Data Sheet
12B, 20A, 20B, 20B-V4, 30A

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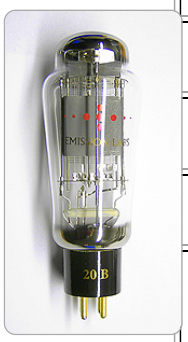
Description

This is a series of tubes with medium gain, with with very good voltage capabilities, and very low distortion even at high signal.

Applications



	ANODE TYPE	Driver tube	Line Out	Speaker Output	OTA	Head Phone	Sakuma
12B	Black Powdered	Yes	Yes	Yes	.	Yes	Ideal.
20A	Mesh	Yes	Yes	.	.	.	
20B	Black Powdered	Yes	Yes	Yes	Yes	Yes.	
20B-V4	Black Powdered	Yes	Yes	Yes	Yes	Yes	
30A	White Powdered	Yes	Yes				

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 receival, at the Emission Labs web site, to participate in the 5 years guarantee program.

Our Guarantee conditions

Register here for the 5years guarantee

Features

- Gold Plated Grid. (See Notes)
- NEW Soft rubber suspended tube base
- Hard metal Construction (See Notes)
- 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 24k gold, and red color burned into the glass
- Gold Plated, black ceramic socket

12B

This tube has gain of appr. 12x, and medium-low impedance. It can be used in almost any application, including speaker output at almost 5 Watt. Also, beautifully 12B can be used as a SAKUMA amplifier, using a 12B to drive a 12B speaker tube. This tube has sound resemblance to the vintage PX25, due to curve similarity.

20A

This is a mesh tube, with gain of appr. 20x, and medium impedance. It has a very pleasant triode sound, due to nearly total absence of odd harmonics. It's application is a driver tube for medium signal.

20B

This is a solid plate version of the 20A. It works well in all 20A circuits, but can also be biased higher as 20A. At medium voltage it is a wonderful driver tube. For lower signal it may be used at low anode voltage, like 250V. At higher anode voltage, up to 580V, 20B becomes capable of delivering very high output signal, as required for instance to drive the 845 or GM70 tube. Also at higher voltage it can deliver a few Watts output power. It can be used as driver tube or low power output tube.

20B-V4

V4 means only the heater wire has a center tap. This gives a fifth connection, so this tube needs an octal base. It is compatible to the classical 20B, but offers the advantage of the center tap on the filament. The center tap, provides a real cathode connection, for a simpler circuit, yet with better performance. **Application Note AN-6** explains the meaning of the V4 Version.

30A

The 30A has an unloaded gain of appr. 30x. It is intended to combine the driver and pre-amplifier tube in one. This tube has exceptional low distortion, below 0,1% 2nd harmonics, and 0.01% 3rd harmonics, at FULL signal output of 60Volt RMS. Here is a print of the simulation program, to show this. This program used these 30A tube curves, measured with the Sofia curve tracer. At lower signal, distortion drops even further.

Filament Ratings		
	Standard tube 12B, 20A, 20B, 30A 4Pin Socket (UX4)	Cathode Tapped 20B-V4 8Pin Socket (Octal)
DC voltage recommended	= 5Volt	= 2.5 - 0 - 2.5Volt
Electronic heater modules:	**Only** voltage source	**Only** voltage source
Tolerance on filament voltage	5%	5%
Filament Current	~ 1,4Amp	~ 1,4Amp

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Maximum Conditions (See Notes)	**EML 12B**	**EML 20A**	**EML 20B**	**EML 30A**
Anode Voltage	500V	490V	580V	500V
Anode Current	60mA	40mA	60mA	40mA
Continuous Anode Dissipation	25Watt	11Watt	25Watt	11Watt
Grid resistor	below 470k	below 470k	below 470k	below 470k

