

TUBE ROTATION AND REPLACEMENT

The R-390A Frequently Asked Questions Page Tubes (Valves)
Send Comments to the FAQ-Meister, WAØHQQ:
(r390a-faq@mindspring.com)
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This page contains information about the 26 tubes (valves) contained in the R-390A series of receivers. Nine types of tubes were used in the construction of The R-390A. John Harvie assembled a very useful spreadsheet for identifying tube types, functionality and references. His work has been translated into the table below. Wisdom gleaned from postings to the R-390 and Boatanchor reflectors have been added. This document is a compilation of the wisdom shared by members of the online community of R-390A enthusiasts. As such, it is advice to those who endeavor to maintain and restore the R-390A family of receivers. The information is shared without warranty, expressed or implied. This information is in the public domain and can be freely copied or shared. Appropriate attribution is appreciated.

3TF7	26Z5W	5814A	5749/6BA6W	6C4WA
6DC6	5654/6AK5W	6AK6	OA2	

One **3TF7** is used in the R-390A. It is a current regulator or "ballast" tube.

The Amperite part number for the ballast tube is 3TF7. Amperite also carries an equivalent, the TJ311M01.

1. RT510 is located on the IF subassembly, where it provides a regulated 6 volt filament voltage to V505 and V701, which are wired in series. RT510 is fed from the 26.5 volt filament supply. RT510 appears in figure 77 of TM-11-856 and in figure 85 of TM-11-5820-358-35. Of all of the tubes in the R-390A, the ballast tube has garnered the most controversy, discussion and creativity regarding a replacement. Replacement tubes cost between \$15 and \$25, generally. Some replacement suggestions that have been tried:

- * Jumper pins 2 and 7 of RT510 with a piece of wire, Replace V505 (The BFO oscillator tube) and V701 (the PTO oscillator tube) with 12BA6 tubes.
- * Jumper RT510 with a resistor of 40-50 ohms rated at 5-10 watts
- * Install a 3-terminal Solid state voltage regulator to provide 12.6 volts
- * Rewire the sockets of V505 and V701 to use the 6 volt filament string available to other tubes.
- * Replace the 3TF7 with a diode that is rated to handle the voltage and current. This creates a pulsing DC voltage of the proper value for the filaments.

Nolan Lee provided some background on the 3TF7: " The resistance wire is usually iron, and the glass envelope is filled with either hydrogen or helium gas for heat conductivity. The glass envelope runs about 160 degrees. Current regulation is usually within plus or minus 1%. They work with either AC, DC, or pulsating current. When the current in the circuit is increased to a high enough level for the regulating function to start working, only a small portion of the filament will glow. As the voltage across the ballast increases, more and more of

the filament will glow. When the entire filament is glowing, you're at "max" and any additional increase will overheat the tube and shorten it's life. The rated life expectancy when operated as recommended within its ratings is 2000 hours. Run it at "max" all of the time and it's only 1000 hours. Run it at 80% of max and it's 5000 hours. If a steady voltage of a value in the middle of the operating range is applied to the tube continuously, it's life will be tens of thousands of hours. Opening and closing the circuit with the resulting expanding and contracting of the filament greatly reduces the life of the tube. Also, as in incandescent lamps, turning the unit on and off many times will reduce it's life especially if the unit is operated near it's maximum voltage.

If full voltage is applied to the tube, the circuit may be opened and closed only a few hundred times before the current is outside of the limits or the filament is burned out. Thus the life of the tube will be determined entirely by it's duty cycle."

Two **26Z5** tubes are used in the R-390A. The 26Z5W is a high voltage rectifier tube.

1. V801 is located in the Power Supply subassembly, where it forms one half of a full-wave rectifier. V801 appears in figures 47 and 80 of TM-11-856 and in figure 28 of TM-11-5820-358-35.
2. V802 is located in the Power Supply subassembly, where it forms one half of a full-wave rectifier. V802 appears in figures 47 and 80 of TM-11-856 and in figure 28 of TM-11-5820-358-35.

Solid state replacements were installed in some R-390A receivers by the military. Often, The shield bases on the tube sockets were bent inward and flat with the chassis to prevent tubes from being inserted into the sockets. This modification can usually be reversed by removing the solid state diodes from under the tube socket, carefully bending the tube shield bases back into position, and inserting tubes into the sockets. When the solid state modification is in place, a somewhat higher B+ voltage is present in the receiver.

Seven **5814A** tubes are used in the R-390A. The 5814A designation is for the Mil-Spec version of the 12AU7, a dual section medium-mu dual triode.

1. V205 is located in the RF subassembly where one half, V205A, is used as the oscillator tube for the crystal calibrator and the other half, V205B, is used as the 100 kc oscillator cathode follower. V205 appears in figures 46 and 75 of TM-11-856 and in figures 27 and 58 of TM-11-5820-358-35.
2. V206 is located in the RF subassembly where the two halves form a multivibrator. V206 appears in figures 46 and 75 of TM-11-856 and in figures 27 and 58 of TM-11-5820-358-35.
3. V506 is located in the IF subassembly where one half, V506A, is used as the AGC time constant generator and the other half, V506B, is used as the detector. V506 appears in figures 34, 38, and 77 of TM-11-856 and in figure 17 of TM-11-5820-358-35.

4. V507 is located in the IF subassembly where the two halves form a limiter. V507 appears in figure 77 of TM-11-856 and in figure 17 of TM-11-5820-358-35.
5. V509 is located in the IF subassembly where one half, V509A, is used as the AGC rectifier and the other half, V509B, is used as the IF cathode follower. V509 appears in figures 37 and 77 of TM-11-856 and in figures 20 and 21 of TM-11-5820-358-35.
6. V601 is located in the Audio subassembly where one half, V601A, is used as the 1st AF amplifier and the other half, V601B, is used as the AF cathode follower. V506 appears in figures 42 and 45 of TM-11-856 and in figure 23 and 26 of TM-11-5820-358-35.
7. V602 is located in the Audio subassembly where one half, V602A, is used as the local AF amplifier and the other half, V602B, is used as the Line AF amplifier. V602 appears in figure 43 of TM-11-856 and in figures 25 and 62 of TM-11-5820-358-35.

Six **5749/6BA6W** tubes are used in the R-390A. The 5749 designation is for the Mil-Spec version of the 6BA6W, a remote-cutoff pentode.

1. V501 is located in the IF subassembly, where it is used as the 1st IF Amplifier. V501 appears in figures 33 and 77 of TM-11-856 and in figures 16 and 60 of TM-11-5820-358-35.
2. V502 is located in the IF subassembly, where it is used as the 2nd IF Amplifier. V502 appears in figures 33 and 77 of TM-11-856 and in figures 16 and 60 of TM-11-5820-358-35.
3. V503 is located in the IF subassembly, where it is used as the 3rd IF Amplifier. V503 appears in figures 33 and 77 of TM-11-856 and in figures 16 and 60 of TM-11-5820-358-35.
4. V505 is located in the IF subassembly, where it is used as the BFO oscillator. V505 appears in figures 36 and 77 of TM-11-856 and in figure 19 of TM-11-5820-358-35.
5. V508 is located in the IF subassembly, where it is used as the AGC IF Amplifier. V508 appears in figure 77 of TM-11-856 and in figures 21 and 60 of TM-11-5820-358-35.
6. V701 is located in the VFO subassembly, where it is used as the VFO oscillator. V701 appears in figures 28 and 78 of TM-11-856 and in figures 10 and 61 of TM-11-5820-358-35. Nolan Lee reports that "used" tubes that have aged for a while seem to work better than new tubes when making replacements of the VFO oscillator tube. "New" tubes appear to cause oscillator drift with age, moving the tuning range as much as 1 KC.

Three **6C4WA** tubes are used in the R-390A. The 6C4WA designation is for the

ruggedized version of the 6C4, a medium-mu triode. The 6C4W tube WILL NOT work as a replacement for the 6C4WA in the R-390A. The 6C4 will work as a replacement, but sometimes not quite as well as the 6C4WA.

1. V202 is located in the RF subassembly, where it is used as the 1st mixer. V202 appears in figures 22 and 75 of TM-11-856 and in figure 4 of TM-11-5820-358-35.
2. V203 is located in the RF subassembly, where it is used as the 2nd mixer. V203 appears in figures 24 and 75 of TM-11-856 and in figure 6 of TM-11-5820-358-35.
3. V204 is located in the RF subassembly, where it is used as the 3rd mixer. V204 appears in figures 27 and 75 of TM-11-856 and in figure 9 of TM-11-5820-358-35.

One **6DC6** tube is used in the R-390A. The 6DC6 is a semi-remote-cutoff pentode.

1. V201 is located in the RF subassembly, where it is used as the RF amplifier. V201 appears in figure 75 of TM-11-856 and in figure 3 of TM-11-5820-358-35.

Two **5654/6AK5W** tubes are used in the R-390A. The 5654/6AK5W designation is for the ruggedized version of the 6AK5W, a sharp-cutoff pentode.

1. V207 is located in the RF subassembly, where it is used as the 1st crystal oscillator. V207 appears in figures 23 and 75 of TM-11-856 and in figures 5 and 58 of TM-11-5820-358-35.
2. V401 is located in the Crystal Oscillator subassembly, where it is used as the 2nd crystal oscillator. V401 appears in figures 25, 26 and 76 of TM-11-856 and in figures 7 and 59 of TM-11-5820-358-35.

Three **6AK6** tubes are used in the R-390A. The 6AK6 is a pentode power amplifier .

1. V504 is located in the IF subassembly, where it is used as the 4th IF amplifier. V504 appears in figures 33, 40, and 77 of TM-11-856 and in figures 16 and 22 of TM-11-5820-358-35.
2. V603 is located in the Audio subassembly, where it is used as the local audio output amplifier. V603 appears in figure 43 of TM-11-856 and in figures 24 and 62 of TM-11-5820-358-35.
3. V604 is located in the Audio subassembly, where it is used as the line audio output amplifier. V604 appears in figure 44 of TM-11-856 and in figure 62 of TM-11-5820-358-35.

One **OA2** tube is used in the R-390A. The OA2 is a 150-volt voltage regulator. The OA2WA or the 6626 is a better replacement for the OA2, according to Nolan Lee, because they give longer service

WARNING: The OA2 family of tubes has a small amount of radioactive isotope inserted into them during manufacture to enable them to 'fire' consistently at whatever voltage they are designed to regulate. Handle broken tubes with care!

1. V605 is located in the Audio subassembly, where it is used as a voltage regulator. V605 appears in figure 79 of TM-11-856 and in figure 28 of TM-11-5820-358-35.

From: Steve Stutman <sstut@...>
Date: Sat Dec 6, 1997 1:21 pm
Subject: Re: [R-390] Tube Failure and its Avoidance

> What causes tube failure and what can we do to prolong
> the life of receiving and transmitting tubes?

