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# The 12AX7 / 7025 / ECC83 Tube family

## 12AX7 types at a glance:

Preamp tubes .... a few bits of info:

I received a question from one of the folks on a forum in late 2007 who wanted to retube his whole amp. For his objective I felt it was not necessary to replace every tube. He was making some classic mistakes and after giving him some guidelines and suggestions I felt that some of what I wrote might be beneficial for others.

On preamp tubes ... this is all personal preference but you DO NOT need to change them all. Experiment with V1 ... the tube most close to the input jack. This is 85% of the tone and gain in your amp and has the most effect.

Again ... this is personal taste but a little guideline here is:

**12AX7R** - lowest gain and darkest. Generally better in current driver spots such as effects loops or reverb circuits rather than in the front end. This tube is also known as the Sovtek 12AX7WA and Sovtek 12AX7WC. The gain of the WA is lower than any other 12AX7 type. The gain of the WC is about average compared with other 12AX7 types.

**12AX7R2** - smooth but not bright, sort of mid range in response. Average gain. Great in phase inverter positions too. Also known as the Sovtek 12AX7LPS. How a phase inverter breaks down and passes signal to the output section can affect the tone and feel of your amp. I know some say the phase inverter has no effect. I disagree and am happy to demo this to others and let them decide. In any case, my personal preference in many cases in a longer plate tube for the phase inverter in amps that use 12AX7 phase inverters. This is also a great front end tube.

**12AX7R3** - bright and articulate. Average gain. Can sound a bit thin to some ears in some amps. This tube is also known as the 12AX7EH (Electro Harmonix) and with a slightly different internal structure also known as the Tung Sol Reissue. These tubes are all over the map on specs so if you buy a EH or Tung Sol version get them from a trusted vendor that tests them well. If you get these in the GT Gold Series they are already tested for noise, output, etc. and will be within a good spec range.

**12AX7C** - Chinese 12AX7. The most smooth and linear of the 12AX7 family. A lot of Marshall folks swear by these and in Fender type front ends are really nice. Make sure you use generation 9 only. Generation 7 and 8 are not as nice. Some early generation 4 tubes are prized by some high gain amp folks. There are a lot of "Chinese" 12AX7s on the market and lots are Gen 7-8. There are also a lot of Chinese tube companies and co-ops such as Sino. The only Gen 9 folks I know of at the moment are GT and Ruby. These are a great all around tube. These are also the tube I select for tube preamps or amps with tube front ends and solid state power sections. This is also my pick for bass amps with tube front ends.

**ECC83S** - This is the JJ produced tube and has a short plate design that is very free of physical microphonics. These have a different mid range response than other 12AX7 types. They are the most gainy of any of the 12AX7 family and the tubes that have the highest percentage of ones that fall in the 85+ actual gain spec. The gain of a 12AX7 should be 100 at 250 plate volts with a 2 volt bias but most tubes made today are 75-80 or so. Many of the ECC83S tubes exceed a gain of 90. Just a five point drop in gain in the front end of many amps will turn the amp into an OK amp rather than a great amp as this is the main tone and gain stage in many amps. These have a classic British response; Vox, Marshall, Selmer etc. These are what I use to build the SAG-MHG kits after hand selecting for gain, current output, transconductance and plate resistance.

**Ei 7025** long smooth plate - Not available at the moment from GT or perhaps anybody else as Ei is getting back on it's feet but ... if you can find any of these out there they are the highest gain 12AX7 tube around but tend to be physically microphonic in many amps and if they are working nice today it is no guarantee that they will work that way tomorrow.

**12AX7M** - We have re-tooled this tube almost a dozen times in the four or so years since it's release to make it more consistent, more stable, and just better in every way. They were out of stock for a long time and will be back in December of 2007 with any luck.

The gain is now on par with the ECC83S. They are smooth and in Fender tolex era amps are just terrific and with a Tele will tame the brightness. There is a following of Marshall and 5150 folks that love these in their amps in the past and they look to be much more stable now. This is the tube that I use most often in the SAG-MHG kit as the phase inverter, the third tube in that three tube set. This is a GT exclusive tube.

**5751M** - Think of this as a lower gain (about 70) 12AX7. This is a tube to use in V1 when you want more clean headroom and a smoother response. This was one of SRV's tricks in the first gain stage of some of his Fender amps. This is a GT exclusive tube.

**Preamp Tubes - most critical, least expensive, most overlooked tubes in your amp.**

**The tonal signature of your sound and interchangeable without adjustment or the need of an amp tech.**

Unlike power/output tubes, which are routinely matched when they are sold (in different ways, some much better than others), preamp tubes are tested at best to: (a) make sure they work, (b) they are not microphonic. In testing, we have found that some suppliers don't seem to test their preamp tubes at all, as we have found one side of the triode that is dead at times. Since most warranty preamp tubes for up to 6 months and longer, they possibly figure that is cheaper to just send them out as they get them in, and if there is a problem, it is cheaper to just give the customer another tube. This is of little comfort to somebody that either has to make another trip to their music store, or worse, box up the bad tube and ship it back to the supplier, and then wait for its replacement. This is one reason to consider a proven supplier when you buy preamp tubes.

Today's amplifiers, whether modern high gain types or boutique amplifiers, have one thing in common; the preamp tube in the first gain stage (usually V1 and / or V2) sets the tone and initial gain structure of the amplifier.

**Amp design -**

Today's modern amps get just about all of their characteristics in the preamp section. How the gain stages are set up, how the EQ is set up, gain structure, and tone stacks, all are the main aspect of the sound character of the amplifier.

Amps such as Mesa Boogie, Fender, Marshall, Bogner, Peavey, and others, all use the same Sovtek, Svetlana, JJ/Tesla, Electro Harmonix, and other power tubes from the same factories. In spite of the same output sections, and in many cases the same range of B+ voltages on the plates of the output tubes, these amps sound different. This is all because of different designs, primarily in the front end, or initial gain section of the amplifier.

#### Inconsistencies -

Today's newly made preamp tubes are very inconsistent compared to the tubes of the 1940s to 1960s. There is little need in the medical sector or the military sector for tubes. They are primarily used today in audio applications. For the high end audiophiles, their needs are more easily met, as their tubes are not subjected to the same stresses as those on a guitar amplifier, they use less of them, and they last much longer. There are high end audio suppliers that will match tubes and hand select them, at much higher costs (check out a Western Electric 300B matched pair for example). They pop their tubes in, and ten years later, all is still just fine.

Tubes for the guitar and bass player for use in the preamp section, are a different story. The tubes today are very inconsistent. You contact your local tube supplier, plunk down your money, and the roulette wheel is now set into motion.

To show the inconsistency, we went through a batch of over 100 tubes that were from the Electro Harmonix 12AX7EH, ECC83, 7025, Sovtek 12AX7WA, LP, LPS, Chinese 12AX7C (old tooling and new tooling), and a few others.

Basically, the standard 12AX7 spec that applies to 12AX7 / ECC83 / 7025 tubes, has a reference of 1.2 mA at 250 volts with a -2 volt bias.