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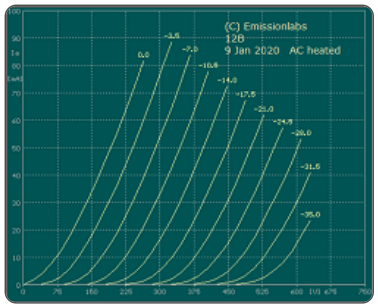
Factory Test Data	**EML 12B**	**EML 20A**	**EML 20B**	**EML 30A**
Anode Voltage	390V	400V	420V	400V
Anode Current	40mA	25mA	42mA	25mA
Anode Impedance (Rp)	2k9	3k7	3k	6k2
Amplification Factor	13.5	21	21	32
Transconductance	5.6 mA/V	4,2mA/V	6,9mA/V	5,2mA/V
Control Grid Voltage *Tested with DC heating*	-16V	-7.4V	-5,6V	

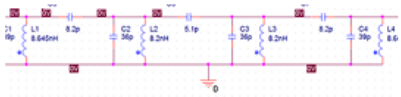
Control Grid Voltage *Tested with AC heating.*		-9,9V	-8,1V	

- Control Grid Voltage. *Actual voltage depends on individual tubes.* Factory test data is taken with DC heating.
- Gain is unloaded gain, as will occur choke or inter stage loaded. If resistor loaded, gain will be lower.



- Curves 12B
- Curves 20A/B
- Curves 30A

- Bit map 12B
- Bit map 20A/B
- Bit map 30A



SPICE Parameters

12B Some operating points.

This is AC heated. If DC heated, Grid voltage shifts 2.5 Volt. (See Notes)

Anode Voltage	Grid Voltage See Notes	Input	Cathode resistor for Auto Bias	Anode Current (mA)	Circuit Gain	Tube Ri (Ohm)	Load (Ohm)	Lundahl Trans former	Output	Tube Dist. Total	Use as
430V See Chart	-20.9V	4.1V RMS	831R	25mA	14.6	3k1	Choke or inter stage	LL1668-25mA	60V RMS	0,03%	Driver Stage
430V See Chart	-15V	10,7V RMS	257R	58mA	10	2k3	5k	LL1663-60mA	2,2Watt	1.4%	Output Stage
430V See Chart	-15V	10,7V RMS	257R	58mA	10.8	2k3	6k5	LL9202-50mA	2Watt	0.9%	Output Stage
500V See Chart	-21.1V	14,9V RMS	422R	50mA	10	2k4	5k	LL1663-50mA	4,1Watt	3,3%	Output Stage
500V See Chart	-21.1V	14,9V RMS	420R	50mA	10.5	2k4	6k5	LL9202-50mA	3.8Watt	2.1%	Output Stage

As a driver stage, most power tubes like 300B, need appr 60V RMS on the grid. Using 12B as a driver, only 4.1V is needed. This can be achieved with a 4x step up transformer, which gives this gain free of noise and microphonics, and supplies even a balanced input.

20A Some operating points

Anode Voltage	Grid Voltage See Notes	Input RMS	Cathode resistor for Auto Bias	Anode Current (mA)	Circuit Gain	Tube Ri (Ohm)	Load (Ohm)	Lundahl Trans former	Output	Tube Dist. Total	Use as
350V See Chart	-12.6V	3.14V	1263	10mA	20.8	5k4	Choke loaded	LL1668-10mA	60V RMS	0,17%	Driver Stage

For full output signal, most power tubes like 300B, need appr 60V RMS on the grid. This is 170 Volt peak to peak, and it needs good consideration how to generate such high signal free of noise and distortion. Using 20A as a driver, only 3.14V is needed. This can be achieved with a 3x step up transformer, which gives this gain free of noise and microphonics, and supplies even a balanced input and no further drive tube is needed.

20B Some operating points

Anode Voltage	Grid Voltage See Notes	Input RMS	Cathode resistor for Auto Bias	Anode Current (mA)	Circuit Gain	Tube Ri (Ohm)	Load (Ohm)	Lundahl Trans former	Output	Tube Dist. Total	Use as
521V See Chart	-12,2V	8.5V	254R	48mA	16.4	2k9	11k	LL9202-50mA	1,8Watt	1%	Output Stage
580V See Chart	-15.7V	11.1V	368R	43mA	13.4	3k	6k5	LL9202-50mA	3,59Watt	3.7%	Output Stage
								LL2935B			Output Stage