In TX tubes filament voltage is critical. Often a loaded supply will be at the hairy lower edge or conversely an unloaded supply will be overvolting, especially with high mains. In general we speak of 110 VAC mains or 120 VAC mains; that's 8 per cent one way or the other. Checking at socket with a meter is a good idea. OSHA warning: observe all HV safety precautions and do not touch the wrong part of the socket or plate.

One way to ensure in spec filaments is by using a separate regulated supply. These are common and inexpensive in surplus. But they can exacerbate a problem seen in most supplies; inrush current. Cold filaments exhibit a much lower resistance than hot ones; this contributes to the turnon "thump" some amps have. A conventional filament supply; a secondary winding, is at least limited by the resistance of the winding. A regulated supply (voltage) wants to see constant voltage across its output, so some regulated supplies, especially if stiff (Zout is low), are probably worse than unregulated in the long run.

Some amps have a "softstart" feature which is a resistance which limits turn on currents either in primary or secondary for several seconds. Filaments are usually warm enough after say 10 seconds to take full voltage with no negative effect. Clearly, overheated bases and pins, inadequate ventilation/cooling, and parasitics or mistuning don't help anything either. I am sometimes surprised by even experienced ops trying to max out a PA. The on air difference between say 1200W and 1.5 KW is nothing, Nada, roomheat. Yet backing off just a little increases life disproportionately. If you are running tetrodes, regulation of screen current is vital. Great article in recent QEX on same. For RX or small sig tubes, filament probably not as important, but you still don't want to overvolt. Check at pins with a meter; you might be surprised. Substitution of solid state rectifiers in BA will often result in B+ rising more than is good. Hollow state restifiers have drop. Also, a point often overlooked is that a solid state rectifier B+ comes up essentially instantly when rig is turned on. Tube rectifiers don't deliver much B+ until their filaments heat up and guess what, they heat up at rate similar to all other tubes in rig. I have heard that B+ applied to a tube with cold filaments can cause damage. Probably a real concern with TX tubes, but probably doesn't help RX either.

When I turn on a tube radio that hasn't been used in say 4 months, I run it from a Variac on mains. Start off at maybe 15 volts and go to full 110VAC over maybe 15 seconds. This is nice for filaments and good for PS filters too. If no smoke after a couple minutes< I shutoff and plug into the main. Easier on everything.

From: Jim Haynes <haynes@...>
Date: Sat Dec 6, 1997 2:18 pm
Subject: [R-390] Re: tube failure

I don't claim any special expertise on this, but

We know that when the heater power is turned on the heater resistance is lower than it will be when the heater is hot. So the initial current is high; plus there's the mechanical strain from temperature cycling the heater and cathode; plus maybe there's some magnetic effect proportional to heater current. So frequently turning on and off is bad, turning on with current limiting is good, leaving turned on all the time is good up to a point.

We also know that for whatever reason heat is very bad for tubes, nickel-plated shields are very bad, should be used only to hold the tubes in for shipping, IERC shields are good and are actually better than leaving the tube unshielded. Operating tubes well within their ratings helps to keep the heat down too. What specifically does the heat damage?

Then we learned in early computer days that tubes run with the heaters on but biased to cutoff tend to develop an insulating interface that disconnects the cathode wire from the emitting surface of the cathode. Does this also happen if the tube has heater voltage only applied, or does it require running with cutoff bias? I suppose cathodes tend to deteriorate with time, probably by poisoning from stray gas molecules within the tube.

From: k5fte@... (Earl C. Harris)
Date: Sat Dec 6, 1997 2:02 pm
Subject: [R-390] Tube Failure

You cannot prevent tube failure but you can make sure you get maximum life out of them. This is done by maintaining the supporting components, ie, resistors, capacitors, etc. Some equipment was designed poorly and "THRASH" the tubes. Stick to equipment of excellent design and a proven track record of reliability. I like to put some kind of muffin fan on my old stuff to keep air flowing. This helps also. Also, refrain from putting in those "solid state" rectifiers unless you take measures to reduce the increase in B+ they cause.

Date: Mon, 6 Sep 1999 19:26:06 -0400
From: "John F. Bunting" <w4net@carneconn.com>
Subject: [R-390] Another failure of note.

<snip> Another thing I encountered here for the first time was that the socket for V508 6BA6(AGC IF Amp) had a 6AH6WA plugged in and the socket for V201 6DC6 (RF Amp) also had a 6AH6WA plugged in to it. Has anyone else seen this before? Do they work well enough or would this have been a desperation move by someone that did not have any 6BA6s or 6DC6s on hand at the time ??
<snip>

Date: Wed, 08 Jul 1998 01:52:10 -0500
From: Nolan Lee <nlee@communique.net>
Subject: [R-390] Mil Specs for tubes

If any of you are interested, I've uploaded the current Mil-Spec standard for electron tubes to my website. It's available for download in a 468K zip archive that contains an Adobe Acrobat format file containing 70 something pages. I'd appreciate it if a few of you guys with BA sites would mirror it on your sites. Hit <http://www.acadiacom.net/nlee> and follow the prompts.

From: David Ross <ross@...>
Date: Mon Oct 18, 1999 11:17 am
Subject: Re: [R-390] WTB 26A7,26A6,26C6

Looks like Francesco is re-tubing an R-392. My R-392 book lists the 26FZ6 as a sub for the 26A6, and AES used to sell the 26FZ6 a bit cheaper than their 26A6s. I tried a set of 26FZ6s in my R-392 and saw no difference from the original 26A6s.

Date: Fri, 15 Jan 1999 22:34:22 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] MTBF (was tubes and 3TF7 ...)

Every six months, I pull the tubes out of the R-1051B's and install new ones. They'll last longer than that but I've got plenty of them. I think that I paid .25 a piece for the 6AN5WA's when I bought them and only about .70 each or so for the 6BZ6's. At the current rate of consumption I think that I have enough for 30 years or so. :-) It costs me about 4 dollars a year to retube both receivers. Cheap, huh? And, yes I can notice a difference in sensitivity before and after retubing. The performance difference and the low cost of the tubes is the reason that I don't even bother to test them.

The antenna couplers, have a switchable meter on the front panel that monitors the ten pairs of 6922's in each one. When I see the numbers drop to a level a little below the recommended reading, for one pair, I replace that pair. I used to just replace all of them but my supply of good quality Amperex 6922's is getting low and they now cost more than the coupler is worth thanks to the golden eared audio crowd. When they're finally gone, I'll have to start using the Jan 6922's but in the mean time, I'll cook Bugle Boy's in the couplers.

I've make little cards up that I keep on each of the receivers. On the card is the testing date, the location (V#) in the receiver, the SN of the tube tester, and the tested value of the tube expressed as xx/yy, where xx is the tester reading and yy is the minimum value of the tube. I try to test the tubes about every six months. After a couple of decades, you see trends. It's been my experience that for the R390A's the tubes that seem to have to be replaced the most often are the 26Z5W's, and the 0A2WA's. I typically let them run 24/7. I don't trust the regulator tubes as far as I can throw them. I hate the damn things. Anytime I install new rectifier tubes in an R390A, I select and install a new regulator tube. Amazing how many are a couple of volts or so "off". I've also had "noise" problems in the receiver that I've traced to them. It's amazing the difference in sensitivity the the tubes in the RF section make as they start to deteriorate. Since it's a gradual thing and you don't notice.

About the least trouble that I've had is the 6 or 7 dozen or so tubes in the old Tektronix scope and the CA plugin that's usually in it. Over the last twelve years or so, I've changed a set of 5 of the 5642 HV rectifiers, the 0G3 regulator and a pair of 6CW5's that come to mind. Very well engineered piece of equipment. As long as the tubes aren't noisy or shorted, they'll usually work fine in it even when

their test values are well below the normal "worn out" numbers that the tester manuals list. I've had MORE transistors fail in the 547 than I have tubes fail. Finding matched pairs of those old early 1960's transistors can be a real pain, too. No BA collection is complete without a hundred plus pound tube type Tektronix scope setting on the bench sucking up a thousand watts or so. They're magnificent pieces of gear that are first class examples what what American industry was capable of producing at one time. Quality engineering, craftsmanship, and best quality materials available, but mainly, when people took pride in their work.

Tubes, as a whole, are a hell of a lot more reliable than a lot of people believe. There were some really suck designed tubes/applications in the 1970's, such as those damn compactrons used in televisions and used in applications like RF amplifiers that they really weren't really up to. Ditto to the tubes in the power supply for the IP-173 series panoramic adapters. I've not real impressed with the life of the 6AK6's used in the R390A's either. They don't seem to last as long as they should. For what it's worth, the RCA's seem to last longer then the other brands. The 6DC6's on the RF deck are another one that should be replaced every 6 months of 24/7 in the R390A's if you're interested in peak performance.

On a side note, try to never install a new 5749 in the PTO module of an R390A. Always use a good strong used one. The alignment will hold longer.

Just for kicks, measure the sensitivity of your receiver, remove and label the tubes on the RF deck and replace them with new tubes. Then retest the sensitivity. I'd almost bet money that you'll leave the new ones in there. :-)

Oh, about the only piece of gear that I have that gives a time frame for tube replacement is my AN/PRM-10 Grid Dip Osc. The 955 acorn tube in the head is supposed to be replaced every 300 hours. I was curious about this a while back, so I tested the tube then let it run for a couple of weeks and sure enough, the tube was flatter than hell. ;-) Which reminds me, I need to pickup a few more spares, I only have a couple of them left. ;-(Thinking of the GDO, 6X4 rectifier tubes don't impress me much either either. I've went thru a lot of them in the GDO, the RC and RCL bridgers, the old CV-116 when I used it (it has five of them in it), and the pair of them in the TV-2 tube tester. The 6X4 is one of my least favorite tubes.

One factor on "tube life" that's over looked is the application that the tube is used in. As an example, lets look at the 6AK6 used in the R390A as an example. There's three of them in there if I remember right. Two on the audio deck and one on the IF deck. The one used as the 4th IF amplifier on the IF deck seems to last the longest, followed by the line output amplifier and then the local audio amplifier on the AF deck. Same tube, way different "life". When I have to replace a 6AK6 used for local audio, I always install the new tube on the IF deck, and take that tube and install it in the line audio position, and then place the line audio tube in the local audio position. Hmmm, maybe we need a tube rotation schedule. <grin>

nolan

From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] be nice...solid state "tubes"

<snip> Actually, R-390A users are lucky. None of the tubes that are used in it are rare or unavailable. Granted, a few of them are a little more expensive than some of the others, but they ARE available. Anyone that owns an R-390A to actually USE on a regular basis and not simply as a "trophy", should have a few extra sets of tubes or more depending on the amount of usage. My spare tube inventory of new "R390A tubes" is well over 300. I'd guess that I've got another 200 or so "used and hot" spares. Even so, I still keep my eyes open for more. They aren't made any more and I plan to keep the R390A's for "the duration".