Some people like to use those little references that say if you want less gain than a 12AX7, use a 12AT7, as it has only 70% of the gain of a 12AX7 etc. These little tips are cute, but with the wide range of inconsistency out there, they are not all that useful, as it is still a matter of chance. The 12AT7 has a different current capacity than a 12AX7, so if you are just looking for less gain, then you may, or may not get it with just a different 12AX7, even from the same brand, same date code, and same batch - just by swapping tubes around already in your amplifier. With today's inconsistent offerings, the old tables of gain cannot be used with much accuracy.

In the tubes we went through, keeping in mind our 1.2 mA / 1600 transconductance industry standard spec, we found our samples ranged from 0.7 mA to 1.6 mA. When you take into account, that the amplification factor of a 12AX7 is 100, there is a dramatic difference in these tubes.

Looking at a 1.6 mA tube, we see a factor of increase over the standard of 33%. This is a LARGE number. A 1.0 tube versus a 1.2 tube will turn the gain you loved in your 5150 into something less than what you used to know what you liked there. You sit dumbfounded - how can this be? I just put in new tubes, the same as what I had before?

You want even MORE GAIN from your Triple Rectifier or Bogner ? look at those first gain stage preamp tubes, and get some tube vendor to measure them for you. If you have a 1.1 in there, and put in a 1.3, you will hear the difference in gain IMMEDIATELY. This is not a subtle change that only the "experts" can hear. Leave the settings on the guitar and amp the same, swap the tube, and listen again.

When we see a transconductance of 1200 versus the 1600, the way the tube reacts is different too, in this case, its rise time is about 25% slower. This might be just the ticket for a blues player, looking for some nice initial compression on the pick attack, but it may not be the sound for a metal or speed player.

Transconductance in the testing, ranged from 1060 to 1790. 1600 is the industry standard.

There is one other aspect of preamp tubes. Unlike power tubes, where one tube is one tube ? a preamp tube is two tubes in one bottle. There is an A side and a B side. The are independent units sharing only the heater. In a Marshall amp as an example, the NORMAL channel input 1 uses one side of the tube, and input 2 (lower gain input) the other side. The BRIGHT channel uses the other side of the preamp tube. BUT, anytime we use that tube in the phase inverter position or driver position of the amp (which is the driver for the power tubes), then having the two sides matched is important. This matching subject has been covered before, so I won't elaborate on this again here.

#### New versus Vintage amp needs -

NOS tubes are sought after by folks that have original amps like Fender Tweeds and the like. If you want the original sound, feel, and character of these amps, then NOS is about the only way to go. Getting NOS tubes for your amp to be correct is much easier in some ways than getting decent new tubes for an amp. There are folks that deal with NOS tubes. Some of them are on my website, but I will say here, that I can recommend KCA and Tube World very highly. Either of these folks have the tubes and the equipment that will let you know that when you purchase a Mullard or RCA 12AX7 or whatever, it's characteristics will be noted for your information. If you are in Europe, check with Watford Valves, as they also have NOS offerings. Eurotubes in the USA, a JJ importer, also may have some NOS offerings.

When it comes to new tubes for you modern or class amp, or new boutique amp, there is the problem. Preamp tube suppliers guarantee the tubes to work, and not be microphonic. That is about all they can do. Going though tubes that retail for less than \$20 in most cases, one at a time to measure them, is beyond reason economically. Watford Valves will do this for folks. Other folks offer these services, and in most cases, they are an additional cost. In my mind, the money is well spent. When you want a nice high gain tube for your Rivera or Demeter, putting in a tube that is 30% down from spec., is not the ticket! At that point, what can you do with that tube? Take it back? Why? It works. The store or vendor never stated it would do anything more than "work". Perhaps they will exchange it, and now you start the process over? And over. And over.

Recently I was going with a fellow named Tom Dunn. He plays a 5150 II. We performed a blueprinting session of his amp, and it was found after working through maybe 2 dozen of his own tube stock, that he had picked out his tubes by ear, and placed them in the most advantageous position in his amp. You can do this by ear, if you have the ears of this guy, and also the time (he did this over many months), and the tube stock.

#### Conclusion -

Your first gain stage in your amp is its soul, sound, and character. We talked here about gain, and a little about rise time, which is a subject in itself. We did not get much into "sound", such as the articulation and definition that comes from NOS tubes like the Mullards and Telefunken's. If you have an older amp with a more moderate gain structure, and want it to sound closer to magic, than this is the way to go. In a modern amp, a lot of the articulation from the output section is not the target of these designs. Today's designs look for two or three or more stages of gain, channel switching which we did not have on the older amps of yesterday, and flexibility. The only flexibility we had when I was the age of most of you, was a high gain input and low gain input ? or tuning the reverb on or off J

All I can suggest, is try to find a tube vendor that can supply you with the tubes you need with some degree of classification. This way, if you have a 1.3/1670 tube in there now, and you want to tone it down a bit, then maybe go for a 1.1 ? it will make a difference. If you want tonal changes in color, rather than gain and compression, then you want to go with a little stash of tubes, depending on your use for the day or evening. Most of my clients keep the following:

JAN 12AX7A - Most often general use.  
 12AX7C - Chinese 12AX7 - take off some amp edge or brightness  
 12AX7EH - Electro Harmonix - general use  
 ECC83 - for the Marshall sort of sound  
 7025 - for the Fender 60's and 70's sound

5751 - for blues and less aggressive attack (and perhaps less gain as compared to an in spec 12AX7)

**Marshall trick if you use pedals:** When you use most pedals, the input of your amp is loaded in a different way than without the use of these. This also add capacitance, and rolls of some of your high end. If you want to get back the "edge" with your Marshall, try a 7025 in V1. This will usually make a Tele or Strat sound too bright without pedals, but may be just the ticket to fix the problem when pedals are used. On which 7025's to use ... this tube has a long plate structure that is a bit prone to microphonics in some cases. My clients use the Groove Tubes version of this tube as they seem to be screened for microphonics to the point that they work more often than many of the other versions available, even from the same manufacturer.

**More detailed information on preamp tubes and their output, matching, and other aspects can be found by [CLICKING HERE](#).**

Some of the following reviews are courtesy of Watford Valves in the U.K. These are purple. My reviews are more technical in nature and a bit more "black and white", so these reviews by Watford Valves are really nice when you want some "tone" viewpoints. I have to say, I cannot disagree with these folks. There is a link at the end of the reviews to their website. The most up to date test data and reports will be found in the Tube primer documents elsewhere on this website.

### **ECC83,12AX7 Test Report from Watford Valves in the U.K.**

#### **OBJECT OF THE TEST**

To establish the best sounding ECC83/12AX7 of both New Old Stock and current production variety.

#### **EQUIPMENT USED**

The amplifiers used were: 70 's Fender twin reverb fitted with J.B.L's. A 70's Fender twin reverb fitted with original Fender blue back speakers. A Mesa/Boogie mark 4 combo. Marshall 100 super lead into 4 x 12 cab. Fender Princeton reverb 2. Vox AC10 with Elac speakers. Guitars used where a 1973 Fender Stratocaster, 1980 Yamaha SA 2000S semi acoustic and a 1980 Gibson Les Paul Standard.

Audio tests were carried out using a Croft Micro Audiophile pre amp. A Leak stereo 20 power amp trough Tannoy 15' super reds. The source was Thorens TD150 Grace & Supex & A.R. Legend, Linn arm & Denon Cartridge.

The tests were carried out to provide in real working and playing situations how the valves performed. The test rig use to select the valves prior to evaluation was our own custom designed unit [click here](#) for picture.

