



**US Dollar
cost breakdown &
parts ordering info**

Part 1, Attachment 2. Revision 1

US Dollar Parts List & Cost Breakdown

Revised Feb. 10, 2020

Wall of Sound.ca Tubelab DIY EL84 Amp

Notes:

- 1.** Transformer and tube options consist of a "Lite" version which uses smaller but adequate transformers and an economically priced, though still decent, "Basic" tube set. The "Heavy" version uses larger transformers for potentially better low frequency response, cooler operating temperatures and a more "Upscale" tube set. A builder is not locked into a particular choice. For instance, a "Lite" transformer set can be used with the "Upscale" tubes or "Heavy" transformer set with the "Basic" tube set. Personally, if finances are tight, I'd try to stretch to the "Heavy" transformers with the "Basic" tube set and upgrade the tubes later.
- 2.** The Tubelab board is quite compact. The component spacings are a bit tight in spots. Some of the part numbers on the Tubelab.com site are not current. I've selected currently available parts that will, for the most part, fit without physical and/or electrical interference. The exception is the coupling caps. I've selected caps with a bit more audiophile "cred" that are a little long. These will require a bit more care in placement on the board but won't be too onerous, or dangerous doing so.
- 3.** To better dissipate heat, which should yield longer component life, the components producing the most (principally the higher wattage resistors, and the tubes of course) will be mounted on the top side of the board. The capacitors and most of the small resistors will be mounted on the underside of the board. Component placement will be covered thoroughly in the assembly instructions.

A Word about Transformers:

The tube gurus – I *don't* consider myself one of them – maintain that the single most important part of a tube amplifier is the output transformer. Below I've specified what I consider to be necessary for decent musical reproduction. It is possible to substitute less expensive, and consequently smaller transformers, but there is a price to be paid for doing so. This is usually poor bass extension and distortion at higher power outputs. In the interest of long-term satisfaction, it's best to spend a hundred or so bucks (per transformer) upfront, rather than forty or fifty and kick ourselves later. If economies must be made, start with the basic tube set. It's far easier and less painful to upgrade tubes later than it is to buy new transformers and drill more holes in a chassis. Listed next page is a choice of two transformer sets. Our patron chose the *Heavy* version. With the clarity of hindsight this is definitely the preferred option. When putting hours on new components to break them in, I will run them for 48 to 36 hours non-stop. The *Heavy* option power transformer

only got moderately warm with 48 hours continuous use, unlike the transformer in the prototype. The prototype's trannie must have been a seriously under-rated component as after a few hours use, it becomes too hot to touch for more than a few seconds. Note that the power transformer in the prototype was harvested from an ancient amplifier and is about 2/3 the weight of the *Heavy Hammond*.

Transformers:



Hammond Transformers and Choke:

Transformer package (Lite version) 272HX (x1), 1620 (x2)

~\$286 plus shipping *

OR

Transformer package (Heavy version) 272JX (x1), 1650F (x2)

~\$306 plus shipping *

plus

156R Filter Choke used with either transformer set (optional but highly recommended)

~\$15 *

* The best prices I've seen advertised in the USA are Angela Instruments

<https://www.angela.com/>

and Antique Electronic Supply <https://www.tubesandmore.com/>

Hammond transformers are also available from Mouser Electronics. The cost is slightly higher than the least expensive (~\$20 US more for the "Heavy" package) but it might balance out when ordering the other Mouser parts. You won't qualify for the \$100+ free shipping (because of the heavy trannies), but the higher price might still balance out once shipping is added to other suppliers' prices.

Other transformers may be used if desired.

Triode Electronics sells replacement Dynaco transformers that are reputed to work well. ~\$210 US, plus shipping for a set of two output transformers.

<http://www.triodeelectronics.com/> The Triode Electronics replacement Dynaco power transformer does not have the 5 volt winding that the Tubelab.com board requires for the rectifier tube.

