

EML 45 Data Sheet



45 years after the last American tubes of 'Type 45' were made, EML was the first company, to take this tube back in production again, in the year 2001. The EML has 4 four original V-shaped filaments like found in vintage 45 tubes. (See note4) This tube has fully original specifications of the American RCA Type. All critical parts are made of hard metal for higher reliability and reproducible quality.

Guarantee program for first owner.

At EML we have the normal guarantee. In addition to that, the first owner can register the tube within 4 weeks after receipt, at the Emission Labs website, to participate in the 5 years guarantee program.

We have added a gold grid to all EML tubes, some time ago, also to the 45. Very few NOS tubes have this. You can see the gold color of the grid wire when you look into the tube in the sunlight. The gold grid will give better bias stability, and you will may see the EML tubes bias perfectly right out of the box, and no bias change during burn in. Also read the next table 'features'. As an overall total result, the standard 45 is a no compromise replacement for the original RCA 45. Check also the 45-mesh data sheet.

Features

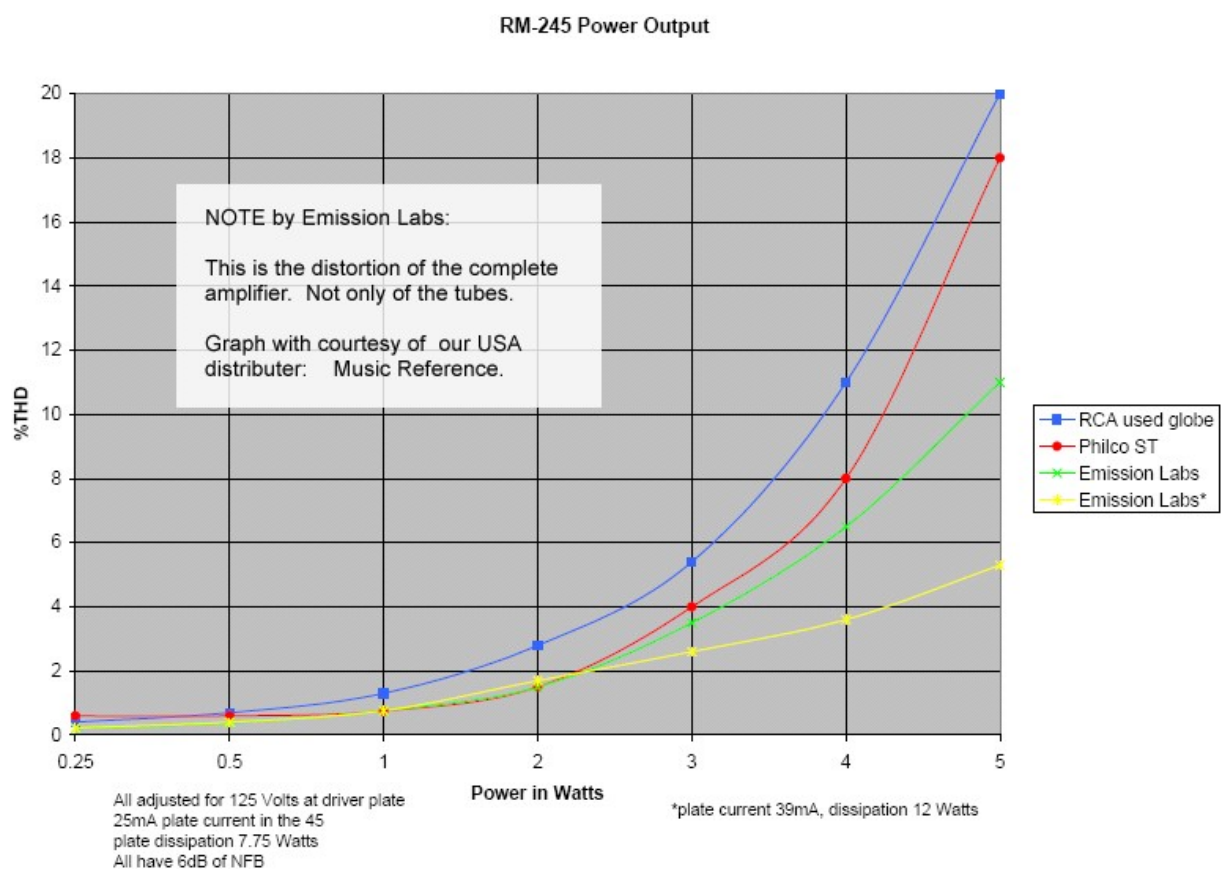
- Nano Ampere range grid current, vs NOS tubes which can have sometimes 2uA.
- Cathode Tapped filament
- 30% lower distortion compared to any other 45. [Read here.](#)
- Hard metal Construction (Note1)
- Extra large getters
- Hand blown Glass bulb
- Anti-microphonic Anode- and grid suspension
- These tubes are shipped in a [high quality dual box](#)
- Tube printing with real gold (metal), red color is glass burned into the glass
- YAMAMOTO tube sockets highly recommended.
- Gold Plated pins, black ceramic socket. (White bottom.)