Valves were selected for low microphony, low noise and gain rated [Click for more info](#)

Mullard ECC83 & Mullard M8137 Box anode, R.C.A 7025 & Telefunken ECC83 Where used as the reference.

The test reports have been updated on 1st September 2000. We used the same equipment with the addition of a Fender pro junior and the same reference valves for evaluation. All the valves tested where selected to the same specification as our original test samples. The new valves tested where, The French Mazda 12AX7 military grey plates, The French Mazda 12AX7 military silver plates, The Tesla N.O.S E83CC/ECC803S Telefunken replica new old stock valves. The only new current production item being the Sovtek 12AX7LPS.

#### **ECC83/12AX7LPS SOVTEK**

The new Sovtek 12AX7LPS valve is now in full scale production in Russia. The valve is of medium to high gain and has a special spiral filament. This filament greatly reduces hum when operated in amplifiers with AC heaters. This is certainly the best 12AX7 that Sovtek have come up with. On the plus side in audio you get more detail in the treble register. The valve is open and has very balanced presentation and importantly the valve has life and sparkle not muddy like the WA or WB. Over long periods the valve was easy on the ear again unlike the other Sovteks we have listened too. Bass response was fine, not as deep or thundering as the Mullard , Brimar or JJ/tesla but one could easily pick out the bass line. The minus points were on vocals as they were not as refined as the new old stock tubes.

In Guitar amps we noticed that the level of microphonics were higher than the WB, This would be also be consistent with the higher gain of the tube. The valve gave a bright and clean sound but not as sharpe as the G.E. When the valve distorted it retained it's control and sounded sweet. Overall this is a very good sounding valve that provided a good choice for audio or guitar.

#### **ECC83/12AX7 MAZDA GREY PLATE**

A French military valve that is noted for it's Mullard Tone. In audio application these valves were detailed , lively and very balanced. Plenty of bass slam in these babies. In guitar amps these rocked. The valves are very high gain, yes more gain than the famous Mullard ECC83. The distorted tone was rich and fat . Treble response was clear even when really distorted. The valves were supremely quiet, however due to the immense gain special selected version would be needed if your amp has a cascading gain pre amp section.

#### **ECC83/12AX7 MAZDA SILVER ANODE**

A French military valve with special silver plates made for special application military use.

In audio amps the valve displayed a slight treble forwardness. This gave the impression of less bottom end thump when compared to the Mazda grey plates. A Fantastic detailed performer the sound stage was big . The valve was again very quiet which shows how well made they are. The gain on these valves are somewhat less than the grey plates but still in the medium to high gain bracket.

This valve was amazing in Fenders. That sweet rich out of phase sound with a strat just jumped out of the speakers. The valve was more percussive than the siemens E83CC and with a sweet alnico speaker the guitar sung. It's compression was quite late giving bags of clean headroom. For that sweet Fender tone these have no equal.

#### **ECC83/E83CC/ECC803S TESLA**

This valve was the Czech replica of the famous Telefunken ECC803S. The valve has the large "A" frame getter and thick grade glass which eliminates microphony. The valve also retains the gold pins and plate structure of the Telefunken. This valve is not the same as the new JJ/Tesla E83CC. The first thing that strikes you is that it is very quiet and the valve displayed no microphonics whatsoever. Beautiful on female vocal as it has a super midband, very fast and dynamic. We dug out our private stash of real Telefunken ECC803S and noticed that these were identical in every way including the sound ( except for the diamond mark). The valve is not as high gain as the Mazda Grey or the RFT. Sonically this was excellent. Rich bottom end silky smooth treble and nice balanced.

In Guitar amps the sound stage was big, no rings, no pops just your guitar. This valve seemed very neutral not colouring the sound in any way. When pushed into distortion the valve sounded rich with super late compression. This valve is super it just does what it is supposed to do nothing more nothing less.

#### **ECC83/12AX7WA SOVTEK**

Low to medium gain double triode with the same sound quality and less gain than the WB. When distorted did not have the detail or balance of n.o.s valves. The valve seemed to be pushing everything through the mid band. When pushed hard the sound compressed very early. Good for general repairs.

#### **ECC83/12AX7WB SOVTEK**

Low to medium gain double triode with low microphonics. Clear bright sound earlier distortion than WA. The valve lacked clarity and definition of new old stock valves. Same sound as WA however far better than the Chinese 12AX7. No snap crackle and pop.

#### **ECC83/12AX7WB SILVER ANODE SOVTEK**

This is the early silver anode WB as used by Groove tubes. Many of our customers tell us these have a better sound than the current production type. We found that they sounded identical to the current WB but we found generally that they had higher gain than the modern item. This resulted in the distortion happening a little earlier, therefore we found these to be a good choice for guitarist on a budget.

#### **ECC83/12AX7 Sylvania**

Classic American valve which was fitted by all the great 60's amplifier companies such as Ampeg, Fender & Gibson. This valve produces a rich warm sound with excellent balance. When distorted produces a fat sound with plenty of drive without loss in top end clarity. In the Fender amps the valve produced a clean bright response which was great for finger picking. Single coils sounded full with no harshness and plenty of detail. In the Boogie a sweet clean sound was easily attained which was crisp and clear. Once you rocked the Boogie the Sylvania valves produced a classic rock sound with a little mid forwardness which I liked. In the Boogie we found that due to the high gain nature of the amp low microphony selected valves produced the best results. Early 1960's production ideal choice for all vintage Fenders.

#### **ECC83/12AX7WA Philips-JAN**

American military low noise valve made in the famous Sylvania plant in emporium. It retains the classic warm solid sound of the early Sylvania but has less drive. This proved useful in the Boogie as the lower gain of the valve gave less microphonics. Mid range was very musical with all the clarity of the Sylvania. the bottom end was superb and in comparison to the Sylvania sounded a little tighter and better defined which was welcomed in the Marshall amps. The bass was not as deep as the Mullard but the Philips did have that instant British style tone. In the Fender amps all the tone that you would expect was there. This is a superb valve and an instant upgrade for all modern amps.

#### **ECC83/12AX7WA G.E.-JAN**

This is a rugged American military spec valve of immense quality. This is the same valve that was standard in 70's Fenders. The G.E valve is famous for it's big crisp sound stage and bright top end response which breathes life into Fenders. This valve really supplied that authentic Fender twang. The valve was brighter than the other American valves and also worked really well in the vox by giving it a clearer top end response. When the valve distorts it has a rich harmonic feel and chime. Even under heavy Boogie distortion the bass and mid range detail was also superb. Thoroughly recommended.

#### **ECC83/Mullard**

The legendary British valve which is the most sought after ECC83/12ax7 type of all time. The key is the way the valve distorts. It reproduces exactly what is driven into it with great musicality. It combines smooth drive with balanced low microphonics. The Mullard reproduces every subtle detail with a rich sound stage. When overdriven the valve had a 3 d effect which made the valve really sing. This sounded amazing in the Boogie. The noise level even at full saturation were very low. The bass response has great kick without loss of definition. We came to the conclusion that this was going to be a hard act to follow.