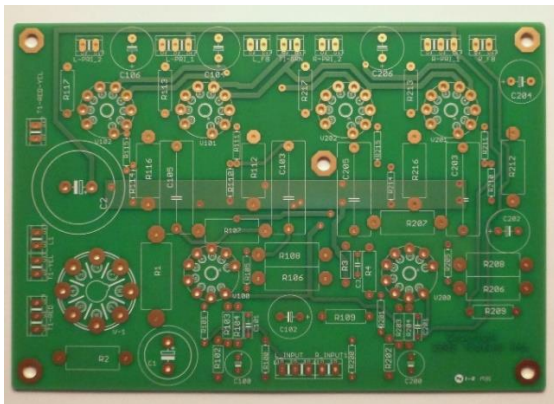
Edcor offers transformers that have been reported to work well too. ~\$215, plus shipping for a set of three transformers and one choke! Though reasonably priced, their chosen shipping method is very expensive for transformers shipped to addresses outside of the USA. Edcor won't consider using carriers other than USPS, I asked. Edcor doesn't stock transformers, they only build to order. Expect an up to eight week delay between order placement and shipment. <https://www.edcorusa.com/>

Possible Edcor transformers:

XPWR-131 or -178 (power) Quan. 1 CXPP25-7.6K (output) Quan. 2

XC75-1.5H-250mA (choke Quan. 1

Circuit Board:



Tubelab Simple Push-Pull (SPP) circuit board

Tubelab.com <http://tubelab.com/pc-boards/ordering-legacy/>

\$43 shipping included

George Anderson, aka Mr. Tubelab, doesn't have an e-commerce cart. You essentially email him PayPal funds and he mails out a board. PLEASE NOTE: George sells three different boards. Be sure to put in the text accompanying your PayPal payment that you want a: **SPP Board**. If you don't specify, he won't know what to ship you. All his boards are the same price. George usually mails out boards the next business day. It's all explained on George's order page.

Tubes:



(Thetubestore.com or any of the other likely suspects)

"Basic" Tube Set: Four: JJ EL84, two: JJ ECC81, one: Sovtek 5AR4

~\$102 plus shipping

OR

"Upscale" Tube Set: Four: Tung-Sol EL84, two: Tung-Sol 12AT7, one: Sovtek 5AR4

~\$142 plus shipping

Chassis:



I use a chassis that has an internal height of 54mm ($\sim 2\frac{1}{8}$ ""). The build method I've chosen suspends the circuit board 19mm ($\frac{3}{4}$ "") below the top plate and most components are mounted on board's under-side. This only leaves about 31mm ($\sim 1\frac{1}{4}$ "") for component height between the board and the bottom plate of the chassis. This principally restricts filter capacitor choice, though ones that are 25mm (1") high are commonly available. If greater capacitor choice is desired selecting a chassis, I've seen ones with the same width and depth as the one I chose but with a 62mm internal height ($\sim 2\frac{1}{2}$ "").

This eBay-sourced chassis (see links below) cost between \$80 and \$90 US, shipping included. It's rather generic looking but does the job. Its external dimensions are 430mm (~ 17 "") wide, 308mm ($\sim 12\frac{1}{8}$ "") deep and 62mm ($\sim 2\frac{1}{2}$ "") high. Though larger than absolutely necessary, it keeps things from getting cramped and maximises space between the power and output transformers, which is good for hum minimisation. The chassis includes an AC inlet, rubber feet and all screws required for assembly.

https://www.ebay.ca/itm/New-aluminum-DAC-chassis-DIY-home-audio-amplifier-case-Size-430-62-308MM/223700279032?_trkparms=aid%3D888008%26algo%3DDISC.CARDS%26ao%3D1%26asc%3D20131227121020%26meid%3Ddf77621e11aa4b58b782610c24875456%26pid%3D100009%26rk%3D1%26rkt%3D1%26sd%3D322539951398%26itm%3D223700279032%26pmt%3D1%26noa%3D0%26pg%3D2047675&_trksid=p2047675.c100009.m1982

https://www.ebay.com/itm/BZ4306-Aluminum-enclosure-DAC-case-amplifier-chassis-BOX-for-DIY/161998860153?_trkparms=aid%3D555018%26algo%3DPL.SIM%26ao%3D2%26asc%3D40719%26meid%3D641124760c04425a8a22b9f208838c4f%26pid%3D100623%26rk%3D1%26rkt%3D6%26mehot%3Dag%26sd%3D253309777192%26itm%3D161998860153%26pmt%3D1%26noa%3D0%26pg%3D2047675&_trksid=p2047675.c100623.m-1

Other eBay sellers might have the same chassis. I've found that sometimes the seller with the lowest price may be a bit slow to ship.

\sim \$82, shipping included

Parts from Mouser Electronics:



Due to many parts being ordered from Mouser I've found it helpful to put the circuit designation (Position on PCB) for each part in the *Customer Number* box as shown below.

