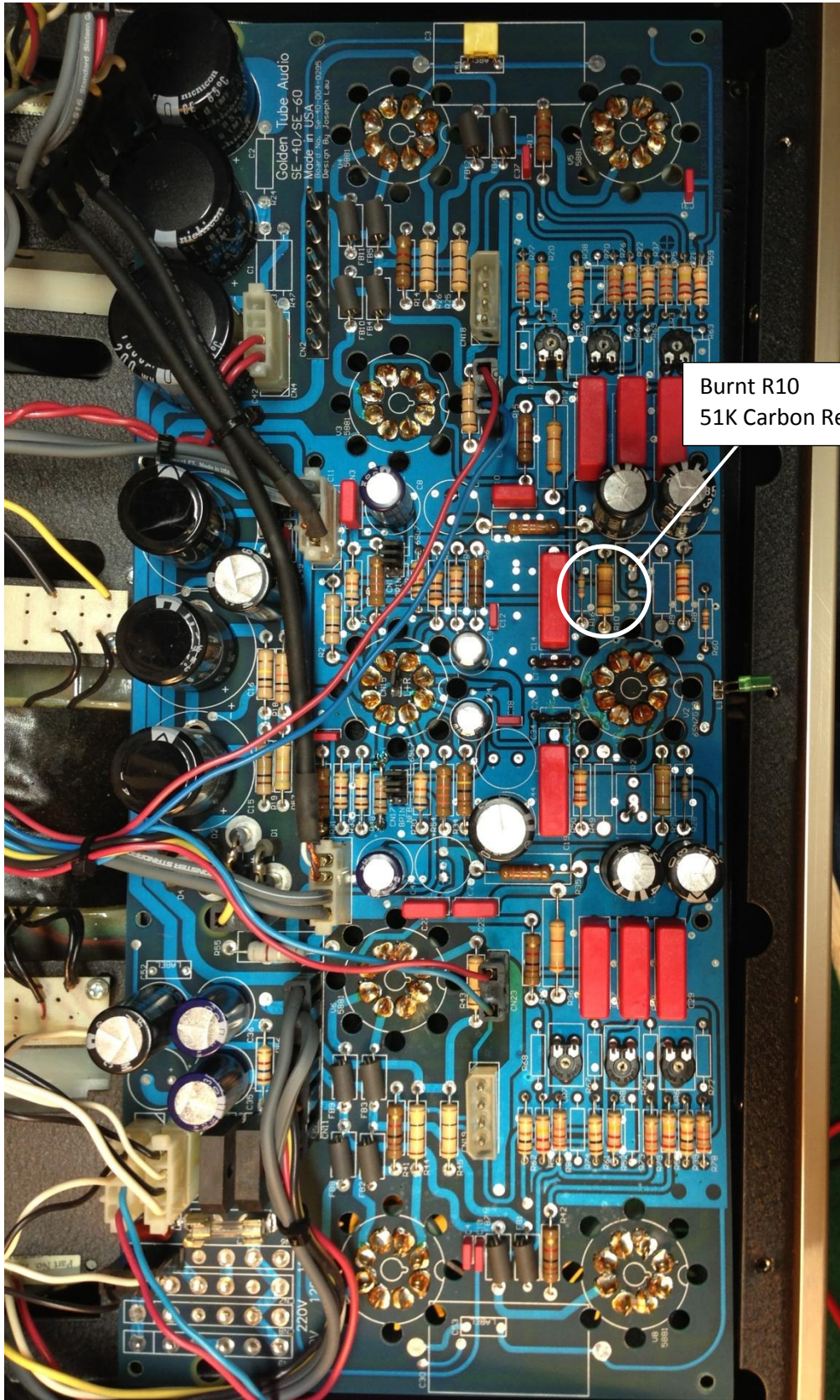
Golden Tube Audio SE-40

Left Channel Schematic

GTA built versions from 1.0 to 1.4. It's unknown which version this schematic pertains. There is debate how accurate this drawing may be or for which version.

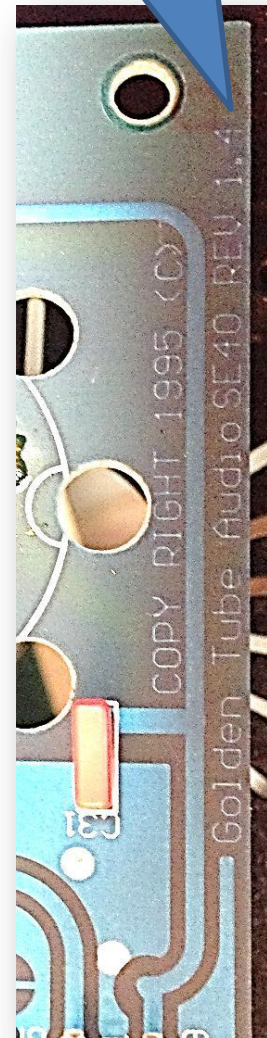


Original Circuit Board v1.4 - Bottom Side

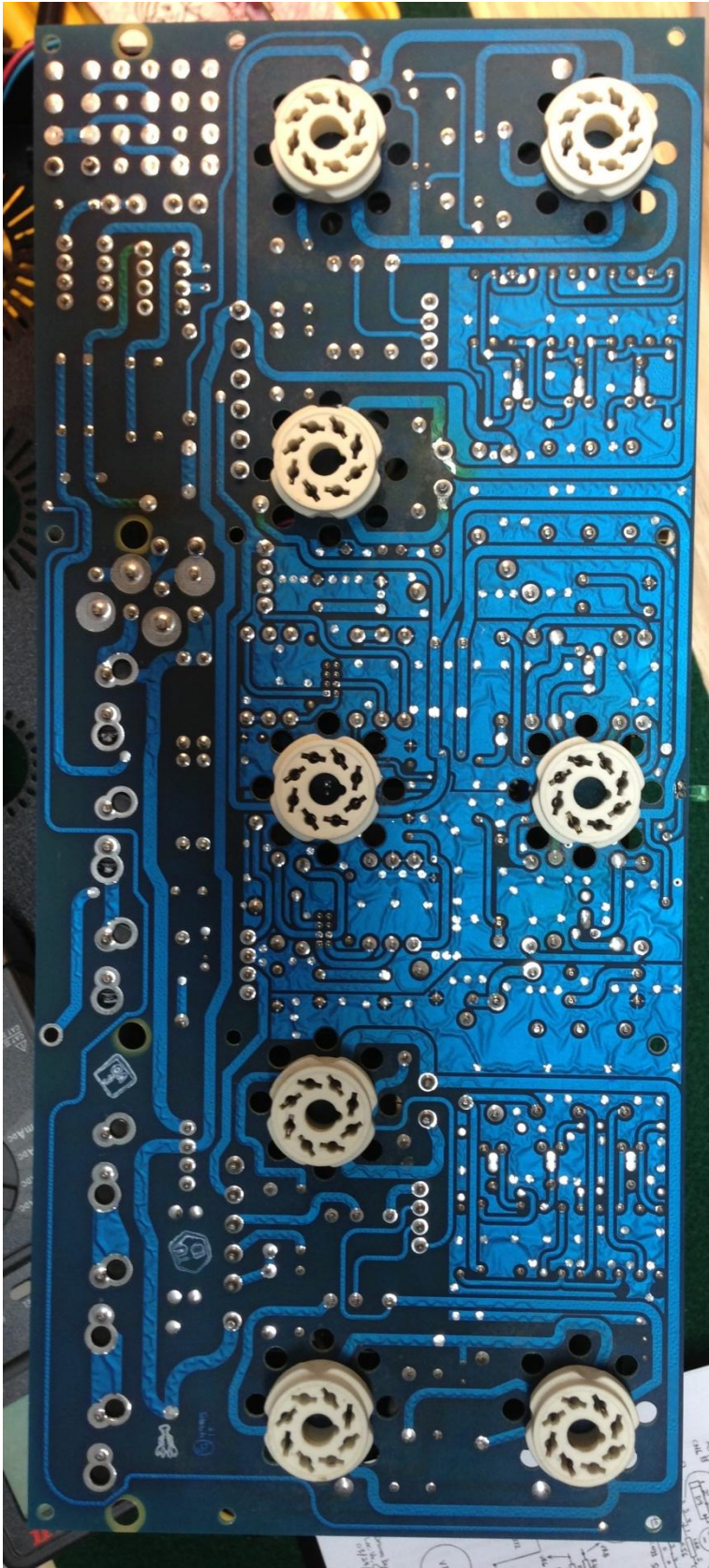


Burnt R10
51K Carbon Resistor

Board pics on Pages
6 & 7 are version 1.4



Original Circuit Board v1.4 - Top Side



SE-40 Owner's Manual

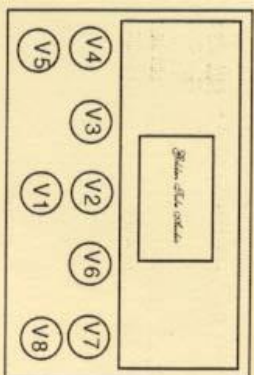
Golden Tube Audio
Model No. SE-40

Tube Location Map

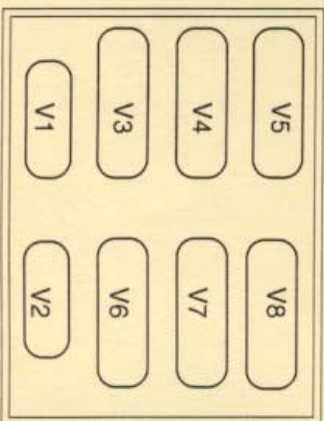
VACUUM TUBE LIST:

V1 6SN7G1B	V5 5881
V2 6SN7G1B	V6 5881
V3 5881	V7 5881
V4 5881	V8 5881

Please refer to the map below for vacuum tube installation. Make sure all tubes are installed correctly before turning on the unit. All the bias adjustments were pre-set with the factory matched, tube set in this package. Improper location of tubes will require re-adjustment of the bias.