#### **ECC83/M8137 Mullard BOX ANODE**

The special military grade Mullard is one of the lowest noise and distortion types ever built with a superb box style anode plate. Raved about by vacuum tube valley and quite rightly so. The sound stage is detailed and relaxed and it handles complex music with ease. If you want the best audio valve then this is it as it has less distortion than the standard ECC83 Mullard. The mid band is superb with vocal rich and clear. Now very rare and sought after. For audio, stamps on the Telefunken ECC83 and leaves it for dead.

#### **ECC83/E83CC Siemens**

Original German valve with extra mica support at the top of the valve and ribbed anode plate. Well balanced with large sound stage with low distortion. Relaxed and very detailed. The valve had a real percussive ability which was great for Fender style picking. Bass & treble where in correct proportion. The valve also had a superb mid band response which was not as detailed as the Mullard but crisper than the U.S valves. Superb in audio applications on acoustic or Spanish guitar as this gave the impression that the guitar was being played in the same room. Super in the noise department and was as quiet as the box anode Mullard. This valve can be highly recommended for audio or guitar.

#### **ECC83/TELEFUNKEN**

The classic German low noise ECC83 which provided a superb rich sound stage. The valve was electrically well balanced but did not have mid range honk or bite of the Mullard ECC83. The midrange detail of the m8137 also left the tele in the shade when we used it in an audio test. The valve shares all the Siemens strong points and does everything exceptionally well. Clarity is perfect with no fuzz or bass distortion. This is an all-time classic valve and has a very high regard in audio circles.

#### **ECC83/R.F.T**

German valve that I have seen also branded Brimar, Siemens & Telefunken. This tube was also used for a long period by Marshall. The valve has a rich bass response with great drive. Very low in microphonics due to thick glass envelope. The valve also distorts earlier than the U.S.A types. The valve does show less treble response than the U.S.A types which lends the valve to be used in a more rock style set up. The rich harmonic distortion make this a great valve in Marshall. Boogie and Vox amps. It showed rich sustain with plenty of bass crunch. Mid range was clear and detailed. Defiantly for the rockers and blues players.

#### **ECC83/CV4004 Brimar**

British military spec with half flange anode. Instant British rock sound. Exceptional balance and sound staging with great drive. Has not good the rich harmonic distortion or the unique 3d effect of the Mullard and under full distortion does not appear to have the same bite. The presentation is relaxed and musical which all the new ECC83 types do not match. It does everything it should do excellently.

#### **ECC83/TUNGSRAM**

Hungarian valve which is identical in construction to the Mullard. It has additional internal supports which greatly reduces microphonics. Good balance with clean top end response. The valve sounded vibrant in the Fenders and was low in noise. This is very important in old Marshall if you want to make the amp cut through by increasing the presence control setting without all that hiss. The Tungstram does need around 48 hours run in to get the best out of it. The valve had more headroom than the R.F.T. and was as quiet as the Mullards.

#### **ECC83/12AX7 CHINESE**

This valve tended to be fitted by all the major amp manufactures when it was in production. On the plus side the valves have good gain and low microphonics, which suited the Boogie and the Marshall amps . The drawback is its complete lack of tone. This gave the wasp in a jam jar trade mark sounds. The treble was fizzy and the bass response gave a hazy distortion. The music sounded like a vale was placed in front of the speaker. The valves also after small amounts of gigging tended to sound harsh and brittle. Therefore we do not recommend this type. (The latest Chinese 12AX7C made on new tooling is currently under test and has shown some positive results at Westwood Music.)

#### **ECC83/E.I YUGOSLAVIA**

This valve closely resembles the Telefunken ECC83 due to its' smooth anode plate design. This , however is where the comparison ends as the valve sounds nothing like the tele. The valve is far too microphonic for use in guitar amps. We have even tried so called selected versions from other dealers and even Boogie branded items all of which are in our opinion unusable except as phase splitters. The valve does have plenty of gain and have a rich rock sound. The downside is that even ones which are low in microphonics seem to go microphonic within a few months. Therefore we don't recommend its' use in guitar amplifiers.

#### **ECC83/E83CC JJ TESLA**

We re-evaluated this valve as early production items seemed to produce excessive hum which rendered them useless. The valves gain characteristics place it in the medium to high gain range. The bottom end response is clean and clear. The valve has a solid structure which makes it free from adverse microphonics. Tonally these are great. The mid range has a slight blurring which seems to increase the harder you push it. Great for rock sounds but not ideal for clean. The top end is sweet clear and has nice sustain.

#### **ECC83/5751 G.E.-JAN**

This is a low gain valve which produced all the classic G.E sound stage and performance as described with the 12AX7WA. The valve was very low in distortion and very difficult to clip. This is an excellent valve for use in Fenders or any clean stage application. The sound was bright and vibrant

with plenty of detail. The valve was very well balanced indeed it was very easy to get identically matched valves. This valve is far better than any currently produced valve for clean pure Fender style twang.

### **ECC83,12AX7 Test Conclusion**

The first thing I will say is that under these tests the unanimous conclusion was that the new old stock valves offer better sound quality than the current production types. The second thing is that tonality is in the ears of the listener and you may find that a current production item has exactly what you are looking for. So try as many valves as you can until you find the sound you are looking for.

#### **Guitar valves**

The Mullard ECC83 was the clear winner as its own superb character shone through. Detail, sustain and perfect balance were second to none but what won the day was its' superb 3 d distortion character which not even the Mazda grey plate could match.

The runner up was a very close race. The RFT had a great rock tone and Mullard style gain. The valve could be made to distort very easily and was really at home in the Marshall and Boogie amps. This is ideal for the rock player as bass crunch is there in abundance. The Tungstram was also close. This valve had detail, balance and large sound staging. This was a good all round valve with less balls than the Mullard or the R.F.T. The R.F.T & Tungstram are exceptional valves and will work well in any situation.

The Siemens E83CC was the runner up in our last test report up by virtue of its percussive nature in the top register. Some people thought this was due to its treble forwardness. The silver anode Mazda was definitely better for finger picking as it seemed to jump out of the Fender amp and demand attention. The Siemens still retains that position as it was a better balanced valve for audio use.

The Tesla E83CC/ECC803S was the best all rounder as it is very well made and it will let the music sing through with no additions. The valve had detail, balance and finesse. The valve is as rare as the Telefunken and for use in valve microphones is a dream as super low noise.

The Mazda 12AX7 grey plate are Mullards on hyper drive. Mass gain, this is the most powerful valve in terms of output we have ever measured. It is a great rock valve but just does not have the Mullards unique distortion character or freedom from microphonics. Superb in vintage amps where you need a little more bite.

The G.E. were considered to be the most American sounding due to its bright nature. I love the sound stage and crisp distortion of this valve and it is certainly a great all round valve with low microphony.

The Sylvania and Philips valves all showed a similar sound quality. The Sylvania valves were of higher gain and higher drive than the Philips. This would lead to if the valves were unselected to microphony in critical driver positions. The Philips seemed to be tighter in the bass area but retains the classic mid band warmth. This I love and I must say it really sounds good in Fender amp.

The Brimar CV4004 is a classic British sounding valve. Refined and well balanced and does everything it should very well. The valve is not aggressive as the Mullard, G.E. or the R.F.T.

The current production items in terms of pure sound quality the Tesla JJ and the New Sovtek 12AX7 LPS are top of the bunch. The E.I valves also sound good but are just so appalling in the microphony department that in our opinion it is unusable in guitar amp. Many dealers advertise these as tested and low noise. They may be low noise compared to each other but I have never found any that are true low noise low microphony when compared to a Mullard, Siemens, Telefunken & Brimar.