The screenshot shows the Mouser Electronics product page for Xicon 283-150K-RC resistors. The 'Customer #' field is highlighted with a red circle and a red arrow pointing to it, containing the text 'R2'. The page includes a navigation bar, a search bar, and a product information section with a table of pricing.

| Qty. | Unit Price | Ext. Price |
|-------|------------|------------|
| 1 | \$0.412 | \$0.41 |
| 10 | \$0.145 | \$1.45 |
| 100 | \$0.138 | \$13.80 |
| 1,000 | \$0.115 | \$115.00 |

Note:

1. Part quantities shown: (10?), are almost worth ordering 10.
2. Part quantities shown: (10), are less expensive to buy 10 pieces than a lesser quantity.

| Line No. | Mouser Part no. | Quantity | Position on PCB | Description | Price |
|---|------------------|----------|---|-------------|------------------------------|
| Resistors: (price for the quantity required/ price if 10 ordered) ↓ | | | | | |
| 1 | 594-AC05W150R0J | 1* | R1 | 150Ω 5W | \$0.90 |
| *R1 not required if power supply choke is used. See, <i>Transformers</i> , above) | | | | | |
| 2 | 283-150K-RC | 1 (10?) | R2 | 150K 3W | \$0.29 (\$1.02) |
| 3 | 281-10K-RC | 1 (10?) | R3 | 10K 1W | \$0.17 (\$0.27) |
| 4 | 282-150K-RC | 1 (10?) | R4 | 150K 2W | \$0.23 (\$0.76) |
| 5 | 293-220K-RC | 2 (10) | R100, R200 | 220K 1/2W | \$0.48 (\$0.28) |
| 6 | 293-1K-RC | 6 (10) | R101, R201, R111, ↓ R211, R115, R215 | 1K 1/2W | \$1.44 (\$0.28) |
| 7 | 293-220-RC | 2 (10) | R102, R202, | 220Ω 1/2W | \$0.48 (\$0.28) |
| 8 | 293-100-RC | 6 (10) | R103, R203, ↓ R105, R205, LED (x2) | 100Ω 1/2W | \$0.66 (\$0.21) |
| 9 | 271-5.1K-RC | 2 (10) | R104, R204 | 5.1K 1/4W | \$0.44 (\$0.21) |
| 10 | 594-5093NW75K00J | 2 | R106, R206 | 75K 3W | \$0.96 |
| 11 | 594-5083NW24K00J | 4 | R107, R207, ↓ R108, R208 | 24K 2W | \$1.36 |
| 12 | 294-1.5K-RC | 2 (10) | R109, R209 | 1.5K 1W | \$0.36 (\$0.38) |
| 13 | 293-470K-RC | 4 (10) | R110, R210, ↓ R114, R214 | 470K 1/2W | \$0.96 (\$0.28) |

Note: Our patron chose the *Heavy* option power transformer. I suspect its increased current capacity resulted in the output tubes running a bit too close to their power dissipation limit. Resistors R112, R212, R116 & R216 set the current draw of the output tubes.

If a builder wishes the Tubelab-specified 270Ω resistor may be changed to lower the current draw. The optional resistors listed below will lower the stress on the output tubes. I recommend choosing the 300Ω or 330Ω if using the *Heavy* transformer option for use with Russian-made EL84s. If JJ EL34 tubes are contemplated then a 360Ω resistor might be best. (JJs have a slightly lower power rating than Russian-made EL84s.)

| Line No. | Mouser Part no. | Quan. | R112 212 116 216 | Description | CDN \$ Price |
|----------|-----------------|-------|------------------|-----------------------|--------------|
| 14 | 594-AC05W270R0J | 4 | 270Ω 5W | (Tubelab stock value) | \$3.60 |
| 14 | 594-AC05W300R0J | 4 | 300Ω 5W | (Reduced tube load) | \$3.60 |
| 14 | 594-AC05W330R0J | 4 | 330Ω 5W | (Reduced tube load) | \$3.60 |
| 14 | 594-AC05W360R0J | 4 | 360Ω 5W | (Use with JJ EL84s) | \$3.60 |

| Line No. | Mouser Part no. | Quantity | Position on PCB | Description | Price |
|----------|-------------------------|----------|-----------------------------|-------------|--------|
| 15 | 594-PR02FS0201000KR5 | 4 | R113, R213, ↓ R117, R217 | 100Ω 2W | \$1.64 |
| 16 | 527-CL90 Inrush Limiter | 1 | (mounts on power switch) | | \$2.55 |
| 17 | 594-AC05W10R00J | 1 | Grounding Resistor | 10Ω 5W | \$0.55 |

