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Data Sheet

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

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Description



For these tubes we use a very fine gold grid wire, to achieve higher gain. If not used as output tube, It is recommended to use these tubes choke loaded, and they can be used at normal supply voltage then. If used resistor loaded, they can be used on a supply voltage of 600V or more.

This series of tubes are made for higher gain. The mechanical dimension is the same as our 300B series. Miniaturization of tubes, as you can quickly seen, is always on the cost of distortion, and also such miniaturized tube have a tendency to work on lower voltage. All of which makes such miniaturized tubes not ideal for larger signal. This is where our tubes step in. So if size is not a problem, these tubes offer a combination of low distortion, high gain, yet at high signal as well, which is not found with tubes made before.

Gain of 12B is appr 14x, 20A/20B is appr. 20x, and 30A is appr. 30x. Depending on the tube type, they can be used as driver tube, [pre-Amp Output](#), Head Phone, or low output speaker amplifier.

A unique application is possible with 20B, called the OTA amplifier. Such a complete amplifier works only one tube: The 20B. Thus providing a speaker output, and a normal signal input. The method here, is to use an input transformer with voltage amplification if appr 4x. Together with the gain of 20x of the 20B, this provides the gain needed.

All of these applications are combining high signal level with high gain and low impedance at the same time.

As a driver tube, when using a Anode resistor, 20A an 20B can work with high voltage circuits for instance for an 845 tube, from a high power supply voltage of around 800 Volt. For supply voltages around 400Volt the use of an Anode choke is recommended to have sufficient Anode voltage remaining over the tube.

	ANODE TYPE	Possible applications
30A	White Powdered	One single tube for the first stage and driver
20A	Mesh	Driver tube, or output tube
20B	Black Powdered	Driver tube, head phone, output tube, OTA (One Tube Amplifier)
20B-V4	Black Powdered	Pre-Amp, driver tube, head phone, output tube.
12B	Black Powdered	Very good combination of medium gain, and higher speaker output signal possible. Yet also a perfect driver tube.

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 ♦ web site, to participate in the 5 years guarantee program.

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

[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
- YAMAMOTO tube sockets highly recommended.
- Gold Plated, black ceramic socket

Sound Character of the EML 12B, 20A, 20B, 30A Series

- Used as **OTA** (One Tube Amplifier).
- Used as a driver tube

20A/20B vs 30A

The 30A tube is just made for higher gain, and less gain of it's driver stage is needed. However output impedance of 30A is accordingly higher, and the design must be made with more care. Whereas the lower output impedance of the 20A /20B Series is generally easier to work with. (Here is a [measurement](#), showing 60dB distance from 2nd to 3rd harmonics, using the 30A tube. This graph is for the tube + transformer together).

The new 20B-V4 tube

We recommend this tube for new designs, because it is upwards compatible to the classical 20B, but offers the advantage of the Cathode Tapped heater. By adding a Cathode Tap connection to the filament, we get a real cathode connection, for a simpler circuit, yet with better performance. This requires an socket with more than 5 electrical connections pins, so we choose for the Octal socket.

With the Balanced Heater, we enter a new field of applications. When biasing a DHT tube, there is no cathode to connect something to. The cathode connection must be artificially constructed, either by two resistors, or by a Cathode Tap on the heater transformer. Both these methods are a compromise to the signal path, and this compromise is now eliminated by the V4 version.

It must be said, the V4 is a beautiful tube, which fulfills the needs of designers, the best possible way. Link to [Application Note AN-6](#) about balanced (Cathode Tapped) heater.

Recommended LUNDAHL SE Output transformers



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 Used as a driver tube

Application info #3

This is a most interesting application, because you may even be able to skip the use of a pre-amplifier tube. Which one is always the source of noise and microphonics.

For driving a 300B, it needs appr. 60V AC signal, which is 170V Peak to Peak. Quite a lot, but 12B can do this nicely.

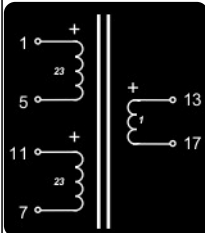
What is nice about 12B, with a gain of 12x, you need only 5V input signal on it's grid. Using a 1:3 step up transformer, it needs only 1.6V AC at the input, and every CD player and most other sources can deliver that easily.

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.

Moreover such a transformer allows a normal asymmetrical input.

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



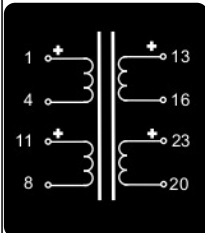
SPEAKER OUTPUT APPLICATION
LL2735B. Specially designed by Per Lundahl, for the EML20B.

The specialty: When using an 1:4 input transformer, it is possible to build a complete SE amplifier with just one tube. Such concept is called One-Tube-Amplifier (OTA).

We have a programmable (1...4x) gain [PCB for this purpose](#), using LL1544A.

Some Examples of OTA amplifiers [Pic1](#) - [Pic2](#)

Designed for 20B, this transformer works also on 12B. When using 12B, you need a driver tube in addition, but not the step up input transformer any more.



INTERSTAGE APPLICATION
For 12B, 20A-Mesh or 20B, we recommend Lundahl inter stage **LL2756**.

20A or 20B can be used 1:1.