30A Some operating points

Anode Voltage	Control Grid Voltage See Notes	Anode Current (mA)	Trans-Conduc-tance (mA)	Tube Ri (Ohm)	Gain (mu)
300	-3	10	4.6	8k	36
300	-2	15	5.3	6k6	35
300	-1	20	5.5	5k9	33
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360	-5	10	4.4	8k	36
360	-3.8	15	5.1	6k9	35
360	-2.8	20	5.7	6k	34
360	-2	25	6.2	5k6	34
360	-1.1	30	6.6	5k1	34
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420	-6,7	10	4.3	8k5	36
420	-5.6	15	5.0	7k	35
420	-4.6	20	5.5	6k	33
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480	-8.6	10	4.1	9k3	38
480	-7.5	15	4.9	7k2	35
480	-6.5	20	5.5	6k3	35

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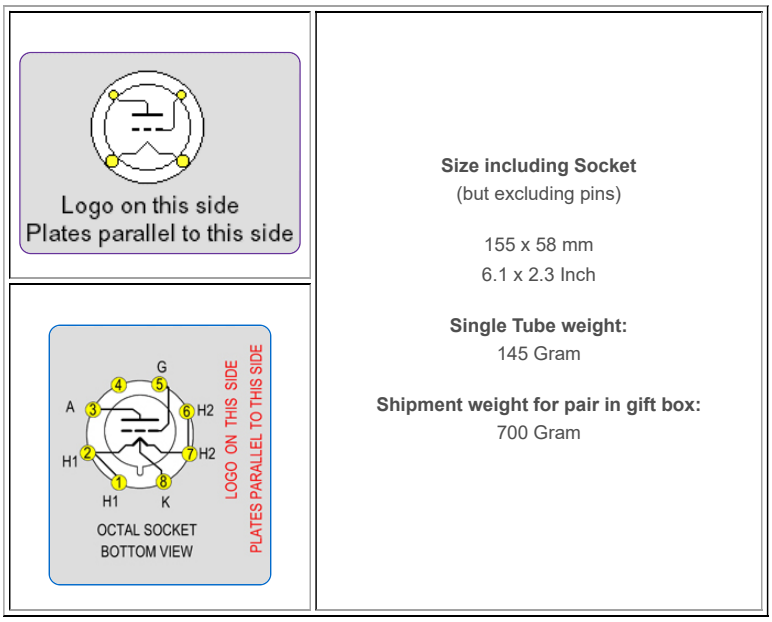


Notes

- Hard-metals can be used in electron tubes, though these are more difficult to use, and more costly than classic nickel. This ensures reproducible tube parameters, and long term stability.
- Individual Test data, such as: Matching Data, Grid Current, Vacuum, Filament Current, etc., are on the Certificate that is on the outside of the tube box. Each tube is numbered from the inside, with a metal Tag
- Plate Characteristics are made with the Sofia Digital Curve tracer.
- We are recommending the same values as Western Electric in their 1950 Data sheet.
- Some of our competitors claims to be the only one with a Center Tapped filament, but at EML we build since many years all tubes Cathode Tapped, not just this tube.
- Do not experiment with lower filament voltage, to expect better lifetime. We already specify filament voltage for the best lifetime.
- Gold Plated grids have a few advantages, such as increased bias stability, some protection against accidental overload, and better linearity of tube curves

Use as Pre Amplifier

Application info #1

For use in a separate pre amplifier, a DHT must be used with low noise in mind. Typically the wrong way for this would be to build a pre amplifier with more gain as needed, and then attenuate the **input** signal by the input volume knob accordingly.

Though people LOVE to do this, it is wrong! Such amplifiers will function dissatisfactory because of low signal to noise ratio, and also will sound sterile.

A good pre amplifier, will use an attenuating output transformer, reducing the gain of the complete product, to a number, not higher than needed. Which is 1x for a pre amplifier, or in rare cases 2x. . This will lower the output impedance of the pre amplifier with the square of the transformer attenuation which is the

essential real reason for doing so. Now, with the lower output impedance, a 600 Ohms potentiometer can be used directly at the output. Doing it like this, will drastically reduce noise as well as microphonics. Yet maintain triode sound. In this configuration, the plate signal of the output tube itself, will be 10...40 Volts, also at very low output volume setting. This prevents sterile sound. Overall Signal to Noise ratio stays very high, and microphonics are low.
With such a pre amplifier, even a twisted wire pair can be used at the output, to replace shielded cable, and at very low signal the pre amplifier will be 'dead' silent, or in engineering words, have a very high Signal to Noise ratio.