Sound Character of the EML 45

We are often asked to describe the sound of our 45 tubes. If you are looking for real triode sound, the 45 tube is very interesting. It is important that tubes and speakers fit together well. So low power tubes sound best at high efficiency speakers, and vice versa. Best sound of the 45 is developed at the very sweet first Watt. The 45 will reward you with best sound when you are using high efficiency speaker systems, starting at 96..99dB. At the same time, here comes a drawback for the amplifier and the tubes as well. Such speaker systems of 100dB and above will make smallest imperfections audible, and the amplifier must produce as little hum and noise as can be. This is difficult. When you are thinking of 108db horn systems this stresses the design limits of tubes and amplifiers a lot. A quick way to test the noise level of your amplifier-tube combination is, to measure the AC signal out of the amplifier with the inputs muted, but the speaker connected. Anything below 3 millivolt at 8 Ohms is a good achievement, and such an amplifier below 1 millivolt can be called a fine piece of work. If an amplifier will produce low hum with many different tubes, this is definitely a better design, than such an amplifier that is critical on the tubes. Of course, here the tubes play a major role too. At EML we have greatly reduced hum and distortion of all tubes, by a new filament construction. This was done by a real, physical filament Cathode Tap, that is positioned outside of the Anodes, but inside the glass bulb. The result was, we reduced the hum level of the EML45 even below that of many good NOS tubes.

UPDATED We have two versions for the heater: Normal heater, or Cathode Tapped heater. Here is a link to Application Note 06, describing the Cathode Tapped tubes in general.

Distortion of the EML45, versus Power Output



Distortion of the EML tubes is probably the lowest you can have. Here is a link to detailed test results, made for us by Roger Modjeski from RAM LABs, USA. From this you can see, the EML 45 is having the best results, most specially at higher signal level. For equal loudness, the human ear needs higher

power at lower frequencies, and this is present in all music in a natural way. The result is though, bass tones of amplifiers have the highest electrical signal level, so bass distortion appears always first. This will change the sound character, making the bass less 'dry'. At medium volume you don't hear this as distortion. What you do hear is, the overall sound picture gets less precise, less natural, and it makes your ears tired from listening sooner. This is a very important mechanism to understand. The EML45 tubes give a strong contribution here, by reproducing the bass sound with smallest distortion a 45 tube can do.

EML 45 Filament Ratings

Filament Voltage	2.5Volt (AC or DC) 5%
Electronic heater modules:	Only voltage source
Filament Current	~ 1.5Ampere
Maximum Time on Stand By (Heater voltage only)	2 hours

EML 45 Maximum Conditions

Anode Voltage	300Volt
Anode Current	45mA
Continuous Anode Dissipation	11Watt
Power Output in Class A	2.5 Watt
Grid resistor, highest possible value (Important: Note5)	500k Ohm

EML 45 Factory Test conditions

Anode Voltage to Cathode	250V
Anode Current	34mA
Grid Voltage	at above conditions
Transconductance	at above conditions

EML 45 Typical Data	Single Ended CLASS A1 AUTO BIAS	
Anode Voltage to Cathode	250V	275V
Anode Voltage to Ground	300V	331V
Anode Current	34mA	36mA
Anode Dissipation	6.8Watt	7.9 Watt
Cathode resistor	1470 Ohm	1550 Ohm
Cathode Resistor voltage	50Volt	56Volt
Anode Impedance (Rp)	1750 Ohm	1670 Ohm
Load Resistance (Ra)	3900 Ohm	4600 Ohm
Amplification Factor	3.5	3.5
Transconductance (Gm)	2mA/V	2.1mA/V
Power Output in Class A	1.6 Watt	2 Watt
Total Distortion	5%	5%

EML 45 Typical Data (2)	PUSH PULL CLASS A1 AUTO BIAS	
Anode Voltage to Cathode	250V	275V
Anode Current 2) 3)	68mA	72mA
Anode Dissipation 1) 3)	6.8Watt	7.9 Watt
Cathode Resistor 2)	735 Ohms	775 Ohms
Bias voltage	50Volt	56Volt
Load Resistance (Ra)	4200 Ohm	3900 Ohm
Power Output in Class A 2)	4.6Watt	5.5 Watt
Total Distortion	-40dB	-40dB

1) Values for one tube 2) Values for both tubes together

3) Values are for zero Signal in this table, but will rise at higher signal. Avoid overdrive which exceeds maximum Anode dissipation of 11 Watt per tube.