AMPLIFIER TOP VIEW



TUBE LOCATION IN SHIPPING BOX

*Golden Tube Audio*TM
Solo Electronics

Owner's Manual

Single-Ended Audio Power Amplifier

Model No. SE-40



1. Safety Instructions



WARNING! DO NOT TOUCH TUBES DURING OPERATION, THEY ARE EXTREMELY HOT!

TO AVOID FIRE AND ELECTRICAL HAZARDS OBSERVE THESE CAUTIONS:

DO NOT OPEN THE AMPLIFIER CASE. REFER SERVICING TO QUALIFIED PERSONNEL.

TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE AMPLIFIER TO RAIN OR MOISTURE.

NEVER INSERT ANYTHING THROUGH AN OPENING AND INTO THE AMPLIFIER.

DO NOT ALLOW LIQUIDS TO ENTER THE AMPLIFIER

NEVER BYPASS A FUSE OR REPLACE WITH A DIFFERENT TYPE.



THIS SYMBOL IS INTENDED TO ALERT YOU OF THE PRESENCE OF UN-INSULATED DANGEROUS HIGH VOLTAGE WITHIN THE UNIT THAT WILL CAUSE ELECTRIC SHOCKS.



THIS SYMBOL IS INTENDED TO ALERT YOU OF THE PRESENCE OF IMPORTANT OPERATION AND MAINTENANCE INSTRUCTIONS IN THE LITERATURE THAT ACCOMPANIES THE UNIT.

2. Introduction

CONGRATULATIONS!!

Thank you for selecting a Golden Tube Audio product.

This single-ended power amplifier was designed, engineered and manufactured to meet the highest standards of sonic performance and dependability. Please take the time to carefully read this instruction manual prior to the installation of your Golden Tube Audio amplifier. There are several facts and procedures you should know before you place it in operation.

The serial number is located at the rear of the unit. Please record this number in the space below for future reference.

Serial number: _____

3. Unpacking & Inspection

After unpacking the Golden Tube Audio amplifier, save the shipping carton and all the packing materials, in case you need to ship the unit again. Carefully inspect the amplifier, vacuum tubes and packaging for any sign of damage. Report the damage to your dealer or the shipping company immediately.

The amplifier package includes:

- Golden Tube Audio Amplifier..... 1 pc.
- Owner's Manual & Warranty Card..... 1 pc.
- AC Power Cord..... 1 pc.
- Extension Test Connector..... 1 pc.
- Packing Materials..... 1 set
- SE-40 Tube Package Includes..... 6 x 5881
- 2 x 6SN7GTB

4. Location of the amplifier

The amplifier can be installed on a shelf, table or equipment stand. The SE-40 weights over 45 lbs, please check the strength of the shelf or stand before installing the unit.

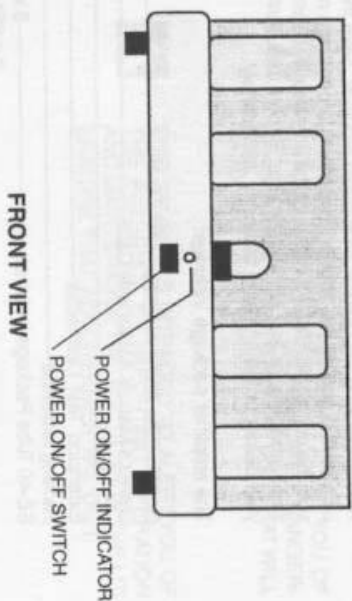
If the amplifier is installed in a cabinet, please leave at least 2-3" of space above and behind for ventilation.

DO NOT PLACE THE AMPLIFIER DIRECTLY ON THE CARPETED FLOOR. The carpet will block the air flow into the chassis and cause damage.

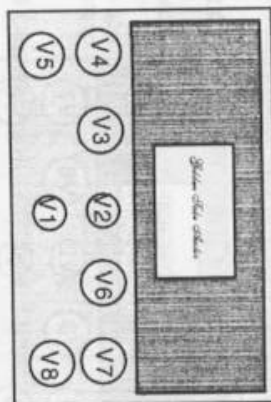
DO NOT INSTALL THE AMPLIFIER IN A HOT OR HUMID PLACE, or in a place subject to excessive dust or mechanical vibration.

THIS AMPLIFIER IS DESIGNED FOR INDOOR USE ONLY. Do not expose the unit to rain, moisture or low temperatures.

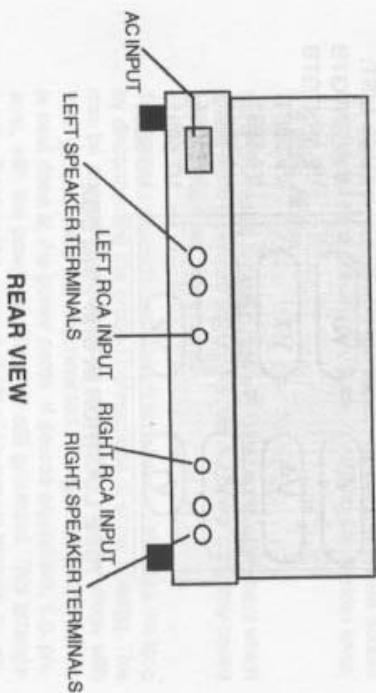
5. Location of Controls



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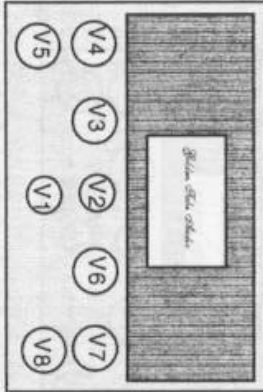
TOP VIEW/TUBE LOCATION MAP



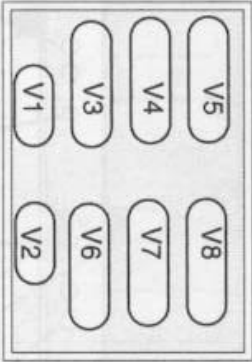
7

6. Set up

6.1 Installation of Vacuum Tubes:



TOP VIEW/TUBE LOCATION MAP



TUBE LOCATION IN SHIPPING BOX

TUBE LIST:

- V1 6SN7GTB
- V2 6SN7GTB
- V3 5881
- V4 5881
- V5 5881
- V6 5881
- V7 5881
- V8 5881

Please refer to the tube map for vacuum tube installation. Make sure all tubes are installed correctly before turning on the unit. All bias adjustments were pre-set at the factory to match each tube in this package. Improper location of tubes will require re-adjustment of the bias. Please refer to 'Bias Adjustment' in 7.2 for re-adjustment.

6.2 Connecting the Input and Output Cables:

Check to make sure all associated equipment is turned off. Connect your signal source (from pre-amp) and speaker cables to the appropriate locations. Please refer to the back of the unit or 'Location of Controls' in Section 5

6.3 Connecting the AC Power Cord:

Please check that the AC Voltage of your country is matched with the label on the amplifier. The voltage label is located at the back of unit. Check the front power switch is in its 'OFF' position. Insert the power cord firmly to the unit and connect it to the appropriate power source.

6.4 Operation

Set your pre-amp volume control at it's minimum level. Turn on the pre-amp first, then the amplifier. Select a program source and advance the pre-amp's volume control to the desired level.

6.5 Hum Noise

Earth grounding in conjunction with other audio equipment which is also earth grounded through its own AC power cord may cause 'ground loops' and hum noise.

To eliminate 'ground loop' noise, it is necessary to break the loop by disconnecting the ground connections at some point(s). This can be accomplished by using power line 'cheater' plugs with their ground wires left unconnected. The ground disconnection is best done at the power cords of source equipment, e.g. pre-amp, with the power amplifier left still grounded. This arrangement will retain the ground of other equipment through the signal cable ground to the power amplifier.

6.6 Warm Up

The amplifier will start working after it is turned on for about 15 seconds. It is recommended that the amplifier be warmed up before doing any serious listening. This may require 10 minutes or longer.

6.7 Continuous Play

For safe operation, do not run the unit continuously for over 24 hours. It is recommended to turn off the unit at least 10-15 minute for every continuous 24 hours operation.

6.8 Initial Burn In Period

An initial 100 to 150 hours burn in period is recommended to get the best sound possible.