Capacitors:

| | | | | | |
|----|----------------------|---|---------------------------------------|-------------|---------|
| 18 | 647-LGU2W470MELY | 1 | C1 | 47uF 450v | \$2.98 |
| 19 | 661-ELHS451VSN151MQ2 | 1 | C2 | 150uF 450v | \$4.06 |
| 20 | 505-MKS4D034702D00JS | 1 | C3 | 0.47uF 100v | \$0.46 |
| 21 | EEU-FP1E102 | 2 | C100, C200 | 1,000uF 25v | \$2.12 |
| 22 | 80-ESH476M450AM7AA | 2 | C102, C202 | 47uF 450v | \$2.90 |
| 23 | 598-940C6P1K-F | 4 | C103, C203, ↓ Basic ↑ or Upgrade ↓ | 0.1uF 600v | \$12.75 |
| 23 | 598-942C10P1K-F | 4 | (as above) | 0.1uF 1000v | \$16.72 |

| | | | | | |
|----|----------------------|---|----------------------------|---------------|--------|
| 24 | 647-UBY1H102MHL1TN | 4 | C104, C204,↓ C106, C206 | 1,000uF 50v | \$8.20 |
| 25 | 72-VY1102M35Y5UG63V0 | 1 | (power switch) | 1,000pF, 500v | \$0.23 |
| 26 | 505-MKS2F031001E00JA | 1 | (grounding) | 0.1uF, 250v | \$0.26 |

Connectors:

| | | | | |
|----|-------------|---------|-------------|-----------------|
| 27 | 571-2828362 | 9 (10) | 2 Pin conn. | \$6.39 (\$3.39) |
| 28 | 571-2828363 | 4 (10?) | 3 Pin conn. | \$3.52 (\$4.20) |

| Line No. | Mouser Part no. | Quantity | Description | CDN \$ Price |
|----------|-----------------|----------|-------------|--------------|
|----------|-----------------|----------|-------------|--------------|

Output Binding Posts:

| | | | | |
|----|----------|---|--------------------|--------|
| 29 | 164-4205 | 4 | Red Binding Post | \$9.44 |
| 30 | 164-4201 | 2 | Black Binding Post | \$4.72 |

| Line No. | Mouser Part no. | Quantity | Description | Price |
|----------|-----------------|----------|-------------|-------|
|----------|-----------------|----------|-------------|-------|

LED:

| | | | | |
|----|--------------|---|-----------------|-----------------|
| 31 | 604-WP469EGW | 1 | Red/Green LED | \$0.51 |
| 32 | 621-1N4007 | 1 | Diode (for LED) | \$0.19 (\$0.17) |

Power Switch:

| | | | | |
|----|---------------|---|-------------|--------|
| 33 | 612-100-F1122 | 1 | DPDT switch | \$3.45 |
|----|---------------|---|-------------|--------|

Chassis dress-up rings for tubes:

| | | | | |
|----|----------|---|-----------------|--------|
| 34 | 836-2210 | 8 | 1.375" Bushings | \$3.12 |
| 35 | 836-2400 | 1 | 2" Bushing | \$0.28 |

Fuse:

| | | | | |
|----|---------------|---|---------------|--------|
| 36 | 693-0034.3122 | 3 | 3.15A SB Fuse | \$1.29 |
|----|---------------|---|---------------|--------|

Hardware:

| | | | | |
|----|----------|---|-----------------------|--------|
| 37 | 534-7327 | 4 | Plain Lug Terminal #8 | \$0.72 |
|----|----------|---|-----------------------|--------|

| | | | | |
|----|-----------|---|------------------------------------|--------|
| 38 | 534-1926D | 5 | Hex Standoff 8-32x $\frac{3}{4}$ " | \$4.80 |
|----|-----------|---|------------------------------------|--------|

| | | | | |
|----|-----------|----|------------------|--------|
| 39 | 514-08461 | 10 | Cable Tie Mounts | \$3.10 |
|----|-----------|----|------------------|--------|

Solder:

| | | | | |
|----|--------------|---|--|--------|
| 40 | 590-4900-35G | 1 | Lead free solder with silver (if needed) | \$4.50 |
|----|--------------|---|--|--------|

↑To be discontinued, may not be available, order 112g spool?

Total Mouser parts: ~\$93

PartskonneXion:



| PCX Stock no. | Quan. | Description | Price |
|---------------|--------|-----------------------------------|--------|
| CONNEX-53452 | 1pr. ↓ | Teflon Insulated RCA Jacks (pair) | \$7.50 |

(I prefer these jacks because they have a Teflon insulator that won't be damaged by heat when soldering.)

| | | | |
|--------------|---|--|---------|
| BELTON-75293 | 6 | Tube sockets \$3.02 ea. (My favourite but you may prefer ceramic) | \$13.50 |
|--------------|---|--|---------|

OR

| | | | |
|--------------|---|--------------------------------|---------|
| SOCKET-59006 | 6 | ceramic tube socket \$3.96 ea. | \$17.70 |
| SOCKET-59017 | 1 | Octal socket | \$2.95 |

Total Partskonnexion ~ \$26

Screws, nuts, washers:



I prefer to use stainless steel hardware when available.