Date: Thu, 26 Aug 1999 20:06:27 -0500

From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>

Subject: Re: [R-390] Why use a tube when Solid State will do!

So far you are replacing heat with heat, just moving to devices that must operate at lower temperatures and so be convection cooled, not cooled by radiation. I suppose that's progress. The main benefit I see for my ballast is in having one when there's no ballast tube available and that my ballast I claim is significantly more precise in its regulation, far less dependent on supply voltage.

Putting in silicon rectifiers and then resistors to drop the voltage puts the heat back that was saved from the voltage drop in the tubes, but still saves the heater power and heat. It would be more advantageous to use a small filter choke to drop the voltage, than a resistor. The filter choke can drop the peak AC voltage with lower power dissipation than a resistor and so operate cooler and have the radio operate cooler than the resistors or the rectifier tubes.

I like the TL431C, but in my 13.8 volt regulated supply using MOSFETs that I built about 32 months ago and have run continuously for the last 24 months running my ham shack and automated packet station, I found that it was faster than the MOSFETs and so tended to bang from limit to limit on the output pin. I calmed it with an 820 μ f capacitor from output to input, and made sure I had enough output capacitance on the power supply to handle load changes faster than the composite regulator circuit. I put 1000 μ f for the large currents, then paralleled a 35 mfd tantalum for the moderate fast changes, and then a 0.1 monolithic for the really fast changes, and so can't detect yoops in output when changing the load drastically by scratching two wires together while watching with a 200 MHz scope.

In the circuit I've sketched for a solid state 0A2, I include that capacitor from output to input on the TL431. By the way if you use the DIP package the regulator can be good for currents from about 0.1 ma to 100 ma, if you watch the dissipation distribution between the 431 and the MRF820...

The plain 390 with 6082, 6AH6 and 5651 reference looks very amenable to going solid state for the regulator. G3SEK has published a solid state regulator for the screens of 4CX250 family tubes in QEX (also on his web page where he offers kits and modules) that uses MOSFETs and should translate to the 390 easily with more heat sinking for greater power capability and probably a current limit change. Removing the heater power of the 6082 is significant progress in cooling the radio. Using a solid state regulator driver that puts 1 milliamp to the reference instead of 15 or 20 ma, saves considerable heating also.

Changing the other stages is harder. The most applicable solid state component is the double gate MOSFET. These are no longer made by US makers, and are getting rare in Japan and Europe. Especially in packages bigger than a grain of

pepper. (I grind my pepper fresh so the chunks sometimes are fairly large).
Though yesterday I received a package from Farnell Components in GB. They own Newark and MCM among others but the local places in the US don't stock the same parts and Farnell has a supply of BF-988 double gate silicon MOSFETs. They have a superb noise figure, lots of gain, but are limited to 12 volts on the drain. I'll be applying them to my halfway working solid state gear. The paper work weighed more than the parts, and it cost 13 pounds (British money) shipping while 35 transistors cost only 10 pounds.

I'm kind of thinking that for replacing 6AK5 and 6BA6 with full supply voltages still on the tube sockets, that a double gate MOSFET can act very much like a pentode, with the gain controlled by the same negative grid bias, and with gate two bias proportional to the screen voltage, and by putting the 0A2 voltage regulator circuit in the drain, just need a tiny power MOSFET and the TL431... And with that constant voltage drop bypassed with a small capacitor to make it nearly invisible to RF. Might need to put a voltage divider on the signal gate or an unbypassed source resistor to keep the gain within reason. The fanciest silicon double gate MOSFETs can have a Gm nearly ten times that of the 6BA6. And are good to more than a Ghz with the same gain so there might need to be some ferrite beads on input and output to calm microwave oscillation tendencies.

Replacing 6AK6 needs more output voltage swing capability. Probably means a cascade of a double gate MOSFET for voltage gain with a power MOSFET for output voltage capability. Means the current may be limited by the input double gate MOSFET but the output voltage range can be wide.

Date: Fri, 27 Aug 1999 10:17:08 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Why use a tube when Solid State will do!

Why not lengthen the life of the tubes by letting them cool during the off shifts. Surely you aren't listening to every radio 24/7 or do you have a couple shifts of helpers trying to intercept low flying aircraft from Columbia?

> I would have thought that the SS mod would have had better regulation
> than the ballast tube to be honest with you though.

Any given LM317 probably does .05% regulation but the set point is only guaranteed to 5%, poorer when the resistors are 10%. Relatively its pretty good if it was trimmed with high quality resistors, but I can't guarantee two circuits with different parts will set within 1%. With the none sinusoidal waveform, I wasn't able to get two meters to agree within 5 or 10% for the current value.

A lot of the early solar panel regulators used the shunt load to regulate the battery charging current. I think they should use a lower voltage panel or a higher voltage panel and a switching regulator to get more energy to the battery.

> My old WWII RBC-2 shipboard receiver uses regulated filament voltage for
> the osc, with a ballast tube too, a 4 pin 6-8B. Come to think of it, the
> B+ feeding the osc is regulated too with an OC3 if I remember right.
>
And it still drifted all over...

> I used to have a stereo equalizer that I used. I'd feed the audio.....

I like to have more drop than most stereo equalizers will do. I use a 7th order chebychev low pass in the speaker lead these days. The good FSK converters working at audio begin with a fairly tight bandpass filter so ignore HF noise.

> Other than replacing rectifier tubes with SS rectifiers, I've never
> really done anything along the lines of SS hacks for tube type.....

The 6AL5 is a pretty good RF diode. Has more voltage drop than silicon or germanium with a lot of current, but less of a threshold at low voltages. Also the electron cloud contributes some forward current even without forward voltage. I've liked germanium diodes like 1N270 or 1N198 for 6AL5 in RF service, probably these days a schottky diode will perform better if it can hack the PIV. Otherwise the common 1N914 like silicon switching diodes are too slow for good RF detection. And that 0.6 volt conduction threshold (.2 in germanium, less in schottky) messes up weak signal detection. Good tube vintage tube manuals show curves for detector diodes like 6H6 and 6AL5.

Date: Fri, 27 Aug 1999 10:39:21 MDT
From: "Kenneth Crips" <w7itc@hotmail.com>
Subject: [R-390] solid state vis hollowstate

One of the many things I like about tube type gear is the pleasure of using macho tools, big honking wire cutters, soldiering guns (with POWER), big screw drivers. It's a pain looking at a board and trying to decide if the speck you are looking at is a surface mount part or a fly speck. When I am asked the difference between solid state and tube type gear I tell them, with solid state you are always worried about hurting it with static, overcooking parts, etc. On the otherhand with tubes you are always worried about getting yourself nailed by high voltage, either from the big electrolytic with the bad bleeder resistor you didn't know about, or when testing with instruments. In other words with soldstate you are worried about killing it, with tube type you are worried about it killing you.

Date: Fri, 27 Aug 1999 12:58:59 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Why use a tube when Solid State will do!

Yes it would be tough to do. I got a sack of new SOT-143 silicon double gate MOSFETs from Farnell in GB two days ago. Took one week from placing my order on their secure web page, cost .45 US per transistor, .65 shipping when I ordered only 35. Shipping likely would have been the same for 300... And cost per transistor probably lower since 25 was their first price break. These are good though better than 1 GHz, the package is about 4 mm in diameter with radial leads. At least this week, that's not bad availability. The part number is BF-988. I found a data sheet somewhere on the web in .pdf format.

I'm no fan of multiple conversion receivers. Mixers, especially tube mixers are obnoxious noise sources and have rotten strong signal handling capabilities. The tracking tuned circuits of the 390 family are there precisely to minimize the strong signals getting to the mixers. The big problem is that the modern double balanced ring mixer that has good signal handling capability is low impedance and all the 390 circuits are high impedance...

At the moment, I'm thinking that the single conversion receiver will outperform the 390 family. The state of the art is probably a Norton feedback RF amplifier

feeding a diode ring double balanced mixer that's properly terminated with wide band terminations feeding the initial receiver selectivity after a low gain wide band first IF stage. That initial selectivity should be most of the receiver's selectivity, then the following IF amps are only for gain and gain control. Just before the detector its worth having another set of filters to remove the wide band noise from the detector that's been added by the IFs. This is rarely ever done. The distributed selectivity is one of the things that makes a 390 probably have a little bit better signal to noise ratio on weak signals (including SSB and CW) than the 390A.

The failings of the supposedly modern rice box tend to come from ignoring phase noise from the synthesized local oscillators that lead to reciprocal mixing (oscillator noise side bands mix strong unwanted signal components into the IF bandpass where they can't be removed), neglect of the wide band terminations of the mixers, and letting the first IF filter be wide enough for FM reception which opens up the second mixer to close in unwanted strong signals. Some I suspect also keep that first "roofing" filter wide because they get the fine steps of the tuning at the second conversion...

TenTec comes closer to what I think is the best receiver, though their best receivers are not general coverage. The TenTec Corsair II uses the Norton RF stage (Ulrich Rohde's favorite) with a ring mixer feeding another Norton at the IF and then the 9 MHz main selectivity... There's a second conversion to a 6.3 Mhz second IF so there can be some bandpass tuning. Which I find very effective. The later Tentecs use the same frequencies but a synthesized local oscillator. They cut the phase noise by keeping the tuning range narrow and doing it at VHF then dividing down to the 5 MHz range. I do find a low pass filter on the Corsair II speaker beneficial in reducing hiss noises from the IFs.

With the slow but practical availability of low phase noise signal generators like the HP8640B (I wish I had a pair to measure receiver intermod) I think a better receiver might be made using one of them as the local oscillator with the filtration right after the mixer. Bandpass filters at the input would be some benefit, and needed for image rejection because the good RF stages and mixers are good from LF through VHF. I do have an HP 5100/5110 synthesizer that is very low noise, covers 0.1 Hz to 49.9999 Mhz. I should try that with a plain IF. I've used it to mix general coverage to a hamband receiver with decent results.

Replacing a shunt regulator with a series regulator (have to remove the series resistor that fed the shunt regulator) should reduce power dissipation some. But it can't be automatically plug in unless there are some wiring changes made to the 0A2 socket to allow some separation of functions. Have to use the jumper in the 0A2 to connect up the original series resistor and supply unregulated to some other 0A2 pin. Beware that applying a high voltage to an unused 0A2 pin might lead to that pin glowing inside the 0A2.

I've not yet bread boarded my 0A2 circuit, but have worked out resistor values. And tossed in the feedback capacitor to slow things down.

There's probably room for a couple henry choke over where the 26Z5s were.