6.9 Monitoring The Bias Voltage

Check the bias voltage on your unit, after the initial 100 hours usage and every 1000 hours thereafter. Adjust the bias if necessary (see 'Bias Adjustment' in 7.2 for details).

7. Service

WARNING! DANGEROUS HIGH VOLTAGES EXIST INSIDE THIS AMPLIFIER!

THE FOLLOWING STEPS MAY REQUIRE SKILL AND EXPERIENCE. TO REDUCE THE RISK OF ELECTRICAL SHOCK, REFER SERVICING TO YOUR DEALER OR A QUALIFIED SERVICE TECHNICIAN.

7.1 Tube Replacement

We paid special attention to the internal cooling of the tube sockets, with ventilation holes providing air circulation above and below the chassis and on the circuit board. This will provide extended tube life. The SE-40's Single-Ended Parallel Circuit does not require that tubes be replaced in matched sets. You can replace them one at a time the way you would light bulbs.

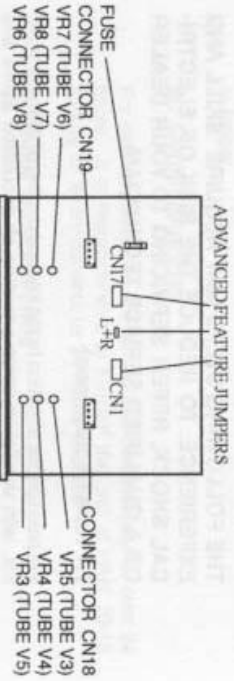
Factory tested vacuum tubes can be obtained from your local dealer or by contacting Solo Electronics.

1. Turn off the unit and unplug the power, input and output connectors.
2. Let the vacuum tubes cool down.
3. Remove the old vacuum tubes.
4. Install the new tubes.
5. Make sure all the tubes are correctly and firmly plugged into the sockets.
6. Adjust the bias of each tube. (see 7.2)

CAUTION! IF YOU DO USE OTHER TUBES THAN THOSE PROVIDED, WE ARE NOT RESPONSIBLE FOR THE TUBE FAILURE OR CONSEQUENTIAL DAMAGES CAUSED BY TUBE FAILURE.

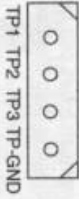
7.2 Bias Adjustment

A DIGITAL VOLTMETER, a PLASTIC ADJUSTMENT SCREW DRIVER and the EXTENSION TEST CONNECTOR are required. Do not use a metal screw driver, it may cause short circuit or shock.



SE-40 INTERNAL BOTTOM VIEW

CIRCUIT BOARD CONNECTORS AND ADJUSTMENT LOCATIONS



TESTING POINTS ON EXTENSION TEST CONNECTOR

ADJUSTMENT PROCEDURES:

1. The SE-40 should be in a cold state. Disconnect all the input, output and AC power cables.
2. Carefully turn unit on its side, allowing access to the bottom of the unit.
3. Insert the 'Extended Test Connector' through the bottom cover of the chassis to the Connector CN18. You may need a ball pen (plastic) help to push the connector into place.
4. Connect the AC power only, and turn on the unit.
5. Allow the SE-40 to warm up for 3 minutes only.
6. Set your millimeter in testing 'DC Voltage' range.
6. Connect the (-ve) from the meter to the 'TP-GND'.
7. Connect the (+ve) from the meter to the 'TP1', observe and record the reading.
8. Use a plastic adjustment screw driver, slowly adjust the 'VR5' pot to obtain the necessary voltage.

Bias Voltage for SE-40-----635 - 640mV DC

DO NOT SET THE BIAS VOLTAGE OVER THE 640mV DC LIMIT.

9. Repeat the same procedures again by connecting the (-ve) to 'TP-GND' again, (+ve) to 'TP2' and adjusting the 'VR4' pot.
10. Repeat the same procedures again by connecting the (-ve) to 'TP-GND' again, (+ve) to 'TP3' and adjusting the 'VR3' pot.
11. Turn the power off, remove the connector and re-installed in the CN19 location for the other channel. Turn the power on.
12. Similarly, repeat the same above procedures for the other channel by fixing the (-ve) from the voltmeter to 'TP-GND' for CN19, testing and adjusting the 'TP1' with 'VR7', 'TP2' with 'VR8' and 'TP3' with 'VR6'.
13. Re-check all the voltages again. Fine adjust if necessary.
14. The adjustment is completed.

7.3 Fuse Replacement

The fuse and the fuse holders is located inside the unit. Make sure to DISCONNECT THE POWER CORD before servicing.

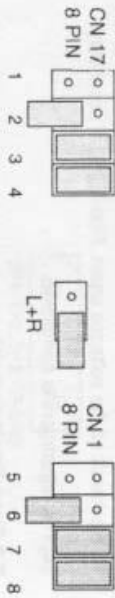
Never bypass any fuse in the amplifier. Never replace a fuse with one of higher value.

SE-40-----6A 250V Slow Blow, Short Type

8. SE40 Advanced Features

WARNING! HIGH VOLTAGE EXISTS INSIDE THE AMPLIFIER! THE FOLLOWING ADVANCED FEATURE ADJUSTMENTS IN 8.1 TO 8.3, MAY REQUIRE SKILL AND EXPERIENCE. TO REDUCE THE RISK OF ELECTRICAL SHOCK, REFER SERVICING TO YOUR DEALER OR A QUALIFIED SERVICE TECHNICIAN.

DO NOT CHANGE THE JUMPERS WHEN THE UNIT IS IN OPERATION. MAKE SURE THE POWER IS OFF FOR AT LEAST 3 MINUTES AND UNPLUG THE POWER CORD BEFORE CHANGING.



- CN 17:**
- Jumper No. 1 Not Used
 - Jumper No. 2 Negative Feedback
 - Jumper No. 3 6SL7
 - Jumper No. 4 6SL7
- CN 1:**
- Jumper No. 5 Not Used
 - Jumper No. 6 Negative Feedback
 - Jumper No. 7 6SL7
 - Jumper No. 8 6SL7

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8.1 Zero Feedback/Negative Feedback Adjustment (Jumper No. 2 & No. 6)

Normally, the amplifier was set in its 'Zero Feedback' mode. Technicians may change this setting by connecting the jumpers together in the 'NFB-L' and the 'NFB-R' positions on the main circuit board. This will change the tonal quality.

Jumpers Open = 0 Feed Back
 Jumpers Connected = Negative Feed Back Applied.

8.2 Higher Gain Application (Jumper No. 3, No. 4, No. 7 & No. 8)

The SE-40 may obtain a higher, input gain by replacing the normal 6SN7 tube in V2 (refer to tube map) with 6SL7 tubes (not supplied) and changing 4 jumpers. This can be useful when driving the amplifier directly from the variable output of a CD player or with a passive preamp.

All 4 Jumpers Connected = 6SN7 = Normal Power Amp.
 All 4 Jumpers Open + 6SL7 = High Gain

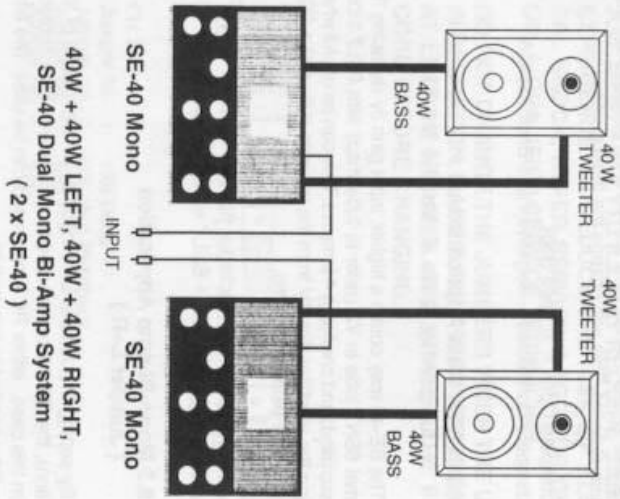
8.3 Mono-Bi-amp Application (Jumper L+R)

By setting the Jumper L+R together (at the bottom of V2 location), the SE-40 can also be converted into a monoblock amp. In this case, either RCA inputs and can be used. Two amplifiers will be needed in this feature.

L+R Jumper Open = Stereo
 L+R Jumper Connected = Mono

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8.4 40W + 40W Mono Bi-Amp Application

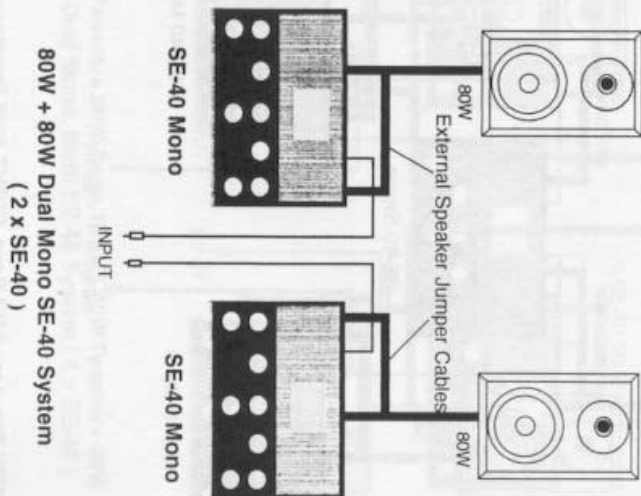


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8.5 80W High Power Mono Output Application

It is possible to double the output power in the amplifier by setting the L+R Jumper together to mono and connecting the 2 sets of speaker output terminals together, red to red and black to black. The output impedance is also lowered to 4 ohms and more suitable for speakers with low impedance loads.