The current Tesla JJ valves are higher gain than the early production years and are used heavily by Groove tubes & Mesa Boogie. The valve generally has a good rich sound with a forward presentation. When pushed really hard the valve can sound a little rough around the edges. The valve has less top end sparkle than some of the new old stock tubes but has plenty of bite. The audio boys may look for a brighter top but this is the best sounding current production ECC83/12AX7 for rock guitar around.

The Sovtek valves are certainly low on microphonics. This is why they are used by more o.e.m than any other valve. The WB and LPS are the best for guitar. The LPS seems to be cleaner and sharper than the other Sovteks. What you lose in low microphonics you get back double in terms of gain. This provides more crunch, more drive and more musical than any other Sovtek before.

The Sovteks do tend to suffer from a little mid range fuzz when pushed and lack the mid range detail of N.O.S valves. The LPS goes a long way to redress the balance. They offer exceptional value for money and are available in quantity.

#### **Audio valves**

Here we are looking for the ultimate detail, fast dynamics and musical involvement. One valve has it all.

The winner is the Mullard M8137 box anode. This simply sounded more involving and musical than the Telefunken or the Siemens. The Mullard ECC83 was also close and is a testament to how well made the Mullards are.

The Mullard just had the most detailed mid band with close mic work easily heard through the speakers. The German valves were all very neutral as was the Tesla E83CC/ECC803S New old stock. The R.F.T just lacking the top end richness and sharpness and bottom end clarity of its' West German cousins. The M8137 showed less distortion than The Mullard ECC83. Both these valves had that bit more detail in the midrange which makes them stand out from the pack.

#### **Two dark horses both of which made late claims to get into the ratings.**

The G.E 5751 is simply a superb valve which showed all the G.E character but with lower distortion levels than the G.E 12AX7.

This I feel is next audio valve which a few years from now will get more and more sought after and more expensive. The valve was specially balanced for identical triode section and has a lower amplification factor (70 mu) when compared to a ECC83/12AX7 (100 mu). The valve had a musical and pleasing sound.

The Mazda grey anode and silver anode are fantastic sounding audio valves. The silver plate is a more musical more detailed G.E type sound. It also seems to handle any music with authority. The grey plate is The Mullard ECC83 before they came of age. Not Quite the Mullard but very close.

The Tungstram is a superbly rich and musical valve. The valve is low noise and has a very sweet treble. Which is full of depth and definition.

The simple rule to remember is that all the valves do sound different and it may be the least expensive valve that meets your needs. Once you have found your preference always get some spares because in life three things are certain, death, taxes and N.O.S valves will dry up.

These tubes are currently available on the net from [www.watfordvalves.com](http://www.watfordvalves.com)

In the U.K., they use a bit of different terminology than we do in the USA. They call a car's hood a "bonnet". They call a circuit ground "earth". What we call a tube, they call a "valve" (which is a lot more accurate than calling it a tube by the way).

This chart from Watford Valves does a little astray of my terminology. They call V1 a *DRIVER* valve while I refer to it as the first gain stage. I normally



This chart from Watford Valves gives a nice survey of my terminology. They call the DRIVER valve tube model as the first gain stage. I normally call the phase inverter / driver the "phase inverter or driver". What I call the phase inverter or driver, they call the BALANCED VALVE, which again in essence, is really what it should probably be called, as in an amp with more than one output tube, where there are two, four, six, or even eight output tubes, they are generally driven in a hopefully *balanced* way by the A and B sides of this tube.

Keep this in mind when I am talking about preamp tubes, and when you order tubes from Watford Valves. As far as I know, Watford Valves are the only folks that do this as a general practice, and are the only folks with a standard and reproducible rating system for preamp tubes. What this means, is that if you had a WV 225 before, you can order another 225 in the future. With any other preamp tubes, is a pure crapshoot, where they generally vary -50% to +40% in all of our testing, regardless of type of tube or manufacturer.

If you want your amp to sound the same as time goes on, this is cheap insurance. If you decide that you want just a touch more gain, then next time you try a WV 250 or 260 as an example.

## The Watford Valves preamp tube rating scale

We term the **Driver valve** to be the valve which runs the distortion channel normally the first valve in a Marshall super lead head. The **balanced valve** being the phase inverter which supplies the signal to the output valve.

Here is a chart which will help you in choosing the valve most suitable to your Musical style.

### Drive Rating System

150-200	Low to medium gain generally gives a bright clear tone with fat compression.	Suited to Fenders if you wish to maintain more head room so the amp sounds cleaner.
200-250	Standard gain generally gives good drive to the output valves with quicker overdrive.	Great for all rock and blues players with cascading gain pre-amps.
250-300	High gain generally gives really big fat distortion at low settings on your pre-amp.	Suitable for those critical driver valve positions if you want to thrash. Amazing in the Soldarno SLO 100.

## The Groove Tubes SAG scale

The Groove Tubes scale and Watford Valves scales are similar in some ways. There are a few differences, as GT rated SAG (Special Applications Group) tubes are also selected for rise time, gp and gm. Both GT & WV supply Matched Phase Inverters, which are called "Balanced Valves" by Watford Valves.

### Basic Scale Color Chart

Milliamps	WATFORD VALVES	LOW	MED	HIGH
				12AX7/ECC83/7025
0.6	150	50		
0.7	163	58		
0.8	176	67		
0.9	189	75		
1.0	202	83		
1.1	215	92		
1.2	228	100		
1.3	241	108		
1.4	254	116		
1.5	267	125		
1.6	280	133		
1.7	293	142		
1.8	n/a	150		
1.9	n/a	158		
2.0	n/a	166		
2.1	n/a	174		

Keep in mind that the higher the gain, the higher the noise and worse the signal to noise ratio. Using two very high gain tubes in V1 and V2 in many circuits will limit the flexibility of your volume, gain, and master controls as too much initial gain will result.

The GT scale begins it's HIGH rating at 100, as this tube is also selected for a faster rise time than original 1957 spec tubes.

80% of today's production tubes, no matter WHO the maker, fall into the range of 50-75, far below spec of the past. If you do not want selected tubes, the other option is NOS tubes, as their quality control was far better when tubes were used in medical, scientific and military applications.

ALL TUBES ARE NOT AVAILABLE IN ALL RANGES. Different batches of tubes yield different results. An ECC83 may have much more gain as a group than a Chinese 12AX7C in one batch, and the opposite results in the next batch. If you request a "high" spec GT SAG tube, it will be in the lower of the high ranges (100-150). You may specify a requested rating and Groove Tubes will try to come close, but depending on which 12AX7 tube you request, not all ratings are possible.

The Groove Tubes SAG tubes may be ordered directly off the Groove Tubes website by [clicking here](#). You may specify specific ratings which may or may not be available. You may direct inquiries, or receive assistance in selection or building a specific kit by emailing me directly at [techsupport@groovetubes.com](mailto:techsupport@groovetubes.com)

As of May 15th 2003 - all factory test results will be published in the Tube Primer book or in my data online on this website in the prints and tube spec area. I cannot keep adding server space to this website, and having all the current and historical information in one single document will be better for all parties concerned.