EML 45 Typical Data (3)	PUSH PULL CLASS AB1 AUTO BIAS	
Anode Voltage to Cathode	275V	300V
Anode Current 2) 3)	67mA	64.5mA
Anode Dissipation 1) 3)	7.3Watt	7.6Watt
Anode Dissipation 1) 4)	8.4Watt	8.2Watt
Cathode Resistor 2)	850 Ohms	1000 Ohms
Bias voltage 3)	57Volt	64.5Volt
Bias voltage 4)	69,7Volt	72Volt
Load Resistance (Ra)	4000 Ohm	5000 Ohm
Power Output in Class A 2)	6Watt	7.4 Watt
Total Distortion	-34dB	-40dB

- 1) Values for one tube
- 2) Values for both tubes together
- 3) Value are for zero Signal.
- 4) Values are at maximum Signal.

EML 45 Typical Data (4)	PUSH PULL CLASS AB2 AUTO BIAS	
Anode Voltage to Cathode	275V	275V
Anode Current. 2) 3)	72mA	72mA
Anode Current. 2) 4)	90mA	97.4mA
Anode Dissipation. 1) 3)	7.9Watt	7.9Watt
Anode Dissipation. 1) 4)	9.2Watt	9.7Watt
Input Signal, RMS. 1) 4)	37.5V	39.2V
Input Signal current. 1) 4)	7.5mA	5.3mA
Cathode Resistor. 2)	775 Ohms	775 Ohms

Bias Resistor voltage. 3)	56Volt	56Volt
Bias Resistor voltage. 4)	69.5V	75.5V
Load Resistance (Ra)	5810 Ohm	5420 Ohm
Power Output in Class A 2)	12.7 Watt	13.2 Watt
Total Distortion 5)	-26dB	-26dB