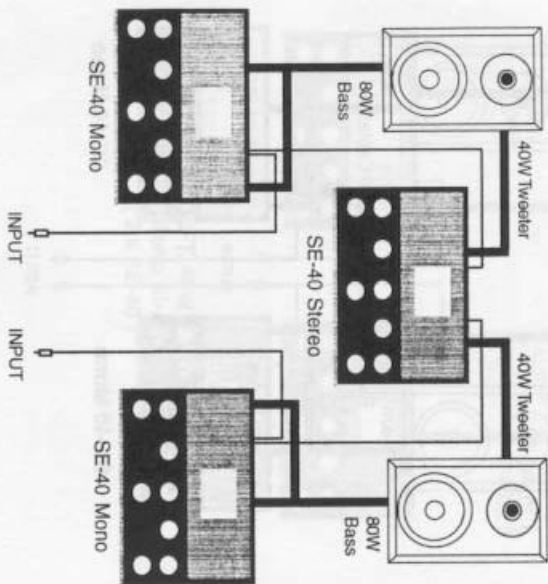
The SE-40 amplifiers will sounded at it's best when used in a pair of 80W monoblock. It will have more power, more low end punch, better channel separation and soundstage.



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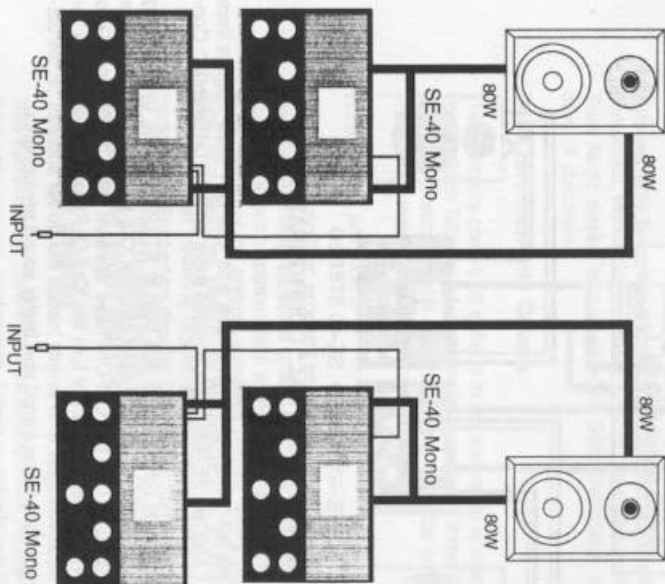
8.6 Multi SE-40 Applications

In the mono SE40, the unused RCA input can also act as an signal output for connecting more SE-40's or a surround sound amp or processor.



LEFT 40W Tweeter+ 80W Bass, RIGHT 40W Tweeter+ 80W Bass, Stereo + Dual Mono, Multi SE-40 System (3 x SE-40)

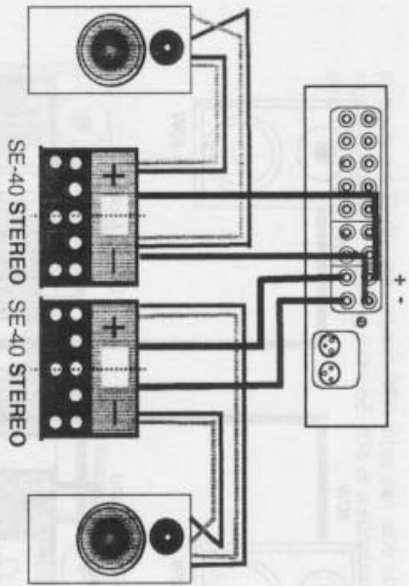
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LEFT 80W Tweeter+ 80W Bass, RIGHT 40W Tweeter+ 80W Bass, 2 X Dual Mono, Multi SE-40 System (4 x SE-40)

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8.7 'RCA Differential' connection, 2 x SE-40 with SEP-1



"RCA DIFFERENTIAL" CONFIGURATION

Description:

You can take advantage of the 'In-Phase' and 'Out-Of-Phase' outputs from the SEP-1 and two SE-40s, by connected them in 'RCA Differential' Configuration.

This concept is to drive two SE-40s both in **STEREO** mode, by operating one channel 'In-Phase' and the other channel 'Out-Of-Phase'. On the other hand, **REVERSE** only the 'Out-Of-Phase' speaker cable connections (+ to - and - to +). This will physically turn the 'Out-Of-Phase' signal back to 'In-Phase'. The advantages is to evenly loaded the power supplies on the SE-40s and provide a faster transit and better sound performance.

Hints:

1. Both SE-40 **MUST** be in **STEREO** mode.
2. Carefully double check all the wiring before you put it in operate.
3. Because of different speaker crossover network design, results may varies from speaker to speaker.
4. For 40+40, try to put the "+" Output' to the HI and the 'Reversed -" to the Low, or the other way around, to test for the best result.
5. For 80W, connected both "+" Output' and the 'Reversed -" to the speaker together.
6. You may want to try different brands of speaker cable or cables in different length (e.g. 5 feet for "+", 15 feet for "-") for fine tuning.
7. For more details, see SEP-1 Owner's manual.

9. Warranty

Solo Limited Three-Year Warranty

This warranty becomes effective only if the registration card is completed, evidencing purchase through an authorized Golden Tube Audio dealer, and received by Solo Electronics within 45 days of purchase.

What this Warranty Covers

This warranty covers all defects in workmanship or materials in your Golden Tube Audio amplifier for a period of three (3) years, (3) three months on the vacuum tubes, from the date of purchase. This warranty is transferable.

How to get service

Return the amplifier, properly packaged in the original packing materials and freight prepaid to Solo Electronics. The return product must be accompanied by a written description of the defect, a photocopy of the original purchase receipt, and a Return Authorization Number. Before we will accept your product for repair, you must obtain a Repair Authorization Number by contacting Solo Electronics directly. The RA Number must be clearly displayed on the outside of the package. Any unit without RA Number will be refused and returned back to the sender.

What is not covered

This warranty only covers defects arising under normal use and does not cover any malfunction, failure or defects resulting from misuse, abuse, neglect, alternation, replacement of wrong vacuum tubes, modification, repairs or consequential damage caused by non-factory supplied tubes. Solo Electronics makes no warranties, representations or promises as to the quality or performance of its amplifier other than those specifically stated in this warranty.

Additional Limitations

Any implied warranty granted under state law, including warranties of merchantability or fitness for a particular purpose, are limited to three (3) years from the date of purchase (three months on tubes). Solo Electronics is not responsible for direct or indirect incidental or consequential damages. Some states do not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental damages, so the above limitations and exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Warranty Outside USA

Golden Tube Audio has formal distribution in many countries of the free world. In each country the Golden Tube Audio importer has contractually accepted the responsibility for the product warranty. Warranty should normally be obtained from the importing dealer or distributor from whom you obtained the product.

10. Problems

If you have any problems with your Golden Tube Audio Amplifier, or be in need of technical assistance, contact your local dealer. You are also invited to call or fax us directly at the factory for technical support.

Tel: (510) 887-8016
Fax: (510) 887-1657

Solo Electronics
2462 Tipaldi Way,
Hayward, CA 94545 USA

11. Specifications

Model No. SE-40

Configuration:

Single-Ended Parallel,
Pure class A, 0 Feedback

Tube Complement:

6 x 5881, 2 x 6SN7GTB

Output Power:

40 Watts @ 8 ohms x 2 channel
80 Watts @ 4 ohm Mono

Frequency Response:

20Hz-22kHz, -1dB 1kHz Ref.

T.H.D.:

>0.009% @ 1W, 5% @ Full Output

S/N Ratio

< 85dB

Sensitivity:

1V rms for full output @ 47kohm

Input Impedance:

100k ohm

Size:

17" W x 14"D x 8"H

Weight:

45lbs net, 55lbs shipping

AC power input

110V, 60Hz

Power consumption:

250W Normal, <500W Max.

Biassing the Amp

What is the Proper Bias Set Value?

The bias values recommended in this service manual are intended for factory tubes or factory equivalent tubes. Maximum bias for factory tubes is 640mV, given drift and fluctuation the bias should be **no more 630mV**.

Quoting Loc, "Some tubes reach their stable bias sooner than others, the final/stable state is about 20 minutes after turn on, so just go back & forth across all 6 tubes to set them within 10 mV of each other. With long use, tube bias can drift by 20mV in difference; if more than 20mV of variance, then re-adjusting is needed. There is no clear cut limit, just an approximate".

Helpful insight from Loc...