Date: Wed, 03 Nov 1999 23:18:06 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] I.F. module

Hmmmm... Actually, what made me think of microphonics was a situation I just came across with an HQ-180AC. While the tubes tested good on my TV-7D/U -- maybe a couple of marginal ones - I seem to be getting some distortion on strong AM signals. Then I noticed that two or three of the tubes have gone microphonic. It may just be one, for that matter. Then I happened across a section in the manual which says:

"Excessive oscillator drift which is most noticeable on all of the high frequency bands plus a microphonic condition, is usually the result of a poor 6C4 (V12) high frequency oscillator. This tube is also capable of producing a poor beat note with a ripple in it, also especially noticeable on the high bands. Sometimes interchanging the 6BE6's between V2 and V3 can produce a noticeable improvement."

These tubes are a bit familiar. Are 6C4's particularly prone?

Another coincidence -- with what you mentioned: When I first powered this up, the meter pinned backwards and stayed there. I compensated with the zero set control, but ...? The HQ-180's use a bunch of 6BA6's. The "most microphonic" one I found was also a 6BA6 - V4, in the 455 KC IF. Hmm, grid emissions, microphonics, AGC, distortion, backwards S-meters, 6BA6's. Seems to be a pattern, even though this is a very different radio. So it might make sense for Fred to do a "tap" test in addition to emissions. I'll have to do an emissions test in addition to the tap test.

Date: Wed, 03 Nov 1999 22:55:21 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] I.F. module

Grid emission is more prone in tubes that are run with high cathode current. Sputtering is a function of electrons emitted. Some of the microphonics may be a function of higher gain caused by grid emission fighting AGC voltage and winning. Depending on the particulars of the AGC filter and AGC isolation between tube grids, one tube with a lot of grid emission may put all the RF and IF stages into high gain modes, while only that one tube has grid emission. Yet being with positive grid bias the plate currents are high and so are the gains so that otherwise minor microphonics are far more noticeable as well as the last IF stages being over driven. When an IF tube is used as the S-meter amplifier from AGC voltage is when the negative S-meter reading happens most often from grid emission. The 390 doesn't do that so its different, though it uses a separate meter tube to read AGC voltage, strong grid emission from a signal tube can still drive the meter negative.

There is a Sencore tube tester made just for checking grid emission. I saw one at a hamfest Sunday, but I already own one. Back in the day of tubes in consumer radios and TV's GC made a little rubber hammer for testing tubes for microphonics, just two pencil erasers on the end of a pencil but shaped like a hammer.

There were shops that declared any other test was a waste of time, only the grid emission test was good for trouble shooting because grid emission was more critical to many circuits than the other tube parameters. And besides with a sensitive enough grid emission tester (that was far more compact than the Gm testers of the era) they could sell more tubes noticing the beginnings of tube failure forecast by grid emission.

Date: Thu, 04 Nov 1999 04:32:53 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] I.F. module

>NO. I said GRID EMISSION not plain emission tester.

OOOPS! Sorry Dr. J, I stand corrected. Copied the list on this just in case others are not clear or I mislead anyone with my last post -- as might happen if we just let the thread end there.

Date: Mon, 13 Dec 1999 00:59:35 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 6AJ5 replacemnt

The 6AJ5 is basically a 6AK5 that works with 28V on the plate rather than normal B+ voltages. Try each of the 6AK5's that you have. I'd almost bet money that several of them will work just fine in the R392.

Date: Mon, 3 Jan 2000 17:59:55 -0400
From: "Chuck Rippel" <crippel@erols.com>
Subject: [R-390] Massaging Tube

Anyone want to start a thread on which sockets should get the stronger tubes? I have a hunch that marginal ones will work fine in certain sockets. I think it was Nolan who says a well aged but not necessarily strong 5749 is best in the PTO, but strongest 5749's should go in the earliest IF stages. How to allocate the seven 5814A's? Here is a way to help conserve our dwindling tube supplies.

If I get a real hot radio and the owner wishes to invest the time, I "massage" the tube line up for optimum performance. That indicator is sensitivity, expressed as the best 10db S/N + N figure.

When a receiver is working properly, the limiting factor is not gain, rather its noise. Thus, convention wisdom which might lead one to install tubes relying on those with the highest transconductance to provide the best performance is flawed. That is why subbing out V201, normally a 6DC6 with a 6BZ6 doesn't provide any additional real sensitivity.

If choosing tubes with increased gain provides for higher performance, there is something within the radio that is not working properly or is mis-aligned.

F'instance, typically I install a 6C4 in V-202 that has a lower transconductance figure. Makes for a better noise figure early on in those bands which are triple conversion.

The 5814's make no real difference save for the one which serves as the detector, V506B. I always replace that with a brand new one unless the one which was already installed is spectacular.

Date: Sun, 2 Jan 2000 21:20:17 -0500
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] Crystal oscillator ?

> > Anyone want to start a thread on which sockets should get the stronger

> > tubes? I have a hunch that marginal ones will work fine in certain
> > sockets. I think it was Nolan who says a well aged but not necessarily
> > strong 5749 is best in the PTO, but strongest 5749's should go in the
> > earliest IF stages. How to allocate the seven 5814A's? Here is a way to
> > help conserve our dwindling tube supplies.

I moved some 6C4 tubes around in the RF deck, and seem to have much better sensitivity as a result. I had one 6C4 that tested considerably lower than the other two; just barely "good" on a TV-7.

All tubes were tested first in socket V204 with V202 and V203 removed. The RF gain was cranked all the way up in MGC mode. This test was just to measure noise with a VTVM at the Diode Load point. I wanted to know if any of the tubes were "noisier" than others. They measured and sounded about the same (within 0.01 VDC).

I measured each on a TV-7 tester, and got a wide range of results. I moved the best one to V202, the second best to V203, and the worst to V204. I wanted the best in V202 because I like the frequencies below 8MHz more than those above, since I listen mostly at night. If I preferred the bands above 8MHz, I would have placed the best one in V203, the second best in V202, and the worst in V203.

I also performed the same exercise on the IF deck with V501, V502, and V503. I tested all for noise in socket V503 with V501 and V502 removed. Again, all were about the same with regards to noise. After testing for transconductance in the TV-7 tester, I placed the best in V501, the second best in V502, and the worst in V503. There was not nearly as much difference in transconductance with these three tubes as with the 6C4 tubes.

Some additional comments:

1. I did repeak the alignment for the variable IF section after moving the tubes around.
2. I checked the voltages at the grids to V202, V203, and V204 using test points E209, E210, and E211 prior to swapping any tubes. In AGC mode with a moderate signal, all DC grid voltages were about the same and a few volts negative. I didn't want to start swapping tubes if I had a "gassy" one with grid emission. (I highly recommend using a VTVM for this measurement instead of a digital multimeter)
3. I do plan on looking for a replacement 6C4 for the one that tested lower than the others.

Date: Fri, 14 Jan 2000 03:11:34 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 5814A tubes

Maybe, and maybe not. ;-(All of the military contract 5814A's that I have are identified on the tube with JAN 5814A, the EIA code for the manufacturer and a date code. The box will have all of that plus the contract number. I've got them in original boxes going back to a 1962 Air Force contract. Almost every JAN 5814A that I've seen was Sylvania. Most had the name painted on the tube in green paint. Phillips ECG bought them if I remember right sometime in the early 1980's. I think they changed the paint color to blue if I remember right. You wouldn't

believe the number of fake branded tubes that are out there. You can't take the labeling for granted Ed. I've been running into "fakes" for twenty five years. Some worked OK, some were crap. It's getting worse and worse for any tube that's an "audiophile" tube. There are probably more fakes available than the genuine articles.

Let's see what I have handy, here's a pair of Mullard EL-34's, in Mullard marked boxes, with the tubes marked as Mullard and "Made in England" that I bought from AES about ten years ago for a modulator. In actuality, they're not Mullards at all. They're dimple topped East German tubes. They're a lot better than the Chinese made fake Mullards on the market today though.

Here's a Raytheon 6LG6C marked as made in Belgium. In actuality it's a Russian Sovtek. I've got a quad of fake labeled 6L6GC's in the HP-712B power supply right now. They're Russian, too. And, they won't handle the load of real RCA's but they're decent enough if I limit the max voltage out put of the PS to under about 425 volts. A quad of real RCA's will grind away at 500 volts and 200 ma output with no internal arcing or the plates glowing for weeks on end. I've seen Mullard marked 5814's almost twenty five years ago. They were really Italian Fivre brand 12AU7's. You don't see many Italian tubes. :-) Oh, plus Mullard never even made 5814's. <grin>

I won't even go into the 6DJ8/6922/7308 fakes or the 6106 (HD version of the 5Y3WGT) that are floating around that are Chinese.

Westinghouse was another brand that was commonly faked. Beautiful job on one batch I saw. The boxes were either NOS or some really high quality fakes. The tubes were Chinese.

Then there were the Servicemaster 12AT7's that weren't really 12AT7's but unknown origin 12AV7's with the original number ground off of the glass and relabeled. Oops, let's not forget the 6DJ8 that were actually 6ES8's. No, they didn't work in the Tek scope very well. I've seen a 6V6GT that had a ground area on the glass. No idea of what that tube actually was. I make it a point to steer clear of International Servicemaster tubes. Chief Brand was another one.

I used to see a lot of the old Radio Shack tubes that had ground off numbers too. Let's not forget the Chinese made Telefunken 12AX7's. It's so easy to identify a real Telefunken that it'd take a real dumbass to attempt to fake them. Lots of fakes out of Eastern Europe too.

> 5814 is a mil numberActually, 5814 is an industrial number. I've had examples of faked 5814's that are actually 12AU7's. How can you tell, you ask? The filament current for one and the internal construction for the other. They were labeled as Amperex and made in Holland.

>so who ever made 'em its gotta be a good tube. Its the tube that works not ye olde boxe.

Typically, the quality control specs for JAN tubes were well above those for normal tubes.

Date: Fri, 14 Jan 2000 19:38:23 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 5814A tubes

>Dang! Thanks for the tubefraud tutorial, Nolan.

It's a lot more common that a lot of people would think. People were faking and mislabeling tubes even in the 1930's. ;-(Even Fair Radio Sales has a batch of 7308's that were marked as Amperex. They realized that they weren't really Amperex and have them labeled as looking "Russian". They've been in their catalog a few years now. I can remember running into tubes with ground numbers when I was a kid. I used to think that they had made an error labeling them and had to remark them correctly. I'm not that gullible today.

Date: Fri, 14 Jan 2000 22:40:46 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 5814A Tubes (More Westinghouse Fakes)

>Then, the aforementioned varmints destroyed my blissful ignorance.
I.....

Was it "Raytheon Red"? ;-(

>.....popped open a 6CB6 box. Yup, my "6HS6" is a 6CB6. The only other.....

All of the glass miniature Westinghouse tubes that I have used their classic yellow logo.

>..... paint have date codes and etched tube types; the 6HS6's do not.....