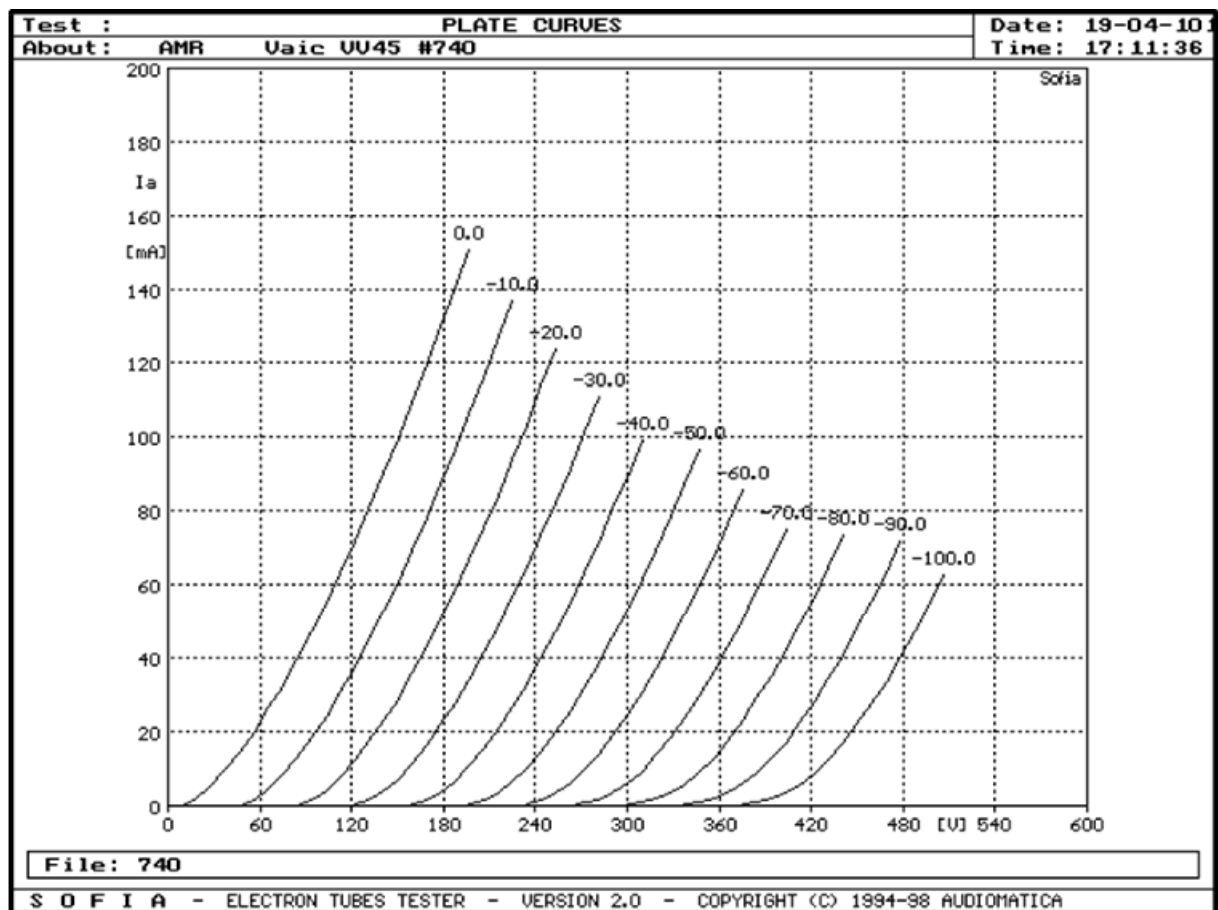
1) Values for one tube

2) Values for both tubes together

3) Value are for zero Signal.

4) Values are at maximum Signal.

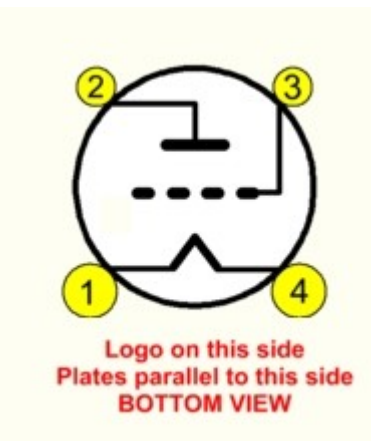
5) class AB2 means the tube is grid current driven. This requires a very low impedance driver stage.
(See table for grid AC requirements)



Recommended Single Ended transformers

	Primary	Output
LL1663-040 Lundahl	5000 Ω	8 Ω
LL1682-050 Lundahl	5000 Ω	5 Ω

EML 45 Mechanical Data



Size including Socket
(but excluding pins)

145 x 58 mm

Weight of one tube:
140 Gram

Shipment weight for
pair in gift box: 700 Gram

Pin 1: Heater1

Pin 4: Heater2

Pin2: Anode

Pin3: Grid

Note 1) Hard-metal filaments prevent filament breakage with DHT Tubes. This material has a higher melting point than classic nickel wires. Wolfram grids allow the most precise grid wire distance, because wolfram is an extreme hard metal. This ensures better grid precision, which gives uniformity and better linearity at the low end of the tube curves

Note 2) Individual Test data: Control Grid Voltage, Anode current, Transconductance and Filament Current is the test certificate that is on the outside of the box. Each tube is numbered, inside the bulb with a [metal Tag](#)

Note 3) Tube Curves: Made on the The Sofia Curve tracer, with courtesy of AMR, Wisconsin, USA.

Note 4) The V shaped filaments will give different electrical fields inside the tube, as compared to parallel filaments. For keeping the original character of this tube, we choose for V-shaped filaments.

Note 5) EML45 first generation (from before 2004) have a maximum grid resistor value of 100k. For tubes after 2004 we have this specification: Auto Bias: 500k. Adjustable bias 100k. As a rule of thumb, the coupling capacitor value is calculated as: $C[\mu F] = 47/R[k\Omega]$. So in this formula, the value of R is in k Ω , and the result is then in μF . Example: A grid resistor of 470k would need a coupling capacitor of $47/470 = 1\mu F$.

Note 6) In a class AB2 amplifier, the tubes are operated mildly into positive Control Grid Voltage, and output power as published here should not tried to be exceeded. The 2nd Harmonics resulting from this, are cancelled by virtue of the Push Pull circuit. A sufficient low impedance driver stage is needed for class AB2. This can be achieved with a step down inter stage transformer, as recommended by the RCA receiving tube manual 1934, Page 93.

Note 7) A quick way to test the hum level of a amplifier, is to measure the AC signal the speaker terminals, with the inputs muted, but the speaker connected. Anything below 3 millivolt at 8 Ohms is a good achievement, and such an amplifier below 1 millivolt can be called a fine piece of work. If an amplifier will produce low hum with many different tubes, this is definitely a better design, than such an amplifier that is critical on the tubes.