Some tubes are more sensitive than others, since all 6 tubes share one common source B+ for current, some could draw more bias and read higher than 640mV, and others will read lower. This is normal, just adjust the other tubes to raise the bias, then it will reduce the current goes to the higher sensitive tube(s). I recommend the value of 600mV and with 10% tolerance; it could be between 540 to 660mV. Remember that the bias does not need to be accurate. If measuring the bias when playing music, you will see how the bias fluctuates. The bias should be stable and not jumping around or continues to increasing higher. As long as bias operates less than 20mV from each other, it's OK, people tend to be perfect right on the dot, there is no audible difference if tubes within 20 mV of bias to each other per channel.

Before Starting

The following is a procedure to bias the SE-40:

- Inspect the tubes for any discoloring, damage, loose glass to base, etc. It may even be a good time to test tubes in a tube tester.
- After handling the tubes, they should be carefully wiped clean of dust and finger prints. This promotes even heat dissipation and aids visual inspection too.
- The trim pots work backwards from what you probably expect (!). eg, Counter-clockwise increases the gain.
- The nomenclature of the trim pots and the valves **are not intuitively** labeled.
- **Important:** Page 12 of the factory manual shows the bias harness pin-out from the female side of the connector and **not** the male connector on the circuit board. Use the diagram below for reference.

Tools Needed

- Small **plastic** slotted screwdriver for Trim pot tuning
- #2 Phillips screwdriver for chassis bottom cover removal
- Digital multi-meter
- (2) Original factory biasing connector & cable or an after-market PC 5.25" hard drive power splitter cable
- Soft clean cloth
- Plastic nitrate gloves to protect from electrical shock



Plastic Screwdriver

Golden Tube Audio SE-40

Removing the Bottom Cover

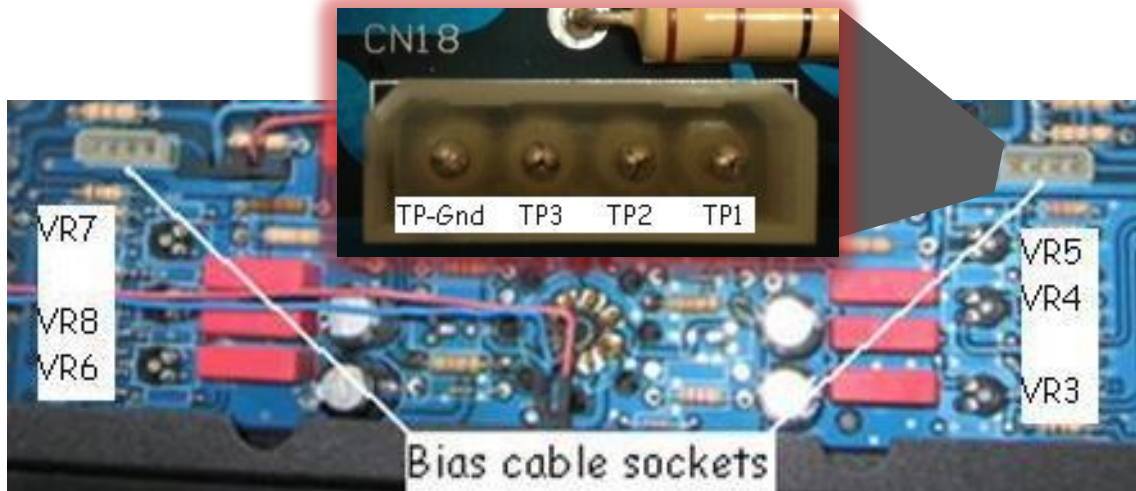
- 1) Unplug the amplifier from AC power, speakers, and signal sources – unplug and disconnect everything
- 2) Set the amplifier on the work surface facing you

Now, with only a cold Amp:

- 3) Remove the 2 screws from the left side
- 4) Stand the amp up on its left side (where the screws were just removed)
- 5) Remove the 2 screws from the right side (now facing up)
- 6) Remove the 6 screws from the bottom cover
- 7) Left off the bottom cover

*****WARNING*** VOLTAGES ARE PRESENT INSIDE THE AMPLIFIER CHASSIS THAT CAN CAUSE DEATH ON CONTACT. IF YOU HAVE ANY DOUBTS REGARDING YOUR ABILITY TO SERVICE ELECTRONIC EQUIPMENT, TAKE IT TO SOMEONE WHO DOES THIS FOR A LIVING. ALWAYS MAKE ADJUSTMENTS WITH A PLASTIC SCREWDRIVER OR ALIGNMENT TOOL DESIGNED FOR THIS PURPOSE.**

Print this picture and table as a bench top guide while following the Biasing instructions



Trim Pot and Bias Cable location, bottom of pic is front of SE-40. Test Points same for CN 18 & CN19

	Sequence	Valve (tube)	Trim Pot	Hard Drive Cable	*Factory Cable
Right Channel (CN18)	1	V3	VR5 (TP1)	Yellow	White
	2	V4	VR4 (TP2)	Black	Red
	3	V5	VR5 (TP3)	Black	Blue
Left Channel (CN19)	4	V6	VR7 (TP1)	Yellow	White
	5	V7	VR8 (TP2)	Black	Red
	6	V8	VR6 (TP3)	Black	Blue
Ground (TP-Gnd):				Red	Black

**Verification of harness wire colors for factory cable needed*

Trim Pot to Valve to Bias Harness Map

Golden Tube Audio SE-40

Setting the Bias

Read this entire section from top to bottom before starting this procedure!

If you are not comfortable making these adjustments, ask a technician for help. Refer to the diagram on page 21 while using this following procedure:

- 1) With the Amp unplugged and resting on its side, Plug in the Biasing harness to CN18. This is the connector opposite corner from the AC power cord connector.

****Follow the above table "Trim Pot to Valve to Biasing Harness Map" to attach the Digital multi-meter probe to the correct test pins.**

Note: If the factory bias cables are not available, standard PC hard drive power extension cables for \$1 to \$2 a piece work great. The colors change to Red for gnd, then black, back, and yellow for the trim pot Test Points (TP's) using a hard drive cable. See Trim Pot mapping table on previous page.

- 2) Set all bias settings to the minimum; by using the plastic screwdriver turn to all trim pots fully to the right (clockwise).
- 3) Connect the power cord and turn on the Amp to let it warm up. After 3 minutes and not much more, attach the black (-ve) probe of your digital multi-meter into TP-GND and the red (+ve) probe of your digital multi-meter TP1.
- 4) Note the bias, with the bias turned all the way down in step #2, the reading should be **well below 600mV, probably around 450-550mV**. If it is over 640mV at this setting then something is very wrong. Turn off the amp. Assuming all is well, get ready to use the plastic screwdriver to adjust the trim pots.
- 5) With the meter's red (+ve) probe still attached to TP3 and adjust VR5 by turning it counter-clockwise. The bias reading should increase. Bring it up to about 630mV.
- 6) Remove the meter's red (+ve) probe and attach it to TP2. Repeat step 5, only this time for the next trim pot VR4.
- 7) Remove the (+ve) probe and insert it into TP1. Repeat step 5, except for the next trim pot VR3.
- 8) Move to the other channel, shift to a bias harness from connector CN18 and connect it to CN19
- 9) Repeat steps 5, 6, and 7 again; except instead adjust trim pot VR7, VR8, VR6 while measuring CN19's TP1, TP2 & TP3 in that order. The trim pots are adjusted starting from the back while working towards the front.

Golden Tube Audio SE-40

- 10) Don't forget to visually inspect each tube for red plates, and adjust bias down really quick and recheck the bias value again. Let the amp idle for 20 minutes and recheck and adjust.
- 11) Once all tubes are biased to the proper mV value, repeat the whole procedure again starting with set #5, checking and fine adjusting each tube up to the right approximate value. Continue to measure and adjust in sequence as necessary. **Remember: all tubes within 10mV from high to low bias reading is great**
- 12) Once all tubes biases are set for their bias set value turn off the amp.

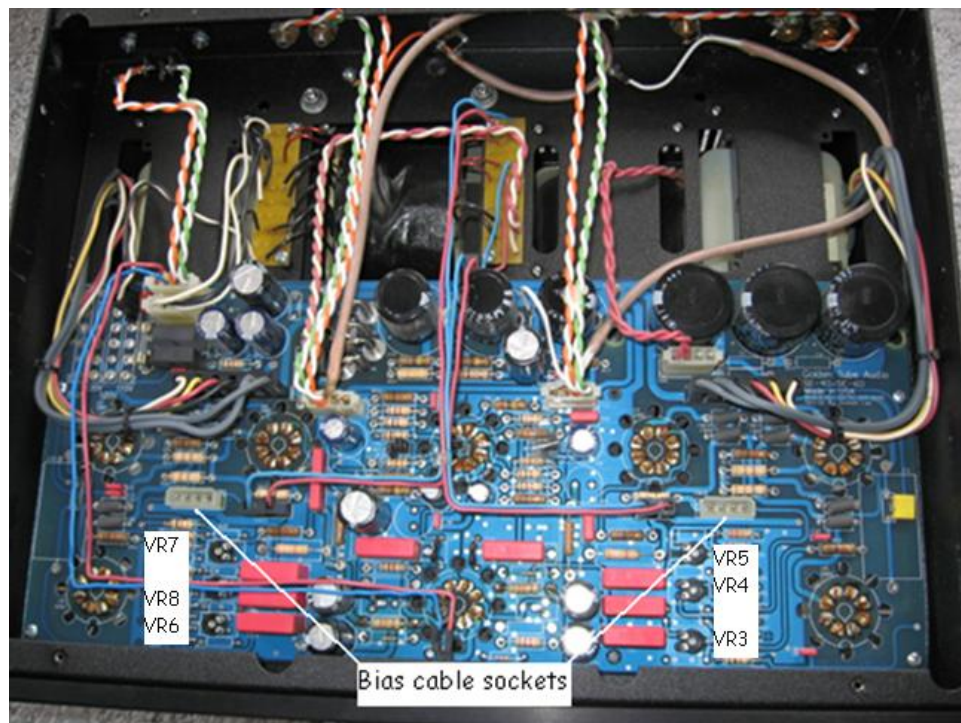
The whole procedure should take about 10-20 minutes to complete depending upon experience. Don't stress over 100th millivolt values, the different cannot be heard. Loc's guidance is 10mV is close enough and not audibly perceivable.