Yeah, that's a tip off. I can't ever remember seeing a Westinghouse tube that didn't have a date code on it. For a while, they used a series of dots and slashes above and below the "Westinghouse" name. Each letter of the name indicated the month/year that the tube was built.

Not all Westinghouse tubes had etched an number though. I've got a little 5654 sized WE409A (6AS6) setting here that I just removed from a piece of military UHF gear that I scrapped that has no etched number. Everything is in yellow paint, including the date code. :-)

>At the moment, it appears I have some NIB 6CB6's that cost twice what >they should have and are of dubious manufacture.

Welcome to the ripped off tube buyers club. I've been a member since the 70's. ;-(
(The conspiracy deepens....

Speaking of which. Do any of you guys remember an outfit back in the late 60's and early to mid 70's that was famous for their 36 cent tubes? I ordered some tubes from them on several occasions. Most of which weren't all that hot but the law of averages usually worked in your favor if you ordered three of one type, you'd usually get a good one. I suspect that most of them were factory culls.

The name of the company was Cornell or Cronwell, or something like that. I'd love to get a copy of one of their old sales fliers if any of you guys still have one.

Date: Sat, 22 Jan 2000 17:25:51 -0600

From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] OA2 testing

>I give up. How come there is no data to test the OA2 in a tube tester? the TV 10D.

Joe, I don't know about the TV-10D, but there is data for testing an OA2 in a TV-2*, TV-7*, and even the old I-177 series military testers. Does your data list the 0B2? If so, all of the settings are the same with the exception of the shunt setting. For the TV-7 series, the OA2 shunt setting is 32 whereas it's 40 for the 0B2. You should be able to get a rough idea if you do have 0B2 data. Also, about half of the problem regulator tubes that I've had checked "good" on testers.

>Can it only be tested in the circuit? What if it shorts when its hot?

If it shorts, the normally regulated 150+ to the PTO would probably shoot up to about whatever the normal B+ is. [*actually it goes to zero*]

I've had a lot of weird problems with OA*, 0B*, 0C3, 0D3, 0G3, 85A2's, 5651's, etc. thru the years but I've never seen one short. There's a hell of a gap between the anode and cathode in there, as much as a half an inch. Its pretty to test one under load. Depending on the particular regulator tube, you're only talking somewhere around a max load of 25 to 40 ma. An adjustable DC power supply, a resistor decade box or good adjustable 5 watt pot, a voltmeter and a DC Ma meter and a half a dozen insulated jumpers will do it. You might want to put a scope on it too. I've found noisy ones using a scope before. I think it normally takes about three minutes of so for one to fully stabilize from "cold". Another advantage to using 6626's over OA2's is that the voltage regulation is a lot tighter. I want to say a half a volt for a 6626 and a volt and a half or a little more for a normal OA2.

Date: Sat, 22 Jan 2000 19:32:52 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Spurious Intermittent Help...

Most tube tester tests are only for conduction. e.g. if it draws current with enough voltage applied through a protective resistor its probably OK as far as the tube tester is concerned. Its important to watch the glow for instability during the test. Few fail shorted, more often they fail open, e.g. not conducting when they should.

Date: Sat, 22 Jan 2000 19:32:59 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] OA2 testing

If a VR tube shorts, the output voltage goes to ZERO because its a shunt regulator and the dropping resistor begins to leak smoke. I don't think I've ever seen one shorted, most of the time their failure is one of lousy voltage regulation or oscillation. Either of those is probably from a change in gas pressure. A scope is a good idea because one failure mode is oscillating. The VR tubes normally have a negative resistance region in their curve and if the current through the tube gets too low and the capacitor across the tube is too large it makes a great neon bulb type relaxation oscillator. It takes 15 or 25 volts above the voltage rating to fire and so long as the current through the tube stays above 5 or 10 ma the tube is in a stable region. But if the current gets lower, or the tube

characteristics change because of a different gas pressure, the tube can stop conducting which lets the voltage rise up to the trigger voltage then the voltage drops while the tube takes current... A zener diode at the same voltage is not as fine a regulator. My solid state circuit that I've not yet bread boarded would do much better. Need to try that some time.

Date: Sat, 22 Jan 2000 20:33:13 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Spurious Intermittent Help...

Apparently voltage regulators fall into a group of tubes that can't be tested definitively-- or at least that's what I infer from the second page of the Test Data for Electron Tube Test Sets TV-7/U through TV-7D/U, TB-11-6626-274-12/1. Sure, you can get an idea of the tube's emission or discharge characteristics, but read the following quote. YMMV:

Note. The meter indication for tube types such as pentagrid converters, mixers, thyratrons, and regulators (listed below) is not a true and conclusive measurement of the tube condition and value. In some equipments, it is necessary to substitute a known good tube of the same type to obtain a true indication of the tube's condition. Do not discard a tube which does not operate satisfactorily in the equipment, if the test set indicates the tube is good. The tube may operate in another circuit. Thus endeth a reading from TB 11-6625-274-12/1. Following the note is a list of the tubes alluded to. 0A2's, 0A3's, 0B2's, etc., plus over eighty other types are included as well as the 26D6 (for you R-392 mavens).

Moral: Tube testers in general are not definitive, but a helpful guide at best.

Date: Sat, 22 Jan 2000 21:18:18 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 0A2 testing

>If a VR tube shorts, the output voltage goes to ZERO because its a shunt
>regulator and the dropping resistor begins to leak smoke.

I had a massive brain fart on that one Doc. I'll blame it this really groovy opiate laced cough syrup. <grin>

>I don't think I've ever seen one shorted,

About the only way that one could short would be to have had a bad internal weld and resulting loose "pieces" rattling around inside of the envelope. There's so much clearance in one that it isn't funny.

>most of the time their failure is one of lousy voltage regulation or oscillation.

Agreed. I've seen a lot of regulation problems. ;-(

>Either of those is probably from a change in gas pressure.

You know, I've often wondered about something Doc. I know that a lot of neon lamps have a trace of a radioactive isotope in them to help the ionization process and I know that a majority of the 0A2's have a hint of radioactivity. There

are three different commonly used isotopes, depending on the mfg of the tube. I suspect that it's for the same purpose as used in the neon lamps. At any rate, I was digging around a while back and noticed that the half life of one of these isotopes was only ten or twelve years. Since I doubt that a new 0A2 has been made in 15 years or better, some of these are getting "old". Any ideas on how this could effect the tubes Doc? I'm guessing that it might cause a higher voltage requirement to initially fire the gas and maybe some instability until it had warmed up but I ain't no engineer. ;-)

Do you think that it could have a noticeable impact on the performance of the regulator even after it's run for a while? More prone to faulty regulation or oscillation? Do you think it might be worth avoiding the mfg tubes that use the isotopes with the short half life?

> > jumpers will do it. You might want to put a scope on it too. I've found noisy ones using a scope >>before. A scope is a good idea because one failure mode is oscillating. The VR tubes normally >>have a negative resistance region in their curve and if the current through the tube gets too >>low and the capacitor across the tube is too large it makes a great neon bulb type relaxation >>oscillator.

It took me an awful long time to track down the problem the first time I had a noisy one. I had measured the regulated voltage and it was right. I never suspected the 0A2 could be a source of audio noise. I ended up swapping out the audio module after I couldn't find the problem. The problem went away so, I swapped the caps and then the tubes in the decks and reinstalled the original deck. I did a tube by tube swap and found that the noise "went" with the 0A2. After you've had one, you don't forget. I had a noisy 0B2 in one of the antenna couplers a few years back and a real nasty problem with either an 85A2 or 5651 in the Tektronix scope a few years ago with screen "noise". That design one glows orange and is a neon filled one. I've seen only one of two of the old fullsize octal based 0x3 type with these problems. I think that all of those that I'm using were built during WWII. or before It was only by accident that I found that the scope was a good tool for finding a bad one. I was looking for a totally unrelated problem and happened to scope the 150V line on a receiver that had no apparent noise. Nasty looking for "DC". Using a VTVM, the voltage was a nice ~150 volts. I got to wondering and started swapping 0A2's and 6626's from my spares and noticed that about half of them were erratic as hell. Since then, the 0A2 is at the bottom of my list as far as a "trustworthy" tube in the R390A's.

>It takes 15 or 25 volts above the voltage rating to fire and so long as
>the current through the tube stays above 5 or 10 ma the tube is in a
>stable region. But if the current gets lower,

OK, gotcha. The current getting lower thru the regulator tube would be caused by an increased somewhere else in the receiver on the +150 line.

>or the tube characteristics change because of a different gas pressure, the tube can
>stop conducting which lets the voltage rise up to the trigger voltage
>then the voltage drops while the tube takes current...

Interesting. I never thought about it from that stand point. It might be possible then that under those circumstances that a decrease in the level of the isotope in the tube could cause problems. I need to dig out all of the tube manuals and see

if there's anything interesting on VR tubes that I've either not paid attention to or forgotten.

>A zener diode at the same voltage is not as fine a regulator. My solid
>state circuit that I've not yet bread boarded would do much better. Need
>to try that some time.

I never was a big fan of zener diodes. My first run in with them was on my old Triumph and BSA motorcycles as a kid. That soured me for life on them. They were used to shunt excess charging voltage to ground. Hey, no moving parts! ;- (Stupid Lucas electrical system...

Date: Sat, 22 Jan 2000 21:31:31 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 0A2 testing

>When testing VR tubes on the TV-7D/U, I find I have to press the
>appropriate test button briefly several times for the reading to
>stabilize. Apparently this is the way the tube warms up.

Yep. I remember reading somewhere that it takes about three minutes for one to stabilize. Norm, something that you might be interested in is that if you're to use your TV-7 or for that matter, any of the Hickok designed tube testers that use a number 83 rectifier, turn the tester on and set the voltage to the line set. Then let it cook for about a half an hour before you test any tubes or press any other buttons.

The 83 tube is designed to run "upright". When it sits on it's side as in the tuber testers, or if it's moved while cold, droplets of mercury can fall/condense onto the cathode/heater of the tube when cold. If B+ is applied while these droplets are on it, it will basically destroy that part of the heater/cathode. It can also cause an internal flash over. Running the tester for a half an hour without testing any tubes will allow the mercury to vaporize and prevent this from happening and can greatly extend the life of the number 83 tube.

The same thing goes if you want to test a number 83 tube. Plug it into the tester and let it run for a half hour before you attempt to test it. also, don't store mercury vapor rectifiers on their sides if you can help it and never ever shake one.

Date: Sat, 22 Jan 2000 20:11:08 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Spurious Intermittent Help...

Ok, I got it now! The tester will tell you if it won't fire or if its totally dead.

Date: Sun, 23 Jan 2000 19:18:53 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 0A2 testing

>The tale I've heard on radioactivity in VR tubes is this: They were needed in aircraft radar units which tend to be sealed in barrels to keep them pressurized. That keeps out light. Light also helps a gas discharge start.