Aug 02 Sovtek 12AX7WA curve traces [click here](#)

NOTE: The conversion scale to the left was done by me in 2002. Since 2005 I have been using a scale that takes into account transconductance, current output, plate resistance and actual true gain.

Unless ALL the above factors are taken into account you will not know what a tube is doing. A tube that passes with high TC numbers on a conventional tube tester can have low plate resistance (and most do these days) and then it will have very low gain.

Conventional tube testers do not measure true gain. The VTV tube tester has a "gain" scale that has nothing at all to do with the actual gain or even the transconductance of the tube.

MOST OF TODAY'S TUBES IN THE 12AX7 FAMILY have a true gain at least 15% less than spec. Finding a tube with a gain of 80 (100 is spec at 250 plate volts, 2 volts of bias and 62.5K of plate resistance) is VERY common.

The high gain kits that I developed at Guitar Amplifier Blueprinting that were turned into a GT product a few years later have tubes that are graded by me and only me as I am the one that developed the scale that takes all the above factors into account.

## Preamp tube characteristics

Tube	mA	TC	Mu (gain)
12AX7 ECC83 7025	1.2	1600	100
12AT7 ECC81	10.0	5500	60.5
12AY7	3.0	1750	44
12AU7 ECC82	10.6	2200	17-20

mA is current in milliamps. This is standard 1957 industry spec at standard test reference voltage and bias settings.

### 12AX7 New Mfg Tube test results - Factory Bulk Tube Tests

#### Aug 1 2002 - Guitar Amplifier Blueprinting

Tube	Tolerance	Ave output	Ave TC	TC Spec
12AX7C - Chinese	25.0%	85.83%	1401	1600
12AX7R2 Sovtek LPS	33.0%	75.00%	1427	
12AX7R3 Electro Harmonix	41.7%	90.00%	1468	
ECC83 JJ	41.7%	109.17%	1552	
7025 - Ei	42.0%	72.50%	1269	
12AX7R - Sovtek 12AX7WA	92.0%	85.00%	1310	

#### Aug 15 2002 - Guitar Amplifier Blueprinting

Tube	Tolerance	Ave output	Ave TC	TC Spec
12AX7R3 Electro Harmonix **	25.0%	92.50%	1430	1600
12AX7C - Chinese *	33.0%	75.00%	1400	
12AX7R - Sovtek 12AX7WA ***	33.0%	89.17%	1295	
ECC83 JJ *** **	42.0%	100.83%	1448	
7025 - Ei ****	66.7%	77.50%	1406	
12AX7R2 Sovtek LPS ** **	66.7%	74.17%	1378	

\* Better TC than Sovtek 12AX7WA and more linear curves. Less microphonic

\*\* The new winner this test. Even closer than the Chinese, but the Chinese holds consistency. Samples from GT ranged 11.2% spread. Samples from four other vendors had same range, or worse for one, than factory untested items.

\*\*\* I think that Groove Tubes pressure (due to buying hundred of thousands of preamp tubes a year and maybe being the factories largest client) was able to push improvement. This batch is much better than the last batch, or they are hand picking thing to be sent to GT?

\*\*\*\* Different plate material. Dark plates rather than silver shiny. Better vacuum, they do not "flash" as much as previous tubes. Higher output than last factory run. Higher percentage of microphonics also due to higher gain.

Less consistent than last batch. If GT graded, these are good tubes. If from unknown vendor then watch out and test first.

\*\* \*\* Tolerances got much worse from last batch. Output dropped a bit also and TC degraded. Do not use for clients unless they come from GT or are screened very closely.

#### Sept 03 2002 - Guitar Amplifier Blueprinting - ranked by consistency

\*\*\* \*\* Still the strongest tube in the 12AX7 family. Showed the same level of consistency from last factory batch.

Will be more microphonic due to higher gain in some amps. Curves have mid and high end push that is not as linear as 1957 spec. Mids higher than 7025. 83.02% high end 35 bit stronger than ECC83.

Tube	Tolerance	Ave output	Ave TC	TC Spec	Gain
12AX7R3 Electro Harmonix *	17.0%	86.67%	1434		89.63%
12AX7R - Sovtek 12AX7WA **	17.0%	72.50%	1172		73.25%
12AX7C - Chinese	42.0%	88.33%	1550		96.88%
12AX7R2 Sovtek LPS ***	50.0%	76.67%	1494		93.38%
ECC83 JJ ****	50.0%	80.83%	1372		85.75%
Svetlana 12AX7 *** **	Useless tube				

The factories are listening, and making changes to tooling and fine tuning their procedures. It seems in most cases that improvements are being made with each new batch.

\* most consistent, gain lower than Chinese, but not by much. Output a touch less than Chinese, but this is a great tube from this run. Consistency improves with each batch from factory

\*\* Some may think this tube is quiet. It is quiet because it has much less gain than spec. The factory fixed the inconsistency quite well, but at the expense of gain and output. This tube's gain and output are down over 25% from spec tube.

\*\*\* Much improved over last factory run. Only 10% of the tubes fell below 80%, which threw overall results off a bit. Overall, improved.

\*\*\*\* Continued to use dark plate material. Less flash than previous runs when power applied. A vast

\*\*\*\* continued to use dark plate material. Less flash than previous runs when power applied. A vast improvement over the last batch. It just indicates that the end use should know where his tubes came from and how old or new they are. Output very close to R3 (the best in this run), but the gain of this 7025 is better than the R3.

\*\*\*\* The ECC83 - what was the strongest 12AX7 in the past is now the one of the weakest. It's consistency is in bottom of the current group.

### October 7 2002 new preamp tube tests

#### OCT 07 2002 - Guitar Amplifier Blueprinting - ranked by consistency

\*\*\* \*\*\* was so inconsistent, that this tube might be used for little more than display of what a tube looks like, or a game of catch on a hard surface where an audible indication of broken glass would limit arguments on whether the object was caught or not.

	Tolerance	Ave output	Ave TC	Gain
12AX7R3 Electro Harmonix	25.0%	95.00%	1507	94.19%
12AX7C - Chinese	25.0%	82.50%	1461	91.31%
ECC83 JJ	33.0%	92.50%	1467	91.69%
12AX7R - Sovtek 12AX7WA	41.7%	78.33%	1190	74.38%
12AX7R2 Sovtek LPS	50.0%	83.33%	1469	91.81%
7025 - Ei (waiting for samples)		0.00%		

On average, between 300 and 1000 tubes are run for each test. The overall winners here seem to be the 12AX7 Electro Harmonix and the 12AX7C from China in the latest version 8 variant.

Test equipment used:

RCA WT-100A

Tektronix 570 vacuum tube curve tracer

Vacuum tube valley small tube characterizer for quick balance checks prior the Tek570 and for all microphonic and noise tests prior to amp testing. This is a GREAT piece of test gear that even fits in a tool box. You can see more on this by [CLICKING HERE](#)

Listeners preferred the two above tubes for overall sound, touch dynamics, and signal to noise ratio. Amps used were:

Fender Blackface Showman  
Marshall JTM 45  
Marshall JCM 900  
Groove Tubes Soul-O 45  
Groove Tubes Soul-O Single  
THD Univalve  
Fender Pro Reverb (newest series)  
Vox AC-15 vintage  
Dr. Z Maz. Jr.  
Mesa Mk IIC.  
Mesa Blue Angel  
Fender Deluxe Reverb 60's  
Fender Super Reverb 60's.  
Rivera TBR-1M  
Rivera Fandango

Guitars used:

Gibson SG Standard (P-90)  
Rickenbacker 360-12  
Fender Strat  
Fender Tele  
Music Man EMG Luke model  
Gibson ES-335  
Guild Starfire (60's)  
PRS McCarty Soapbar  
PRS Custom 22  
Gibson Les Paul Custom 70's  
Gretsch 6120 Re-issue

Additional preamp tube comments:

12AX7C - Chinese - Very linear curves. Best match on A and B sides of any of the 12AX7 family. A bit warmer in some amps than EH. The choice here is the 12AX7C or the 12AX7EH for the "best" preamp tubes of the 12AX7's. The ECC83's and 7025's will have their own character that is even farther removed from the current new 12AX7's.