Note: check old TV repair shops, surplus electronics stores, ham radio dealers, and Guitar amp shops to find a local tube tester.

The above section describes the process if all tubes are being replaced.

Other scenarios include replacing only 1 tube or re-biasing the 6 existing tubes due to drift from component age. These steps outlined above can be used biasing scenarios, however if you are an experience technician there are some steps which may be side stepped. Example; for re-biasing existing tubes to tighten the tolerances, it's not necessary to perform step #2 since step 2 is aimed at unknown new tubes which may introduce excessive bias readings. Also when replacing a single tube, turn down the one associated bias trim pot and measure up to the right setting and **then proceed to check and adjust all other tube bias settings.**

Underneath GTA SE-40



Golden Tube Audio SE-40

Bias cable sockets and trim pot locations

As noted in the biasing instructions above, adjust the bias by starting with the right channel then left in the following sequence: VR5, VR4, VR3, VR7, VR8, and then VR6 as shown on the table on page 21. Be absolutely sure the proper corresponding test points are used for each trim pot. It is very easy to fool oneself, since adjusting the bias for one tube impacts the bias setting for the others. It's easy to think one tube is being adjusted and in fact it's a completely different tube.

Red Plate Condition



The picture above was pulled from the Internet by a person who thought their SE-40 was biased correctly according to the user manual. Some of these tubes are biased too high! Always immediately turn-off any tube device that show tubes glowing bright red and have the amp re-biased. The filament in the center glows orange, but tubes should never have a bright orange or red glowing condition. This is commonly called “Red Plate”.

PC hard disk extension power cables hanging from SE-40 bias sockets for measuring. This is not recommended either, as a wire of any kind hanging out of a high voltage appliance is not good form. The voltage from the bias harness wires is low, but they can get snagged or foreign matter could be introduced.

Extra care should be taken with tube amps. Without a tube cage; kids, cats, and the unaware get hurt with the high temperatures and possible voltage exposure if tubes break.

Golden Tube Audio SE-40

Replacing Tubes

Factory Tubes

Originally as shipped new, the GTA SE-40 came supplied with 8 tubes. These were 6 Sovtek 5881/6L6WGC output tubes and 2 Sovtek 6SN7GT input/driver tubes. The factory output tubes are easily confused with other 6L6 tubes with similar markings.



SE-40 Factory tube on Left with coin base, Same tube with a standard base on the right but marked differently

Golden Tube Audio SE-40

Factory Output Tube Cross-Reference

At time of publication, all of these tubes are really the Sovtek 5881WXT or 5881/6L6WGC available at local guitar shops:

	OEM Brand & Name	Comments
Sovtek 5881WXT	Fender 6L6 Precision Matched Tubes	
	Fender GT-6L6B or 6L6R	
	Groove Tubes GT-6L6B or GT-6L6R	
	Sovtek 5881/6L6GC	Coin base version
Sovtek 5881/6L6GC	Marshall 5881	
	Mesa Boogie STR425	
	Ruby Tubes 6L6R	
	Sovtek 5881WXT	Standard base version

Other acceptable “as-is” plug-in replacements:

- **JJ Electronic 6L6GC** tubes from the Slovak Republic are fully compatible and easy to find on-line and local guitar shops. JJ is the **ONLY** continuously operating tube factory since back in the day.
- **SovTek 6L6WXT+** also works, and has internal measures to limit microphonics. Some claim it and offers superior tone and overall performance as compared to the 5881/6L6GC or 5881WXT. Who knows, but for \$100usd in 2013 anyone can test'em for themselves.

Factory Selectable Input Tubes

As shipped, the SE-40 is configured for a Sovtek 6SN7GT input tube. This is the standard and common amplifier input tube configuration when used with a typical pre-amp.

Higher input gain option: The SE-40 has an alternate configuration to replace the Sovtek 6SN7GT input tube with a Sovtek 6SL7GT input tube to provide more gain with the initial stage of amplification. As the manual states, this is an option for system configurations with passive pre-amps or directly driven from input devices.

Refer to the owner’s manual included in this document to configure the 4 necessary jumper pins if switch to or from 6SN7GT’s or 6SL7GT’s.

Loc’s observations regarding input tubes:

The stock Sovtek 6SN7GT is similar, not identical, to the military Russian 6H8C. I'm very familiar with 6H8C, not Sovtek 6SN7GT, and it sounds detailed and dynamic, however, sounds bright with not-so-good speakers, preamps and sources. The USA made 6SN7s sound warmer, but lacks details, weaker and less dynamic. Dynamic is similar to the force of a car’s acceleration.

- Sovtek 6SN7GT and 6H8C can take the 560VDC B+ cold start very well while the USA made 6SN7s will deteriorate with time: more noise and distortion.
- Sovtek 6SL7GT looks similar to the military Russian 6H9C, again it has the same sound character of the 6H8C, with more details & higher gain, compared to USA versions

Golden Tube Audio SE-40

Tube Swapping

Be careful when swapping to tubes of different models and values. It looks so easy to just pull and plug varieties of tubes to find the best sound. At minimum switching tubes requires re-biasing, and may likely require revised resistor values for voltage and current to supply a different tube type.

According to Loc; “The most reliable & proven tubes for the SE-40 are the original winged-C Svetlana 6L6GC (sound warm), the new Svet 6L6GC is a hit-miss. The original SE-40 stock tubes Sovtek 5881h/6L6WGC or Russian 6N3C-E is well proven (detailed & dynamic). The key here is the main AC voltage and the condition of the main 6 electrolytic capacitors inside the SE-40 C15-C17, C1, C2, C42. If your wall voltage is on the low side, like 117VAC and not 120 or above) and the 6 caps are defective/weak caps, that weaken/sag the main B+ below 500VDC, then some other kinds of 6L6GC can be used. On the SE40 diagram, you can see where to measure the main B+.”

The SE-40 is a single ended Ultra Linear amp, so the screen also sees the full plate voltage. Be careful when swapping tubes other than Sovtek 5881/6L6GC, and of the typical and max voltage & current a tube is spec'd for and the condition and setting of the target amp. With the SE-40's common cathode design, it is not necessary to buy matched tubes. Tubes can be replaced individually if necessary; though it better to have a *consistent type and brand. Matched sets can simplify the biasing process.*

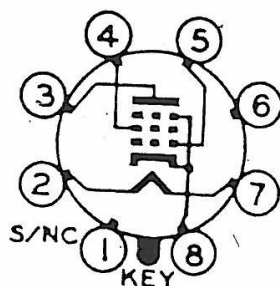
Other 6L6 Varieties

The original Sovtek's are considered a tough and rugged tube with excellent sonic characteristics. Modding an amp can be rewarding and fun for an Audio DIYer, though it's important to remember these amps performed brilliantly as new and garnered an excellent reputation. That said, Loc's mods are reported to improve the overall sound of the SE-40 and improve reliability.

It should be repeated over and again – This Amp is designed for 5881 or 6L6GC 30 watt tubes, not 23 watt 6L6 or 6L6B tubes. Other 23 watt 6L6's can be used, it just takes a few value changes in components upstream. With a drop in bias comes a drop in output power. Realize the Amp will no longer output 40 watts per channel.

Higher value plate and bias resistors are needed to bias other 6L6 varieties. Consider replacing the Power supply caps and plate resistors at the same time, as these are known problem areas with the SE-40.

Special care is needed to ensure pin compatibility, power ratings, and circuit compatibility. Other than one option provisioned for the input tubes, there is no user selectable options for different tube types. Odd are high some circuit modification or enhancement would be needed.



Sovtek 5881 & 6L6GC variety

Golden Tube Audio SE-40

Troubleshooting

Note: *When working on an amplifier always wear a pair of thin plastic Nitrite gloves when working on the board to avoid contact with lethal high voltages*

Refer to the Parts Diagram on Page 3 to see parts placement and key test points with factory voltage values. Loc's contribution to the GTA SE-40 community in making this diagram was essential to making this Amp serviceable for years to come.