20B use as OTA

Application info #2

OTA stands for One Tube Amplifier. So yes, this means a complete HiFi amplifier with only one tube. This is a concept where no pre amplifier tube and no driver tube is used. The output tube is typically 20B-V4 in such a case, and it provides almost enough gain by itself. The missing gain of appr 2...4x can be achieved by a passive gain stage, in the form of a small step input transformer from Lundahl. (We supply PCB for this, with programmable gain of 1..4x, using LL1544A). Such a passive stage costs less than a good tube stage, and provides gain at zero hum and zero noise. We much recommend this concept if only a few Watt output power is needed. Sound of the 20B-V4, as speaker driver will be 'sweet' and not dominant. Moreover, tube sound develops with the 20B also at low volume. Due to exact geometry of the anode box, there will be no audible third harmonics. So any influence will be only by second harmonics, thus achieving in a very good way, what is called triode sound.

Search the internet for this phrase: "OTA 20B One Tube Amplifier", or also click on "Professional Users" on the jacmusic website, and search that page for the phrase "20B"

12B Notes

Application info #3

For driving a 300B, it needs appr. 60V AC signal. Quite a lot, but 12B can do this nicely, and a lot higher voltage too.

It is recommended to check at the external website, jacmusic.com, for the EE-08 and EE-20 board, at the Lundahl Section. These transformer boards will supply the needed gain.

In addition, 12B seems IDEAL to build a SAKUMA amplifier. This very clever concept works almost free of distortion, as long as driver stage and output stage are identical. Enter **SAKUMA** in the search box of the jacmusic.com website. (external website)

About Noise and Distortion

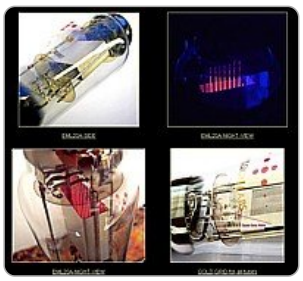
12B, 20A, 20B, 30A tubes are based on a very old principle, where high gain tubes have much wider Anode distance. This is still the ultimate way to make a very linear DHT high gain tube. Miniaturization has always been the enemy of tube linearity, specially with DHT. For this reason, the 20A/20B/30A will outdo any small size tube. We encourage you to check the tube curves of any miniature tube, like 6SN7, ECC88 or ECC82, and you will see this series presented here is much superior. However this results of larger dimension tubes is a higher working voltage. For this reason, tubes like this were not made any more after 1935, when miniaturization of tubes started to become more important. With the new production tubes we make today, miniaturization is no requirement. So for high gain tubes, we can now focus on lowest possible distortion. We build these tubes again the original way, with wide Anodes. Check Anode picture here.

These tubes belong to the lowest distortion tubes ever build. Total distortion for small signal has been measured below 0,08% at 10 Volt Eff output signal, 400V Anode. The distortion will almost not increase at higher signal. (See Note5) . Interestingly, when one DHT triode is driving another, a part of the distortion of the second tube will be eliminated by the first tube. This even harmonics cancellation appears only with triodes, and they must be similar tubes, like drive a 300B with one of the tubes of this series. Since Triodes produce very low uneven harmonics, canceling the overall distortion this way, is an amazing application of the 20B or 30B tube. (See note 4)

For lowest possible mechanical noise with (any) high gain DHT pre-amp tube, use high quality tube sockets that do not pass the chassis vibrations to the tube. Chassis vibrations can come directly from

the mains transformer, or by air from the loudspeaker. The best sockets for this are probably the Yamamoto Teflon, because Teflon is a flexible material. Use tight fitting Teflon tube dampers such as the Duende Criteria. They make the best damper for the EML tubes. They can be fit very nicely on the tube top, or one on the top and one on the bottom.

Note about Blue Glow Appearance.



These tubes will often produce a blue glow on the glass. This is because of the wider Anode distance, some electrons escape after collision. The fluorescent light pattern changes with the voltage or with the signal. These light effects are normal for this type of tube. It must not be confused with gassy tubes, which produce a purple-blue cloud inside the Anodes. D

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