12AX7EH Electro Harmonix -Very linear curves. A bit faster rise time than 12AX7C. 12AX7C may sound a bit "warmer" in some amps. Less prone to microphonics possibly due to simple and short plate structure. Great gain, great output (right on par with NOS test tubes). The new winner for gain and output over the old champ, the ECC83. This tube is a winner.

Sovtek 12AX7LPS - Curves and A/B match not as consistent as last factory batch. Gain is very inconsistent, more so than output. Not impressed with this latest batch. Recommend that users get these from a source that will test

### October 23 2002 Sovtek 12AX7LPS Tests

TC not consistent with output. High percentage microphonic

ECC83 JJ 12AX7LPS - A bit inconsistent A/B side matching. Curves a touch slow on rise time. Problems of lower output and gain. Not as much as the previous batch, but still more inconsistent than last batch. Things



continue to go downhill in Russian factories, and continue to improve in China from last factory batch seem to be resolved. These are the same now as batches in the past prior to the last factory batches problems. Users should get these from trusted vendors that test so tube left on the shelves from the factory. Tolerance Ave output Ave TC Gain  
 12AX7R2 Sovtek LPS (10/23 batch) 67.0% 70.00% 1418 88.63%  
 12AX7R2 Sovtek LPS (10/28 batch) 67.0% 70.00% 1418 88.63%  
 Sovtek 12AX7WA Not very consistent on A and B side in curve matches generally. Low on gain so the inconsistency will not be as apparent. These will be "quiet" due to lack of gain and output.

### Ongoing tests - Summary

Tube		Tolerance	Ave	AveTC	TC %	Ave	Ave
		Output	TC/(gm)		gp	gain	
12AX7R - Sovtek 12AX7WA	10/7/02	41.7%	78.33%	1190	74.38%		
12AX7R - Sovtek 12AX7WA	10/28/02	41.7%	87.50%	1293	80.81%	0.0147	87.96%
12AX7R - Sovtek 12AX7WA	12/13/02	41.7%	77.50%	1180	73.75%	0.0137	86.13%

(10/28/02)Sovtek 12AX7WA - consistency did not improve, but it did not get worse. Gain, output and TC all increased closer to spec. Good improvement on 10/28 tests.

(12/13/02) - consistency unchanged over the last three factory runs. TC is down a touch. Gain is down a touch, and output is down a touch also. These would account for a muddy sort of tone in amps with complex front ends where the drive current is not available as it would be on some other tubes perhaps. The curves are not linear, but suited to quiet operation with the lower gain and output. To tame an amp that is too bright, or with a harsh front end, this would be a great tube. Physically sturdy, and these tend to be low in microphonics, so are suited to amp builders that want to make it past the warranty period without shipping damage to tubes. Long life as these are not really a hot rod sort of tube. This tube will continue to be the "old standby" for a lot of folks. If you amp sounds great with these (as most amp makers use these as stock tubes), the up side is, you will probably love your amp even more with most other preamp tubes. If you cannot decide what you want in a preamp tube, this is always a safe choice. Nowhere near the traces or performance of the latest Chinese 12AX7, but perhaps the retail prices are different enough to be part of a choice aspect.

12AX7R2 Sovtek LPS (10/7 batch)	50.0%	83.33%	1469	91.81%		
12AX7R2 Sovtek LPS (10/23 batch)	67.0%	70.00%	1418	88.63%		
12AX7R2 Sovtek LPS (10/31 batch)	75.0%	83.33%	1505	94.06%	0.0182	82.69%
12AX7R2 Sovtek LPS (12/12 batch)	42.0%	97%	1557	97.31%	0.0186	83.71%

10/28 batch - consistency continues to drop. Current ranged from 0.6mA to 1.5mA, all over the scale. Possibly due to factory stopping and starting production on the many tubes in their line, and thus, lost consistency. Average current output was improved (1.0 mA). Average TC was improved at 1505 Gain was down a bit on average, the lowest gain currently of the 12AX7 family. If it were not for some "flyers" at 1.5mA with high TC, the average gain would be at least 20% down from 12AX7 spec. This batch is not something you want to buy from a tube vendor that is not known to test preamp tubes. The Groove Tubes samples had a tolerance spread of less than 20%, or about 4-5 times better than factory samples or samples from a few tested Internet vendors by a wide margin.

12/12 batch - much improved. More consistent, TC right on the money, gain and output much improved over earlier batches.

12AX7R3 Electro Harmonix (10/29/02)	16.7%	85%	1382	86.38%	0.0162	85.31%
12AX7R3 Electro Harmonix (12/12/02)	16.7%	83%	1403	87.69%	0.0161	87.14%

10/29/02 - A drop in output and gain from last factory run, but consistency was very high, perhaps the tightest of any new tube made today and a rival of many NOS tubes. If this continues, this would be a great sign.

12/12/02 - A good tube continued to improve. Very consistent quality with very tight spread. TC even closer to NOS and standard specs. Good gain with good output drive too. This tube was already a contender for the best new tube, with the 12AX7C. It may be #1 at this point. The curve traces were very good, more linear than many of the NOS Mullard or Telefunken. It was too close to call trace differences between this tube and a Mullard CV4004. This tube comes out of the Reflector Factory (Sovtek / EH), but the consistency shows the newer tooling of these EH offerings makes a big difference in consistency. The folks on the EH side of the Reflector house seem to really know how to run a tube production line very well.

12AX7C - Chinese (10/28/02)	25.0%	83%	1461	91.31%	0.0160	91.31%
12AX7C - Chinese (12/13/02)	16.7%	92%	1588	99.25%	0.0170	93.41%

10/28/02 - Very close tolerances continue from factory batch to batch. Only beat in last test by the EH tube, but still, at 25%, very tight mfg. QA and consistency, rival of many NOS types. Specs are better than the R3 (Electro Harmonix), in reference to NOS standards in some areas. Transconductance is better than EH, and gain is quite a bit better. In output, this tube is two points down from the EH. All in all, a great tube. The difference between the R3 and C is going to come down to user tone preference.

12/13/02 - The tightest tolerance and QA of any current tested 12AX7. The closest to industry spec. TC is right on the money as is gain. The gain and output are both in relationship properly, unlike most other new 12AX7's. Curves are more linear than most NOS tubes which are the less expensive and more common industrial samples. The 12AX7EH (R3) performed very well, and it has always been a close race between the EH and C, but as the EH improves, the C seems to improve a bit more. A very fine tube, very resistant to microphonics, and a warm and linear response curve. The tooling on this still C9, so the continued improvement may be due to production that is running 24x7 with no shutdown or just fine supervision and expertise on the line at Sylvania when Tom Rubio retired that shut down the 6L6 STR-387 line when nobody else could keep it running properly. My hat is off to the folks running this line.