Remember there are high voltages present, and it's a good practice to measure with a digital multi-meter by attaching the black probe to either black speaker binding post. In this manner, the technician never has both hands on the meter probes and reduces the chance for shock.

Dead channel

The most common reasons for a dead channel are failed tube, blown resistor, or defective diodes.

Find a tube tester and check your tubes. The process to test the tubes is simple and easy, just carefully follow the instructions on the appliance to see the strength of your tubes and if there are any shorts or gas leakage (air leaking into the tube).

Before electronic tube testing, be sure to:

- Give the tubes a good visual inspection. Check if the glass is loose or separated from the base.
- Bent pins or discoloring of the glass or loose parts inside
- Were the tubes glowing red like small light bulbs? A white ash could indicate a condition called "red plating" and will dramatically shorten the life of the tube. Commonly due to high bias or improper tube selection for the application. See more on this below.

Note: check old TV repair shops, surplus electronics stores, ham radio dealers, and Guitar amp shops to find a local tube tester.

Common resistors to test are R10, R11, and R29, R35. Visually check to see if these resistors are darkened and measure them with the ohm meter setting on a digital multi-meter for high resistance over tolerance or if open. Check critical power supply resistor R55, and replace the stock R55 with 1.5 - 2 Ohm 5W resistor.

Resistors R17-R19, R43-R45 and the 4 critical resistors R10, R11, R29, & R35 should be at least 2 Watts. It's also a good idea to replace resistors with the same brand and type for each channel. If a resistor fails on channel, get 2 and replace both channels to ensure they match.

Notice that resistors required to dissipate a lot of heat usually don't have the body of the component touching the circuit board, but stand-off slightly to promote air circulation for convection cooling.

Loc states, "The stock resistors are carbon film, not fire-retardant, and sound warm with less details as compared to metal-film or metal-oxide which are fire-resistant and have more details & dynamics, tighter bass. Select the type for system synergy and personal taste. "

Golden Tube Audio SE-40

Hum

Most common cause is a ground loop. More has been written about fixing ground loops than could ever be covered here. Do a web search about fixing ground loops in audio systems and gear.

Red Glowing Tubes

If any tubes are glowing orange or red, this condition is called "Red Plating" and means there is too much bias current.

All the metal rectangular plates should have no heat red/orange color. There are many reasons for tubes glowing red:

- Many tubes cannot take the very high B+ 500VDC
- Leaky coupling caps
- Bias set too high or bias drifting up due to excessive ambient temperature (Bias increases by itself as the amp has more heat generated, or amp is on for longer than 1/2hr on hot days)
- Improper tube type (not all 6L6 tubes are interchangeable)

If not corrected, the affected tubes will become short lived. The only normal glow from the tube is at the top center space, where the heater filament is located.

Low gain

Possible causes are weak input tubes, or low signal source gain. With the SE-40 designed as a single ended input amplifier, it's possible the preamp if it has balanced outputs is not configured for single ended amplifiers. If the input device is truly low gain and not a technical issue, than consider reconfiguring the SE-40 to use high gain input tubes as per the manual.

Static Noise

Common causes of noise or static are loose or dirty connections. First check the easy stuff like external connectors like source interconnects and speaker terminals. Pull the connectors off and reseal. With the Amp cold, pull the tubes and reseal them, and try again. Next it's time to look inside. With the Amp cold, use the disassembly instructions in the Setting Bias section above. Once the lid is off carefully exercise the internal connectors, start with CN2 and CN21.

Check tube sockets! The GTA SE-40 did not have the best tube sockets. With the amp cold, take out the tubes for the channel making the noise one by one and reinsert, as to not change the placement or order of the tubes.

Frequently it's the 6SN7GT input tubes that are the culprits. Sometimes tubes will "walk" slightly within the sockets as they heat up and expand, then cool and contract.

If the issue still persists, check the source for issues. Sometimes a noisy volume control on a pre-amp or other upstream issue travels straight down the value chain to the Amp.

Worth noting, the tube sockets are pretty cheap on this amp and work themselves loose against the tube pins, and this poor mechanical connection is a common noise source as well.

Golden Tube Audio SE-40

Bias Resistors

The common cathode bias check resistors R25, R26, R27 on the right channel and R43, R44, R45 on the left channel, sometimes are changed to 10 Ohm, from stock 11 Ohm, due to availability, then the bias reading should be changed to reflect:

$$54.55\text{mA} \times 10 \text{ Ohm} = 545\text{mV}$$

$$54.55\text{mA} \times 11 \text{ Ohm} = 600\text{mV}$$

$$54.55\text{mA} \times 12 \text{ Ohm} = 655\text{mV}$$

References

Wikipedia primer on Vacuum Tubes: http://en.wikipedia.org/wiki/Vacuum_tubes

The article has a nice explanation of how Beam power tubes like the 6L6 class operate.

Solo Electronics bio – Via *Audio Tools - Defunct Audio Company* web page:

http://audiotools.com/en_dead_so.html

“A Hayward, California, USA based company founded by the Lau brothers in or around 1990 to manufacture valve amplifiers under the Golden Tube Audio brand and did so with some success, but ran into problems in the latter half of the decade, started manufacturing home theatre amplifiers under the Golden Theatre name around 1999 and disappeared in early 2002. There is a fairly low volume [mailing list on Yahoo](#) that deals with the Golden Tube amps.”

Golden Tube Audio Yahoo Group

Excellent small group dedicated to preserving and modding Golden Tube Audio amplifiers

http://groups.yahoo.com/neo/groups/golden_tube/info. If Yahoo! breaks this link, a search of “golden_tube” within Yahoo! groups should work.

Jay Skyler’s Russian Tube Primer

Brilliant primer on decoding Russian tube model codes: <http://www.jayskyler.com/guitar-gear-guide/sovtek-5881-wxt-6l6-wgc-tube-guide.html>

Sovtek Factory Website

<http://www.newsensor.com> ; New Sensor is the parent company manufacturing most of the common tube brands found in guitar amps, audio amps, and for sale on-line and in audio stores and guitar shops.

Audio Parts Suppliers

- **Michael Percy Audio** maintains an inventory of select high-end and exotic audio components for DIYer’s. <http://www.percyaudio.com/>
- **Tube Depot** is a great place to buy tubes online. They more about guitar amps as they do hifi amps, but they are extremely knowledgeable overall regarding tubes. This vendor has a wide selection and typically carries all the tubes mentioned in this manual. <http://www.tubedepot.com/>
- **The Tube Store** is also a great on-line store stocking the tubes mentioned earlier. The tube Store has a better understanding of Audio gear with fast service, and wide selection of parts plus tubes.

Golden Tube Audio SE-40

<http://www.thetubestore.com/>

- **Mouser Electronics** has a vast inventory of components like the highly regarded Vishay Dale RN55 and RN60 milspec resistors DIYer's like for audio applications. Mouser also has an excellent supply of wire wound resistors as well. <http://www.mouser.com/>
- **Digikey** is similar to Mouser and another excellent parts source for components. <http://www.digikey.com/>
- **Parts Express** also sells tubes, but at slight higher prices. They offer a satisfaction guarantee which makes them somewhat different from other suppliers. <http://www.parts-express.com/>
- **Parts Connection** has a large inventory of high end parts, <http://www.partsconnexion.com/>
- **Apex Jr.** is a must for low cost quality parts like surplus tube sockets and quality pure copper wire, <http://www.apexjr.com/>

Special note:

A heartfelt thank you to our Yahoo Golden Tube forum member Loc Vu. Without Loc, it would be extremely difficult for all of us to continue enjoying GTA products. His insights into modding and basic repair were extremely helpful to the GTA community. – dave3868

Email dave3868 at yahoo.com with subject: "SE-40 Manual Edits" for comments or suggestions.

Appendix - Sovtek Tube Specs

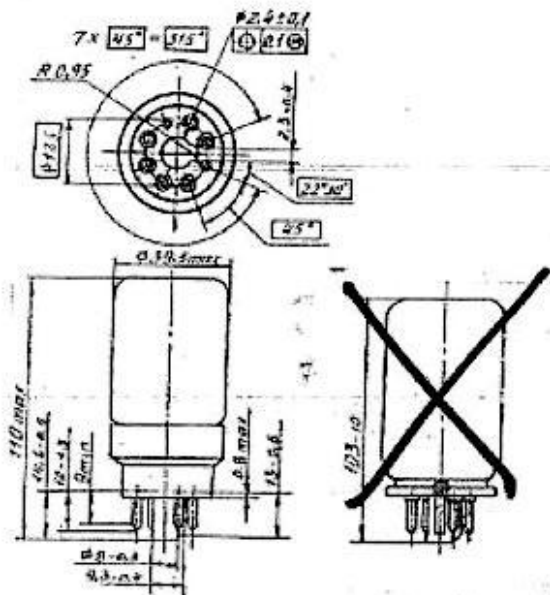
Same as SE-40 Factory Supplied Tube, but with standard base

Made in Russia
TUBE TYPE
1. 0
SOVTEK®

Beam tetrode in a glass envelope with an indirectly heated cathode designed for use in final stages of radio amplifiers of radiotechnic devices, type 3881WXT

3881WXT

Option 1

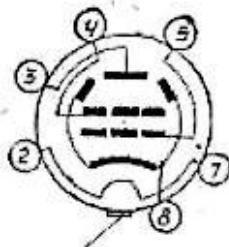


Option 2
See Opt. 1 for other Inf.