I checked thru about twenty tube manuals for the 0A2* and only found one reference to light. It was in a 1960 Phillips manual. In Dutch... Gee, that's real

handy here in the South. If it'd been in that English, I could have figured it out. ;-(

>So a bit of radioactive isotope was added, especially to military VR tubes. So it might be that a photon or two from the glow of a nearby filament or panel lamp would be enough trigger. I don't think the isotope would have any effect on stability or aging, just on the initial firing voltage.

Interesting. I guess that the VR tube parallels the common neon in a lot of ways I'd never really thought about.

>suppose I could include a led to indicate that its working. I sure wouldn't want the noise of a neon bulb!

Agreed.

>It should be practical to create a fairly simple VR tube test set. It
>would need a variable DC voltage, a variable dropping resistor, a
>milliammeter, a voltmeter and a scope connection.

One thing that I noticed in the various tube manuals is that the capacitance across the VR tubes can't exceed a set value or it can cause oscillation of the tube. I checked the schematic for the R390A and naturally, the value is well below the potential problem level but I still found this interesting. I'm wondering if it might would be worth playing with a capacitor decade box across the VR tube while in a simple little test fixture like that. While monitoring the tube with the scope the capacitance level across the tube could be slowly increased until it starts oscillating. Wouldn't it make sense that a tube that started oscillating while shunted with 0.201 mfd would be more stable over the long haul than one that would start oscillating while shunted with only 0.178 mfd? I'm guessing that the 5000pf that the 0A2 is shunted with in the R390A was done as a compromise at cutting the noise level from the tube. Too much and it oscillates, and not enough and you have hash.

>Each data sheet gives a maximum allowable firing voltage. You'd want to
>figure the variable dropping resistor get keep the tube in the rated current
>range (generally 5 to 50 ma) at a hair above the rated firing voltage.

That shouldn't be difficult. :-)

>Then starting with the DC supply lower than the operating voltage gradually
>raise it until the vr tube fires. You could also check the effects of light on that
>firing voltage.

Cool!

>Then you watch the DC voltage across the VR tube as you vary the current
>through the dropping resistor by varying the dropping resistor value, or the
>supply voltage. At the same time you monitor for noise with the scope. Or a
>signal tracer.

This wouldn't be difficult to do at all. An adjustable regulated power supply would be the way to go.

>I don't know why most tube testers don't except they were probably thinking
>consumer radios and TVs which rarely used VR tubes (neglecting short wave

>receivers). It does take a separate circuit, but even just firing the VR tubes takes
>a separate circuit, witness the P4 on the Hickock tester and plate voltage
>position 4 on my Heathkit emission tester.

I had thought that all of the military tube testers would test VR tubes until Joe made his post about the TV-10 series. Even the old WWII I-177 was set up to test them.

>As a minimum fixed tester for VR tubes you'd need a supply voltage for each
>value of tube with just a hair more DC than the rated firing voltage. Then a
>fixed resistor to limit the current to something within the ratings of the tubes.

I'd think that a max of 200 volts DC with adjustable dropping/limiting resistors should do it. About the highest minimum supply voltage requirement is 185 volts for the 0D3W.

>And a reasonably accurate DC voltmeter to check the voltage drop when fired
>at whatever current so long as it was outside the unstable range. You'd want to
>be able to connect a scope or signal tracer to detect noisy or oscillating tubes.

It'd be pretty simple to build. You'd need a total of only two tube sockets, the 7 pin miniature and an octal. All of the 0x3 octal ones use the same basing. The same goes for the 7 pin 0x2 and 5651x types.

>This more careful test than just seeing if the gas glows would likely reject more
>tubes, but those reject tubes probably should have been fed to the trash bin
>anyway.

Agreed. ;-)

> > OK, gotcha. The current getting lower through the regulator tube would be
>caused by an increased CURRENT somewhere else in the receiver on the
>+150 >line. Or by a reduced supply voltage.

Due to weak rectifier tubes, etc. I didn't think of that.

>A lowered (or raised) gas pressure and change in composition because of an
air >leak in or gas leak out could change the stable range, the regulating
voltage, the >noise level, the firing voltage, or all at the same time.

Not to mention ambient light. <grin>

Date: Sun, 23 Jan 2000 19:32:45 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] OA2 testing and the TV-10*

>The manual specifically warns DO NOT press button P3 (mutual conductance test) when testing rectifiers. This would put the full 150 VDC onto the rectifier plate with no way to limit the current. Not good!

There's an old TV-7 and I-177B trick that you might look at doing to your TV-10 to help protect the meter movement in the event of pushing a button when it shouldn't be or trying to test a shorted tube for mutual conductance.

Scoop yourself a pair of 1000V 2 amp or better silicon rectifiers. Solder both

across the terminals of the meter in opposite directions as far as the polarity is concerned. This will limit the maximum voltage to the meter movement to about 6 volts or what ever the forward voltage of the rectifiers are.

This will work on just about any meter movement that normally operates below the voltage level that the rectifier conducts at. I'm not saying that you can't still smoke a meter, just that you have more time to react and let go of the button when the meter is seeing 0.6 volts thru it's windings than 30 volts.

Date: Sun, 23 Jan 2000 22:44:34 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] Re: TV-7/U Meter deflection

Check the electrolytic bath tub style capacitor with white and red wires that go to the meter. Take it out of the circuit by totally removing both wires and substitute a small electrolytic cap and try it. I had one puke out a while back and it caused really odd problems with the meter. The movement was real "slow" to return to zero too. Just removing one wire won't tell you if it's internally shorted to ground.

>A,B, & C scales work normally. Is this a common problem? I suspected one of the two meter circuit diodes, but that would affect all scales, not just D and E, I think.

I would think so too.

> Any thoughts? Is there a "Wizard of TV-7's" somewhere on the list?

Yep, Dan Nelson. Hell of a good guy. Drop him a note at: djn@goodnet.com
His schedule can be pretty tight at times and sometimes he's a little slow to get back with you. He's not ignoring you, he's probably out of town. :-)

Date: Sun, 23 Jan 2000 19:59:52 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] 0A2 testing

I think one of the major failure modes of the VR tube is an expansion of the minimum current to stay out of the negative resistance region. Typically the spec I remember was 5 ma. Shunt C could upset that by supplying current to the load and diverting current from the VR tube. Once the VR tube got into its negative resistance region the shunt C would help slow the frequency of the oscillation but supply more current to be sure of a solid oscillation. I guess I'd test more for the current range that was regulated, than to worry about the effects of shunt C. But if one is doing a compleat test, then running the tube with varying amounts of shunt C would be another test for the series. I think the consensus today on this list is that many tube testers will LIGHT a VR tube and find the really bad ones but not those that oscillate or regulate poorly. Ambient light is also critical to the testing of bipolar transistors and junction diodes. Its important with a glass diode to know if its been tested in the light or in the dark.

Date: Tue, 25 Jan 2000 14:39:09 -0500
From: km1h@juno.com
Subject: Re: [R-390] fixin' gassy tubes

Tungsten plate tubes generally require at least cherry red plates to reactivate the

getter process. The usual procedure is to run them at normal plate voltage and vary the bias until the plates are a nice cherry red to a dull orange. A good 10-15 minutes is sometimes necessary so it requires plenty of air and a PS capable of the load. I use an old SB-220 chassis with one socket, all grid pins grounded, all RF parts removed and a Harbach high speed fan. Been degassing 3-400, 3-500 , 4-250 and 4-400 types for many years. The process also worked well when I used to run a pair of 4-1000A's with 833A (later upgraded to 4-1000's) modulators on AM . Those were the fun days! In any type of degasser it is a good idea to install a resistor in series with the plate HV to limit tube current to a safe limit in case of an internal arc. Something around 20 Ohms/25W wirewound works well for a 3-500 size. A tube that has sat idle for many years may not be salvagable, the 3-500Z is a prime example. Many who bought spares for an emergency found this out the hard way. It is best to rotate them on a yearly basis.

Date: Tue, 25 Jan 2000 12:21:07 -0700
From: "jordana@nucleus.com" <jordana@nucleus.com>
Subject: Re: [R-390] Spurious Intermittent Help...

Hi well it seems that the problems were tube related... I have tested and swapped out ALL of the tubes in the rig... the 6AK5 Crystal Osc., and also one of the 5749/6BA6W IF tubes were both in very poor condition... the OA2 was replaced, and the B+ now reads 151.85 VDC.. the 2 plug in Filter Caps were also replaced with 2 other sets that are known to be good, and this made a slight improvement also... the Spur seems to have been related to the very weak 6AK5 tube, and the intermittent loss of gain seems to have been tied to the 6BA6 tube..I now have audio that is much cleaner and the spurs are no longer present... There is still a very slight amount of audio distortion , but it is only apparent with the RF gain backed off to between 5-6....I still have to try to check the small caps in the VFO which still causes the PTO to jump after an hour or so, but the remaining work cleaning and lubricating the PTO has greatly improved the drifting that was noticed... The rig will hold Zero Beat to within 1 cps for hours, after the jump has occurred... as a test I left the rig on for 48 hours, and it is very stable, again AFTER the PTO jump...Thanks to All who forwarded ideas and tips on the problem... Once I get it back in the cabinet, I will compare the Audio and Stability with my 67 EAC... One thing I have noticed , is that the EAC 390A has much more audio output at lower levels than the S-W , when the audio gain is at 0 on the EAC, it is still clearly audible whereas on the S-W it is audible but at a MUCH lower level... I will swap the Audio deck out with another one once the PTO work is complete....

Date: Tue, 25 Jan 2000 23:15:07 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] fixin' gassy tubes

I used to notice that the getter material in some small tubes was in the form of a ring that probably was heated by coupling to an RF coil.

And the process was stopped automatically when the ring burned open. Likely only Nolan's lighter or candle will heat the getter material now.

Date: Wed, 02 Feb 2000 20:07:59 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] R390/A Prices and blue 6AK6's

>I went tube shopping today to locate some 6AK6's to replace my pretty blue

glow ones.

I've had pretty decent luck with the zippo treatment on gassy 6AK6's. Did you try it?

>I got some NOS ones at \$5.00 each. Not the recovered recycled stock stuff I have been using.

You got burned bubba. You are paying way too much for 6AK6's. The last batch that I bought from Dan Nelson were NOS Radio Shack lifetime tubes made by RCA. I think that they were about seventy cents a piece of so. OH, Radio Shack still honors the guarantee and will replace them with a non lifetime tube if they puke.

You haven't been reading my posts I guess... ;-)

Email Dan and see what he's currently got. He should still have a few thousand of the British military 5654's too. I think that they were around sixty cents a piece of so. You're paying way way too much for common tubes.

Date: Wed, 02 Feb 2000 18:31:01 -0800
From: Dan <hankarn@pacbell.net>
Subject: Re: [R-390] Let's have MORE oil posts!