7025 Ei - (10/31/02)	33.3%	88%	1419	88.69%	0.0155	91.55%
7025 Ei - (12/12/02)	25.0%	47%	1064	66.50%	0.0118	90.17%

7025 - Ei (4/03 batch) Output = 1.1 / TC = 1490 / Gain = 93.1 / QV = 33% - This is the best batch yet, with nice current output, and perhaps more gain than any current 12AX7 too. Tighter specs. If these look like the smooth plate Telefunken NOS tubes, do not be surprised. Ei was a Telefunken OEM, and when Telefunken stopped production, the German tooling went to Ei along with some Engineers to set the German tooling up.

10/31/02 - A return to the silver plate material over the gray plate material from last factory batch. Smooth curves, very much like RCA 60's 7025, nice in Fender BF amps. These still flash when first turned on for the most part, but it means nothing bad. Best batch yet. Better than 2 of 3 of the Russian offering in Quality, and beats all the Russian tubes in gain and output. The most linear curves with the most even frequency response of all 12AX7 family tubes tested in this time frame. The ECC83 tests are still not complete, but this tube looks to be winner.

12/12/02 - A case of showing that gain and output are not at all the same. Silver plates continued. Quiet due to very low output and fair gain. For somebody wanting a lower gain (like a 5751), this may be an idea, but it does not have the current drive of a 5751 or 12AT7 for use in a complex front end amp. This tube still has the characteristic long smooth plate curves of the Telefunken smooth plate, but it has lost its output at the expense of being more consistent.

ECC83 JJ (10/07/02)	33%	93%	1467	91.69%		
ECC83 JJ (11/07/02)	66.7%	113%	1664	104 %	0.0195	85.33%
ECC83 JJ (11/07/02)	58.3%	117%	1604	100.75 %	0.0180	84.87%

ECC83 JJ (11/07/02) 36.3 /0 112 /0 100+ 100.25 /0 0.0107 0+01 /0

11/07/02 - This latest factory batch (11/7/02) lost their consistency. These are now near the bottom of the group when it comes to two tubes doing the same thing. Make sure these are tested if you don't want any tone change surprises. These have the strongest current drive output of the group by a fair margin, but they are no longer the king of gain with about a 15% loss off spec. When it comes to gain, these are near the bottom of the group. If you are looking for current drive in a circuit, these are great (if they are tested), but if you are looking for gain, you will need to check each tube before using it in an amp where high gain is expected. Perhaps there was a change in tooling setup, cathode formula, or plate materials. The inconsistency is generally due to rushed production and general QA issues.

12/13/02 - A bit better on tolerance spread than the last factory batch, output is about the same, gain and TC are a touch down. This tube is still the king of output in the current 12AX7 family, and will have the drive to put most Marshall type amps, or amps with complex front ends, "over the top" when compared to most other 12AX7 offerings. This tube is the master of pure output current drive. Nothing out there can touch it, including any NOS tube that meets spec. The lower gain of this tube will be compensated for in most cases by a cathode biased circuit to some degree, but the current drive here has to come from the tube, and this JJ ECC83 has that to be sure.

## Some NOS preamp tube studies

For the sake of comparing, some NOS tubes will be listed here. They may be seen as being the same in a number of specs in some ways. Some differences are issues like their average output, or current drive ability, is higher. This helps "control" the front ends of many amplifiers in a way that is desirable to a lot of tastes. Their construction was also different at times. As an example, in some Mullard versions, there was a top compression component on the top mica assembly. This kept the plate structure and cathodes in a loaded or compressed state, keeping physical microphonics to a very low level for long periods of use.

Some examples follow:

Mullard 12AX7/ECC83	Current = 1.4	TC = 1470	Gain = 85.6	(many samples)
7729 gold pin	Current = 1.2	TC = 1450	Gain = 85.3	
Tungsram Hungary	Current = 1.7	TC = 1830	Gain = 83.2	
Matsushita	Current = 1.2	TC = 1380	Gain = 86.3	
Pinnacle ECC83	Current = 1.1	TC = 1550	Gain = 86.1	
Telefunken Long SM GP	Current = 1.4	TC = 1710	Gain = 95.0	early
Telefunken Long SM GP	Current = 1.5	TC = 1780	Gain = 93.7	later

## NOS Quality Studies

The below items show the tolerance range from various samples of each type. The first figure is the spread in many samples and how far they strayed from the standard of 1.2 milliamps, a gain of 100 in the case of a 12AX7, 70 for a 12AT7, etc., and the spread in transconductance. The second figure is if the current output was above or below the spec of 1.2 milliamps (in percentage above or below this expected 1.2 milliamps). The last figure is the average transconductance for

the sample batch. Keep in mind that for TC, the expected is listed elsewhere, such as 1600 for a 12AX7/ECC83/7025, 2200

for a 12AU7, etc.

Tube	Tolerance	Ave output%mA	Ave TC (gm)
GE 6072A 1970s Date Code	2.6%	96%	1710
GE 6072A Black Plate 1963	1.9%	100%	1750
GE 12AX7WA (1980s)	8.7%	92%	1520
GE 5751 (1950s)	2.5%	98%	1190
JAN/Philips 12AT7WC 1980s	11.6%	105%	5780
RCA 12AX7 NOS 1950s-60s	8.8%	99%	1620
RCA 5751 Black Plate (1950s)	3.7%	96%	1251
RCA 7025/12AX7 NOS 1960s	6.6%	97%	1580
Telefunken ECC83/12AX7	11.6%	102%	1680
RCA 12AU7 NOS Cleartop	2.1%	96%	2180
12AX7 Telefunken smooth plate	12.6%	102%	1610
12AX7/ECC83 Telefunken Diamond Bottom Ribbed Plates	2.7%	94%	1680
12AX7 MINIWATT / SUPER RADIOTRON AUSTRALIA 1960s	0.8%	100%	1606
12AX7 Amperex Bugle Boy Holland LONG PLATE 1950s	4.4%	112%	1640
12AX7 AMPEREX BUGLE BOY HOLLAND 1967	6.1%	109%	1580
7025 Amperex Holland orange Globe Logo 1971	7.7%	94%	1690
CV4004 Brimar 1961	4.5%	92%	1570
CV4035 / 12AX7 Brimar NOS flying leads	9.8%	108%	1740
7025 GE ribbed plates 1950s	2.2%	100%	1610
7025 GE ribbed plates 1960s	3.7%	100%	1590
M8137/CV4004/12AX7 Mullard Box Plates	11.2%	92%	1640
12AX7 Raytheon black ribbed plates square getter halo 1950s	5.4%	94%	1520
JRC-12AX7 RCA Black Plates 1954	4.9%	101%	1590
12AX7A RCA gray ribbed			

12AX7A RCA gray ribbed plates 1960's-1970's	12.6%	93%	1660
ECC83/12AX7 Siemens long plates early 1960s	9.9%	95%	1620
12AX7 Sylvania Gray Plate square getter halo 1958, 1959 <a href="#">CLICK HERE</a> for page 2 of tube specific curves and additional information	8.2%	102%	1710

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