Mass, max 80g

Terminal Connections

Pin No	Electrodes
2 and 7	Heater
3	Plate
4	Grid No 2
5	Grid No 1
6	Cathode and beam forming screen



Alignment pin
Pin symbols from bottom view

2. BASIC ELECTRICAL PARAMETERS

Parameter, units	Typical			Remark
	Min	Rate	Max	
Filament current, mA	840	880	920	1
Plate current, mA	60	73	86	1,2,3
Plate current at the characteristic origin, mA			10	1,2,4
Grid No. 1 inverse current, mA			0,5	1,2,3,5
Grid No. 2 current, mA			6	1,2,3
Output power, W	5,8			1,2,3,6
Output power at underheating voltage, W	5			2,3,6,7
Transconductance, mA/V	5,2	6	6,8	1,2,3
Cathode-to-heater insulation resistance, Mohm	4			1,8
Grid No. 1-(cathode+heater) insulation resistance, Mohm	200			9,10,12
Grid No. 1-(plate+grid No. 2) insulation resistance	200			9,11,12
Internal resistance, kohm	18		75	1,2,3
Nonlinear distortion factor, %			15	1,2,3,6
Input capacitance, pF		11		
Output capacitance, pF		6,7		
Transfer capacitance, pF			1	
Cathode-to-heater capacitance, pF		11		
Readiness time, s			50	1,2,3

Notes:

- Filament voltage 6.3 V.
- Plate and grid No. 2 voltage 250 V.
- Grid No. 1 voltage minus 14 V.
- Grid No. 1 voltage minus 35 V.
- Grid No. 1 circuit resistance 0.5 Mohm
- Grid No. 1 alternating r. m. s. voltage 9.8 V; resistance in a plate tuned circuit 2.5 Kohm
- Filament voltage 5.7 V.
- Cathode-to-heater voltage ±250 V.
- Filament voltage 7 V.
- Grid No. 1 voltage minus 100 V.
- Grid No. 1 voltage minus 200 V.
- All the other electrodes are vacant.

3. Noble metal content:
gold content—1.9314 mg at Grid No. 1 winding.
Non-ferrous metal content:
nickel and its alloys content in a stem assembled.

4. ACCEPTANCE

The tube complies with special specifications
GTY CA3. 301. 013 TY-P.
Technical Control Department Stamp

Stamp "Reinspection is made" _____ Date _____

Technical Control Department Stamp

5 OPERATING INSTRUCTIONS

- When operating the tube it is recommended to keep within the values determining operate conditions, specified by the Special Specs ratings hereto. Otherwise the tube will become inoperative.
- It is not advisable to use the tube in circuits with heater series connection in order to secure the tube reliability.
- The tube shouldn't be operated either if the bulb temperature is over 180 C and the filament voltage is above 6.3 C at the same time.

SOVTEK

Also Labeled 5881WXT+6L6WXT

Typical operation, Class A amplifier

Plate voltage	350 v
Grid2 voltage	250 v
Grid1 voltage, DC	-18 v
Grid1 voltage, AC, amplitude value	18 v
Plate current	54 ma
Grid2 current	3.0 ma
Transconductance	5.2 ma/v
Plate load resistance	4.2 kOhm
Output power	10.8 w
Cathode to heater leakage current	20 μ a

Limiting values

	min	max
Filament voltage	5.7 v	6.9 v
Plate voltage		500 v
Grid2 voltage		450 v
Grid 1 negative voltage		100 v
Plate dissipation power		30 w
Grid2 dissipation power		5 w
Cathode to filament voltage		\pm 200 v
Resistance in grid1 circuit		
at fixed (clamp) bias		0.1 MOh
at automatic bias		0.51 MOh
Envelope temperature at hottest point		250° C

SE-40 Factory
Supplied Tube

6H8C

SOVTEK 6SN7

Двойной триод
Double triode

Двойной триод 6H8C предназначен для усиления напряжения низкой частоты.

Двойные триоды 6H8C выпускаются в стеклянном оформлении с октальным цоколем, соксидным катодом косвенного накала.

Двойные триоды 6H8C устойчивы к воздействию окружающей температуры от -60 до $+70^{\circ}\text{C}$ и относительной влажности 95—99% при температуре $+20^{\circ}\text{C}$ и вибропрочны при ускорении 1,5 g.

Наибольший вес 50 г.

Гарантированная долговечность 2000 часов.

The 6H8C double triode is designed for amplification of low-frequency voltage.

The 6H8C double triodes are enclosed in glass bulb and are provided with an octal base and an indirectly heated oxide-coated cathode.

The 6H8C double triodes are resistant to ambient temperature from -60 to $+70^{\circ}\text{C}$ and relative humidity of 95 to 99% at $+20^{\circ}\text{C}$, as well as to vibration with an acceleration of 1.5 g.

Maximum weight: 50 gr.

Service life guarantee: 2000 hr.

ЭЛЕКТРИЧЕСКИЕ ДАННЫЕ ELECTRICAL CHARACTERISTICS

U_h 6,3 V	U_{KT} -8 V	S^1 3±1 mA/V
I_h 600 $^{+0}$ $_{-50}$ mA	I_a^1 9 $^{+1,5}$ $_{-1}$ mA	μ^1 21,5±3,5
U_a 250 V		

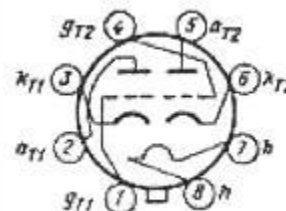
¹⁾ Для каждого триода.
For each triode.

МЕЖДУЭЛЕКТРОДНЫЕ ЕМКОСТИ INTERELECTRODE CAPACITANCES

C_{g1k} 3 pF
C_{g1a} 1,2 pF
C_{g2a} 4 pF

ПРЕДЕЛЬНО ДОПУСТИМЫЕ ЭКСПЛУАТАЦИОННЫЕ ДАННЫЕ MAXIMUM AND MINIMUM PERMISSIBLE RATINGS

	Max	Min
U_a	6,3 V	5,7 V
U_h	330 V	
P_a	2,75 W	
I_a	20 mA	
U_{kb}	100 V	
R_{KT}	0,5 MΩ	



Двойной триод
Double triode

SOVTEK 6SL7

6H9C

Двойной триод 6H9C предназначен для усиления напряжения низкой частоты.

Двойные триоды 6H9C выпускаются в стеклянном оформлении с октальным цоколем, с оксидным катодом косвенного накала.

Двойные триоды 6H9C устойчивы к воздействию окружающей температуры от -60 до $+70^{\circ}\text{C}$ и относительной влажности 95—98% при температуре $+40^{\circ}\text{C}$, а также к воздействию механических нагрузок: вибрационных до $2,5\text{ g}$, ударных многократных до 35 g .

Наибольший вес 34 г.

Гарантированная долговечность 1500 часов.

The 6H9C double triode is designed for amplification of low-frequency voltage.

The 6H9C double triodes are enclosed in glass bulb and are provided with an octal base and an indirectly heated oxide-coated cathode.

The 6H9C double triodes are resistant to ambient temperature from -60 to $+70^{\circ}\text{C}$ and relative humidity of 95 to 98% at $+40^{\circ}\text{C}$, as well as to mechanical loads: vibration loads up to 2.5 g and multiple impact loads up to 35 g .

Maximum weight: 34 gr.

Service life guarantee: 1500 hr.

ЭЛЕКТРИЧЕСКИЕ ДАННЫЕ
ELECTRICAL CHARACTERISTICS

U_b	6,3 V	$I_a^{(1)}$	$2,3 \pm 1,3\text{ mA}$
I_h	$300 \pm 25\text{ mA}$	$S^{(1)}$	$1,7 \pm 0,5\text{ mA/V}$
U_s	250 V	$\mu^{(1)}$	70 ± 15
U_{gr}	-2 V		

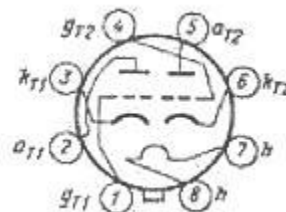
¹⁾ Каждого триода.
For each triode.

МЕЖДУЭЛЕКТРОДНЫЕ ЕМКОСТИ
INTERELECTRODE CAPACITANCES

C_{g1k}	1,7—3,2 pF
C_{sk}	0,2—1,6 pF
C_{g1a}	1,5—4,0 pF

ПРЕДЕЛЬНО ДОПУСТИМЫЕ ЭКСПЛУАТАЦИОННЫЕ ДАННЫЕ
MAXIMUM AND MINIMUM PERMISSIBLE RATINGS

	Max	Min
U_b	7 V	6,7 V
U_s	275 V	
P_a	1,1 W	
U_{sh}	100 V	
R_{gr}	0,5 MΩ	
$T_{огнеопасн. bulb}$	90°C	



--End --