This eBay seller has proven reliable: <https://www.ebay.ca/str/regansstore>

Bolt Depot is another possible source for small quantities:

<https://www.boltdepot.com/Default.aspx>

| <u>Quan.</u> | <u>Description</u> |
|--------------|--|
| 10 | 8-32 x 3/8" screws, button head preferred (for circuit board) |
| 16 | 8-32 x 3/8" screws <u>OR</u> M4 x 10mm screws (for transformers & choke) |
| 16 | nuts for above |
| 29 | flat washers for above |

Note: If flanged screws and nuts, as shown in the two right pictures above, are available only 5 washers are needed.

Budget about \$15 for hardware

Wire & Heat Shrink Tubing:



I prefer Teflon (or FEP) insulated, stranded wire. It's sometimes difficult to source in small quantities and a variety of colours. I've been satisfied with this eBay seller:

<https://www.ebay.ca/itm/2M-PTFE-FEP-Wire-Silver-Plated-OFC-Copper-Cable-300V-High-Temperature/321973325742?hash=item4af71b0fae:m:ml34-hTk29njSjKzBeIk2Q&var=510908710654>

| Colour | Length | Gauge: |
|--------|------------|----------|
| Black | 6 ft. (2m) | 18 or 20 |
| White | 6 ft. (2m) | 18 or 20 |
| Green | 6 ft. (2m) | 18 or 20 |
| Black | 3 ft. (1m) | 26 or 28 |
| Red | 3 ft. (1m) | 26 or 28 |

Some heat shrink tubing will also be needed, 1/16", 1/8", 1/4" and 1/2" diameter. Obtain locally or try the eBay seller just above.

Budget about \$20 for wire and shrink tubing

Obtain locally:

| <u>Quan.</u> | <u>Description</u> |
|--------------|---|
| 1 | IEC-type power cord (computer power cord) |
| 20 | 4" zip ties |

Total for all of the above, not including shipping (median figure, will depend on transformers and tubes chosen):

~\$715

Volume Control Option:



Mouser:

| Part no. | Quan. | Description | | Price |
|------------------|-------|---------------|------|---------|
| 688-RK27112A00CC | 1 | Volume ctrl. | 100K | \$17.00 |
| 517-1634 | 1 | Grounding Lug | | \$0.21 |

If you are planning to incorporate a volume control a knob will be needed. I've found this eBay seller reliable.

<https://www.ebay.ca/str/GDAUDIO? trksid=p2047675.l2563>

Examples are shown here:

<https://www.ebay.ca/itm/2PCS-32-13mm-Silver-CNC-Machined-Solid-Aluminum-Knobs-FR-SPEAKER-RADIO-VOLUME/221153153959? trksid=p2485497.m4902.l9144>

<https://www.ebay.com/itm/1pcs-30mm-full-aluminum-volume-knob-audio-potentiometer-knob-silver-black/163891491885? trkparms=aid%3D333200%26algo%3DCOMP.MBE%26ao%3D1%26asc%3D20171012094517%26meid%3De41724849fbb4782a0d614e6d6dd2f75%26pid%3D100008%26rk%3D2%26rkt%3D12%26sd%3D322504715644%26itm%3D163891491885%26pmt%3D1%26noa%3D0%26pq%3D2047675& trksid=p2047675.c100008.m2219>

Have a careful look before buying. Sometimes one knob will cost \$9 with shipping but two can be had for \$12, shipping included. In some instances, one may be had for \$5 or less.

~\$7.00

Two Input Option:



Mouser:

| <u>Part no.</u> | <u>Quan.</u> | <u>Description</u> | <u>Price</u> |
|-----------------|--------------|--------------------|--------------|
| 612-100-U1111 | 1 | 4PDT toggle switch | \$7.64 |

Parts Connexion:

| <u>PCX Stock no.</u> | <u>Quan.</u> | <u>Description</u> | <u>Price</u> |
|----------------------|--------------|-----------------------------------|--------------|
| CONNEX-53452* | 1pr. | Teflon Insulated RCA Jacks (pair) | \$7.50 |

*Same as pair used for 1 input version