Jerry and group, McMaster Carr has all kinds of syringes with several types, lengths and diameters for all kinds of applications including flexible. Plus all types of synthetic oils, grease etc, in small size containers. Catalog #106. They are on line. If not a regular customer the current catalog is normally very hard to come by.

Date: Fri, 04 Feb 2000 11:49:59 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] Deaf R390/A

>3 6AK6's 1 6DC6 1 6C4 2 5654's later. I now have 1uV input. ...

Not bad at all. :-)

>My 6DC6 was only so-so and replacing it got me another 4DB on the signal to noise ratio.

The 6DC6 is a good example of a tube in the R390A to replace long before it gets anywhere near reject levels. For a while some years back, they were scarce as hell. Lowell Thomas won the bid on a number of them at a Govt auction sometime back and is selling them for about \$2.75 each or so. I suspect that he was the major driving force in a lot of the dealers dropping their prices from six and eight dollars apiece for them. They're NOS JAN tubes. I've picked up an extra three sleeves of them from him about a year ago. I'd guess that he still has some. You can email him at k6kc@lightspeed.net He's a hell of a nice fellow to deal with. If you have a need for 5R4WGB rectifiers, he's got a mess of them too pretty cheap. If you have the physical space in the piece of gear, the 5R4WGB makes a seriously heavy duty replacement for the 5Y3's.

>My next effort will be to put down a ground rod this weekend for the RF ground.

Drive more than one ground rod and use 8 foot rods. Space them about 8 feet apart and use one continuous piece of wire for the ground lead. nolan

Date: Fri, 04 Feb 2000 19:40:55 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] 6GM6 mod for 6DC6

While the 6GM6 is higher gain and lower noise, it doesn't have the smooth extended remote cutoff characteristic of the 6BA6 and so doesn't contribute to good AGC control, nor to handling strong signals with minimum intermod.

While the 6BA6 and 6AK6 share the same basing diagram, the 6BA6 hasn't a ghost of a chance surviving as an audio output stage because it doesn't have the plate dissipation capability. That metal you see is not the plate, its a shield. It probably will also contribute audio distortion from inadequate cathode emission. Its like sending a boy to haul concrete in a contractor's wheelbarrow...

Besides rotten antenna efficiency with the T2FD, any antenna with a long run of small coax like RG-58 is less efficient above 15 MHz because of the coax losses. RS RG-58 is even more deficient in that regard.

I suppose the T2FD with its 90% losses may work better with an unskilled operator and than a decent antenna and a badly mistuned tuner.

Date: Sat, 5 Feb 2000 17:40:35 -0500
From: "JAMES T BRANNIGAN" <JTBRANNIGAN@prodigy.net>
Subject: Re: [R-390] 6GM6 mod for 6DC6

Many years ago I tore apart a 75A3 and did a number of QST mods.....changing mixers and front end tubes...I was never happy with the darn thing....after many changes I realized I was no match for the Collins design team.

When Collins realized the limitations of the 75A3, they built a 75A4 and when they realized the limitations of the A4 they built the 75-S1, etc, etc,

But there was no way in hell I was going to turn a 75A3 into a 75S3B... I have learned to leave Collins gear alone...Factory mods, yes...but after that go buy a new radio Now , if you want a challenge, align a 62S-1

Date: Tue, 8 Feb 2000 17:45:03 -0500 (EST)
From: JOHN_SEHRING.parti@ecunet.org (JOHN SEHRING)
Subject: [R-390] 6DC6 TUBE SUBS

The 6DC6 is used in 390s, by Hallicrafters & Collins in ham rx's because of its superior resistance to cross modulation.

Sensitivity, is not, I repeat, not the most important attribute in an HF receiver. Rejection of crud is in dense RF environments is. That's where the 6DC6 shines.

If a well-designed receiver using a 6DC6 RF amp is not limited in sensitivity by antenna noise at, say, 30 MHz, then the receiver has problems. Fix that rather than changing the RF amp!

Date: Thu, 10 Feb 2000 10:47 -0800 (PST)
From: rlruszkowski@west.raytheon.com
Subject: [R-390] testing a given tube's noise

Asked, Are there any quick and dirty methods for testing a given tube's noise?
And can one in some way calculate its noise from the ordinary tube data sheets,
where noise is not specified? - 73 de Johan

I would say tube noise is independent of any reading on a TV7 tube tester.
Tubes will show the same meter reading in a TV7 and yet give very different
noise performance. In a R390 / R390/A you hang the Signal generator (AN/
URM25) on the front end and a DB meter (TS585) on the audio output and start
swapping tubes.

For the audio and IF put 150UV into the IF deck. For the RF deck use some thing
over 8 MHz at 2-4 UV into the antenna. For the BFO and VFO swap the 5749's
into the IF deck during that test. Use 30% 400Hz audio modulation. and CW. Set
up the test and measure the audio output level with 30% modulation. Turn the
modulation off. Measure the audio output level again. The difference is noise
level of the circuit under test. In the IF deck you need 30DB difference. In the RF
deck across the entire receiver you should be able to get better than 20DB
difference.

Pick one tube socket. The closer to the front end the more reliable the test will
be. Swap the tube in the socket with a spare. and record its difference. The
difference will be better or worse than the first tube. check all your spare tubes of
one type this way in the same socket.

Once you get all of one kind graded best (largest difference) to worse (least
difference) between modulated signal to CW signal, plug them in with the best
ones forward in the signal path.

Repeat the test with all the tubes you just swapped out and again find the best of
the lot to use.

Save the best two 5749's for the PTO and BFO. Use the diode load 5814 for the
test socket to check all the 5814's. You will want a good 6AK6 for test. As you are
only using the Local output to the meter on the rear panel you can swap the line
6AK6 around for test. Do the 5654 (6AK5) in the crystal deck. Do the 6C4 in the
second mixer (Working over 8MHz lets you swap the 6C4 and 5654 of the third
conversion out for test. You will need a spare 6DC6 for the RF.

These are relative test. This tube works better than that tube. Do this test on your
receiver and see the difference in 5749's, 6AK6's, 6C4's and you quickly see that
the noise listed for a type of tube is not the best indicator of where a tube should
be used in a new circuit design.

This test procedure will help you improve the signal plus noise to noise ratio of
your receiver. New tubes are more noisy than burned in tubes. Put the best older
ones forward and add the new tubes to the end of the string to burn in. After a
while burned in tubes get nosier again.

Where we left receivers on forever once every 6 months this exercise was
conducted. We stopped when we got 30DB difference at 150UV in the IF (you
need that or you will never get 20 in the whole receiver). We stopped again at

4UV and 20DB in the receiver. You can do a hell of a lot better than that. I got 1UV and 40DB difference 100 Miliwatts output or better across the entire . 5-30MHz once on a R390A back in 73.

This process can be used on any receiver to compare the noise of like tubes in the same circuit. Roger KC6TRU San Diego.

Date: Thu, 17 Feb 2000 00:46:33 -0500
From: km1h@juno.com
Subject: Re: [R-390] Tube Testing

EXCELLENT point Guido and I would say to take it to all test equipment you own. That includes VTVM, LC Meters, old sig gens....everything. Several styles of old carbon resistors will increase value even when new in the envelope. Test the replacements also! I have been bitten by bad resistors too many times in the past to ever forget the lesson.

Date: Thu, 17 Feb 2000 08:08:58 -0600
From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] Tube Testing

I might be preaching at the choir, but test the replacements! I did a shotgun approach to a circuit board of old resistors in my HP410B. Several had obvious signs of overheating with parallel resistors to try to bring them in tolerance, etc., so I decided to replace them all while I was in there. I needed a 13Meg +/- 5% and couldn't find a metal oxide/film from Mouser, so I decided to get a carbon replacement from the local place. Before putting it in, I checked it: 14.35Meg! I suppose it had been on the shelf for a while; don't know. Due to time constraints my wife went back for me and asked the guy to check through them and see if a 13Meg could be found. What she brought back still checked 14Meg! Perhaps my Fluke needs calibration, but it checked right on the other values. Out of curiosity, I checked the one I took out: exactly 13Meg! It went back in its original location. Yes, check 'em.

Date: Sun, 13 Feb 2000 13:34:37 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: [R-390] 6082 Tube

Anyone know if other variants of the 6082 will work in the R-390 (non A)? As reflected by increasing prices, the 6082 is getting scarce. What about the 6082WB? (Dunno what it looks like.) Any experience with adapting the 6.3 v version-- the 6080? Any suggestions on getting them to run cooler? Perhaps a small fan from, say, an old computer power supply?

I'm expecting my first (maybe only) R-390 any day now from one of our good list members. Am interested in how it will stack up against my three R-390A's, but want to prolong tube life as well.

Date: Sun, 13 Feb 2000 14:00:01 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] 6082 Tube

The 6082WB ought to work fine. Getting filament power for the 6080 would be a pain, lots of amps at 6 volts without a 6 volt source in the radio.

The 6082 run hottest with high line voltage so lowering the line voltage to 110 or maybe lower will cool them down some. A fan probably won't hurt. A reference tube on the high side of its tolerance would also make the 6082 run cooler.

Date: Sun, 13 Feb 2000 18:23:40 -0600
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] 6082 Tube

>Any experience with adapting the 6.3 v version-- the 6080?

Yes. It requires an external 6 volt transformer at lots of amps. The normal tube heat MELTED the wire I lashed up while testing my non-A radio. That's when I decided that a fan was needed.

>Any suggestions on getting them to run cooler? Perhaps a small fan from,
>say, an old computer power supply?

In my opinion, a fan is absolutely required! Either mounted on the side of the chassis externally, or somewhere inside the radio. I made up a mounting plate to hold a 4-inch fan. It has slanted slots to allow use of existing 10-32 frame screws and 6-32 bottom cover screws.

>I...Am interested in how it will stack up against my three R-390A's,.....

Run it on 115 volts (do you know your household line voltage?) Add a fan. Listen to the lovely sound of the non-mechanical filtered IF. Be happy!

Date: Sun, 13 Feb 2000 17:59:09 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: [R-390] Sunday's Rejuvenation

Found on the Nostalgia Air Technical Discussion Forum: The Stancor P-8130 is rated 12.6 volts @ 2 amps. You can clean up some oxide coated cathodes by increasing filament voltage. In receiving tubes, by making grid #1 slightly positive and forcing extra plate current, emission is often increased. I found this almost always works with some older tubes like 26. Once the tube is forced to draw excessive current then voltages are brought back to normal, emission may be normal. The method you mention, only increasing filament voltage without other elements connected, works well on Thoriated-tungsten filaments. Norm

Date: Wed, 16 Feb 2000 12:54:33 -0400
From: "Guido E. Santacana" <laffitte@prtc.net>
Subject: [R-390] Tube Testing

Just a note from a recent experience. I have a simple Heath TC1 tube tester that I had been noticing as being too harsh on tubes declaring many as fair or bad. I had a gut feeling that something was wrong here and a quick check up confirmed my fears. All the resistors in the TC1 had changed value by a lot!! Upon replacement with exact original values the response of the tester changed dramatically giving a lot of tubes a passing grade. Luckily I never disposed of any of the previously tested tubes. I give you this info because we sometimes tend to be more careful about the 15% change in value of a resistor in the RF deck of a 390 than a 100% change of value in a resistor located in one of our testing instruments. In fact many of us tend to think that since the testers are not used so often, everything must be alright. Nothing could be further from the truth

as my experience shows. Check your tubetesters resistors regardless of manufacturer!!