12B can be used 1:1 or 1:2 step up

With this 1:2 inter stage, and an additional 1:2 INPUT transformer this will be a one-tube driver system, for tubes like 300B, 45 or 2A3. Thus bringing down noise, hum, and distortion to an incredible low level as not possible otherwise. This is because the first tube (as in a 3-tube triode amplifier) is not used. The first tube however is the main source of hum and noise.

We recommend the programmable (1...4x) gain [PCB for this purpose](#), using LL1544A

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
Tolerance on filament voltage	5%	5%
Filament Current	~ 1,4Amp	~ 1,4Amp
Filament Current	~ 1,4Amp	~ 1,4Amp
Maximum Time on Stand By (Heater voltage only)	2hours	2hours
Filament Current	~ 1,4Amp	~ 1,4Amp

Maximum Conditions (See Notes)	EML 12B	EML 20AM	EML 20B	EML 30A
Anode Voltage	500V	450V	550V	500V
Anode Current	60mA	40mA	60mA	40mA
Continuous Anode Dissipation	25Watt	11Watt	25Watt	11Watt
Power Output in Class A	6Watt	3,6Watt	5Watt	3Watt
Grid resistor	below 470k	below 470k	below 470k	below 470k

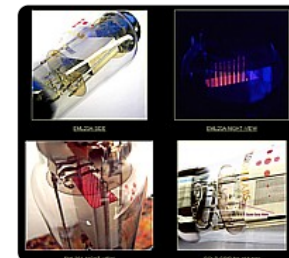
Typical Data	EML 12B	EML 20AM	EML 20B	EML 30A
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small size tube. We encourage you to check the tube curves of any miniature tube, like 6SN7, ECC88 or ECC82, and you will see this series presented here is much superior. However this results of larger 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.

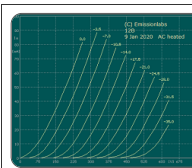


These tubes will often produce a blue glow on the glass. This is because of the wider Anode distance, some electrons

Anode Voltage	390V	400V	420V	400V
Anode Current	40mA	25mA	42mA	25mA
Anode Impedance (Rp)	2k9	4k5	3k3	6k2
Amplification Factor	13.5	22,5	20	32
Transconductance	5.6 mA/V	5mA/V	5,9mA/V	5,2mA/V
Load Impedance (Ra)	8..16k	12..20k	11...19k	19k
Control Grid Voltage (actual voltage may differ, depending on test data)	-16V			

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.

Recommended use	EML-12B	EML 20AM	EML-20B Low bias	EML-20B Med Bias	EML-20B Max Bias	EML-30A
Anode Voltage	390V	380V	380V	420V	500V	400V
Anode Dissipation	16Watt	9 Watt	12Watt	18Watt	25Watt	9Watt
Anode Current	40mA	24mA	32mA	43mA	50mA	22mA
Control Grid Voltage. See Notes	-16V	-10	-9V	-7,5V	-10V	-3V



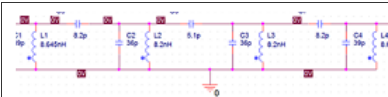
- [Curves 12B](#)
- [Curves 20A 20B](#)
- [Curves 30A](#)



[pdf Print Version](#)

- [Print 12B](#)
- [Print 20A/B](#)
- [Print 30A](#)

DOS Program, using curves as PTE Files
12B-PTE, 20B-PTE, 30A-PTE



[SPICE Parameters](#)

30A Some operating points					
Anode Voltage	Control Grid Voltage See Notes	Anode Current (mA)	Trans-Conduc-tance (mA)	Anode Rp (Ohm)	Gain (mu)
300	-3	10	4.6	8k	36
300	-2	15	5.3	6k6	35
300	-1	20	5.5	5k9	33
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
420	-6,7	10	4.3	8k5	36
420	-5.6	15	5.0	7k	35
420	-4.6	20	5.5	6k	33
480	-8.6	10	4.1	9k3	38
480	-7.5	15	4.9	7k2	35
480	-6.5	20	5.5	6k3	35

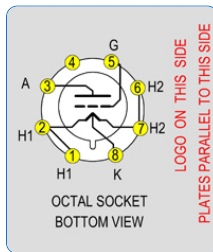
Mechanical Data

UX4 BASE CONNECTIONS (UX4)



Logo on this side
Plates parallel to this side

V4-VERSION OCTAL BASE CONNECTIONS



Pin 1+2: Heater1
Pin 6+7: Heater2
Pin 8: Cathode Tap
(Cathode)
Pin3: Anode
Pin5: Grid

Size including Socket
(but excluding pins)

155 x 58 mm
6.1 x 2.3 Inch

Single Tube weight:
145 Gram

Shipment weight for pair in gift box:
700 Gram

Notes.

- Hard-metals can be used in electron tubes, though these are more difficult to use, and more costly than the classical 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. If it was that easy, we would make the tubes like this ourselves. The specified filament voltage is the one for 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.
- With all DHT tubes, AC or DC heated operation makes the grid bias voltage shift with 1/2 the heater

voltage. (With DC heating, the tube draws less current at the same grid voltage). With DHT tubes, AC heated curves can always be recognized, by the zero grid voltage line, going exactly through the crossing of the axis system (so at the zero Current point). From the same tube, DC or AC heated curves can always be made.

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