Date: Wed, 16 Feb 2000 16:59:02 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: Re (n+1): [R-390] 6DC6 TUBE SUBS + semantic soliloquy

Alignment is needed to compensate for the varying capacitances of tubes as you change them. Good design would maximize the tuned circuit capacitance to minimize the change in tuning when tubes are changed. The rule of thumb (Radiotron Designer's Handbook, section 26.7) suggests 100 pf will minimize the need for alignment and for the change in alignment with changing AVC voltage. But in wide range RF tuned circuits sometimes that much C won't allow tuning to 30 MHz.

I don't think there's any way around realigning a stage when the tube is changed. Means you may not have to realign the whole radio, but that stage needs to be peaked, often to learn the effect of the tube change. A tube may seem to be lower in gain and also quieter when it had a larger change on the stage alignment which killed gain more than the tube's inherent gain.

As for selecting for minimum noise, its probably effective to test for minimum grid emission, minimum gas, and maximum gm, then align. If the gain is up to specs, the first stage probably should determine the entire receiver's noise performance, though at HF sometimes mixers drown out RF stage noise. After that gain has to be apportioned to get good AVC action without driving IF stages to clipping.

Date: Wed, 16 Feb 2000 16:58:59 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [R-390] Grid Circuit testing for tubes

While recapping and replacing the selenium rectifier in my Seco GCT-5 I traced the circuit and made voltage measurements. My circuit tracing is kind of too rough to scan for the first pass but what I found is this:

The 6AD6 eye tube is connected to a 6J5 and the 6J5 has a 10 megohm grid resistor. It has a bias pot in the cathode for zero adjustment. What the circuit does is a 10 megohm impedance DC meter. If the eye opens at all it is marked as questionable and if the eye opens enough its bad. It takes about 2 volts on the grid of the 6J5 to reach the threshold of bad.

The tube under test is connected as a triode, all sections in parallel. The cathode is biased positive to 55 volts to cut the tube really off. The plate has 160 volts DC through a 47K resistor. The grid is connected to that 6J5 grid. The tube heater is blasted with excess voltage: 12 volt switch position applies 17.3 no load, 16.8 with a 12AT7 in the socket. The 6-7 volt switch position applies 8.5 no load, 5 applies 7.2 (and also supplies the 6J5 and 6AD6 eye tube). 4 on the switch applies 6 and 3 applies 4.76. Clearly they want the cathode REALLY hot, quick.

Since all good BA restorers and users own a VTVM with at least 10 megohms input Z on DC, this could be simulated easily enough. Just connect grid of the tube to the VTVM DC probe (shunted by a resistor to make the parallel R 10 Megohms), apply +55 volts to the cathode, +160 to the plates, power supply negative to VTVM negative, and 4.76 through 17 volts to the heater. If the VTVM

deflects, the tube is questionable, if it goes above 2 volts, the tube is bad. That's just about as tough as my capacitor test...

Otherwise at hamfests look out for such a thing. About 9" square, 2-3/4" deep, eye tube in the middle, a filament voltage switch, a zero pot, maybe a line cord receptacle, and several tube sockets labeled with just suffixes, and lots of tube types to most sockets... It might say Grid Circuit Tester or Grid Emission Tester. When you get it home, replace the selenium with a 1N4007 and the electrolytic filter capacitor, check the resistors and hope you can see the eye tube because 6AD6 are fairly expensive. I don't like the odor of selenium or exploded electrolytics so I prefer to replace them before applying power. Too much selenium isn't considered healthy.

I've known tube type TV shop owners to really like this type of tube tester because it sold tubes and it let them fix faulty TV's rapidly with those tubes. It didn't lead them very far astray, not as far as the other types of tube testers that weren't nearly so picky about grid emission. I think this test circuit is also sensitive to gas in the tube though its not the most conventional gas test.

The most conventional gas test would bias the grid positive, heat the cathode or filament to get a grid current with the grid acting as the anode of the diode, and then look at the plate current with the plate biased strongly negative. (45 volts positive and negative bias from the cathode for transmitting tubes). In theory (and often used with the Eimac VT-127 from WW2 surplus, or later with the VT-127 already modified by Eimac) the electron stream will ionize any gas molecules present and the fraction of the grid current that shows on the plate is the proportions of air pressure compared to standard air. There may be a calibration constant that I've neglected. Anyway, the smaller the plate current, and it might be picoamps or smaller, the better the vacuum. One needs to not burn up the grid so watch that grid current to keep the grid power within its power dissipation rating.

Date: Wed, 16 Feb 2000 19:07:56 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: Re (n+1): [R-390] 6DC6 TUBE SUBS + semantic soliloquy

Normally an audio tube doesn't oscillate on its own. Maybe it was in a circuit with an unbypassed cathode resistor for negative feedback and minimal gain and there was a heater to cathode short that shorted out that cathode resistor to raise the gain drastically (as well as the plate current which generally raises the gain a bunch too). Since the heaters are on AC that might have been supplying an AC signal. You didn't say what frequency it took off at. Or maybe you didn't check. It's possible that a very microphonic tube might be vibrated by the modulation transformer to make an oscillation. Sounds as if your tube is touch sensitive... Your tube tester may not show the problem though a heater cathode short or strong leak should show. Microphonics it probably won't show.

Date: Sun, 28 May 2000 12:41:40 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Odd Tube?

Not necessarily true. The VR tubes including the 5651 can change characteristics a lot and lead to loss of regulation or oscillations or both together and still glow. There could be an in-circuit check with a scope to see that the voltage drop was within specification and that they are not oscillating. The DC

should be between 83 and 88.5 volts.

Date: Tue, 20 Jun 2000 21:58:19 EDT
From: DAVEINBHAM@aol.com
Subject: Re: [R-390] Filament Voltages

<< AT WWV they get up to 100,000 hours on tubes by running them at reduced power on the plate and then they lowered the heater and filament voltages to just above the point of loss of emission. >>

Are you talking transmitting or receiving tubes here ?

Date: Tue, 20 Jun 2000 20:04:01 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Filament Voltages

transmitting.

Date: Tue, 20 Jun 2000 23:09:56 EDT
From: DAVEINBHAM@aol.com
Subject: Re: [R-390] Filament Voltages

I kinda figured that would be the case since transmitting tubes are rather simpler than receiving tubes and therefore should last longer, all things being equal.

Date: Tue, 20 Jun 2000 21:40:30 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Filament Voltages

Sometimes transmitting tubes are simpler, but not always. Then they tend to be operated at significantly higher temperatures and voltages and have far larger seal surfaces between glass or ceramic and metal to be potential leaks. Receiving tubes operated well within their ratings should last better than most transmitting tubes because transmitting tubes (except at WWV) tend to be operated AT their maximum ratings, except in ham gear where they often are operated well above their continuous service ratings for greater transient temperatures.

Date: Wed, 21 Jun 2000 09:15:34 -0400
From: "Bill Weinel" <billw@interpath.com>
Subject: Re: [R-390] Filament Voltages

> tubes (except at WWV) tend to be operated AT their maximum ratings,
> except in ham gear where they often are operated well above their
> continuous service ratings for greater transient temperatures.

I've been following this thread with quite a bit of interest as I have a large amount of boatanchor gear here (hopefully soon to include an R-390a. ;-)

I know some here recommend running tube type gear on variacs and leaving it on all the time; but reducing the voltage when it's not being operated. My question is with typical tube type ham gear, how much voltage reduction is normally necessary to help preserve the life of the tubes and gear when it is not being operated? I would like to extend the life of my tubes, but don't want to lower the voltage enough to cause damage to the cathodes of the tubes.

In a slightly different but related subject, I am also looking at adding inrush limiters to my tube type gear to help extend the life of the tubes by limiting the turn on current and allowing them to come up slowly. I believe some here have also experimented with this in lieu of ballast tubes and had success.

Date: Thu, 17 Aug 2000 04:50:31 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] 15.8K hours and it broke...

About the end of the second week of October of 1998 I finished my overhaul of an all original and very low mileage 1967 EAC. Well, after better than 15,800 hours of 24 and 7 operation since I overhauled the beast, it puked a little while ago. This is the first time it actually quit working.

Symptoms? Reception just faded into oblivion over a few seconds.

The receiver had plenty of audio power but no RF. No signal from the calibrator either. I slid it out of the rack and pulled the two top covers and plugged it back in. The 6DC6 didn't light up so I stuffed another one in. That did it and it came back to life so I reinstalled the top covers and slid it back into the rack where it's playing as I type this. It didn't even cool off since the total repair time was under four minutes. :-)

For what it's worth, that particular 6DC6 was replaced last November so it only lasted about 6500 hours before the filament opened up.

In over 15,800 hours of operation, I've experienced a total of two "operational problems" with this receiver. Both of which were corrected by tube replacements, first after 13 months of operation and just now after 22 months of operation.

I've had to replace a grand total of 5 tubes, two 6DC6's, a 5814A, a 5654, and a 6C4W. Not too shabby for almost two years of constant operation sitting in an open rack in a non climate controlled environment where the humidity regularly hits 90+% and the temperatures range from below freezing to over 100 degrees.
nolan

Date: Thu, 17 Aug 2000 21:38:45 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 15.8K hours and it broke...

I still have my first R-390A, a '55 Collins that I hauled off of the USS Topeka when we cut it up in the mid 1970's. It suffered a bunch of different failures over the years. Many of which were catastrophic and due to capacitor failures and the fact that it was a "single fuse" model running a three amp slow-blo fuse. ;-(My previous experiences with it were the primary reason that I made it a point to replace ALL of the paper caps in the '67 EAC when I went thru it.

> The tubes DO last a long time!

I think that running the set on a variac at 115 volts has a lot to do with it, and would guess that the absence of any kind of thermal cycling helps a bunch too. Not only for the tubes but for all of the other components also.

>I don't leave mine on all the time though, can't afford the electricity!

It's only about a quarter a day at ten cents per KWH. Not bad at all. :-)

nolan

Date: Fri, 18 Aug 2000 19:26:03 -0600
From: "B.L.Williams" <B.L.WILLIAMS@prodigy.net>
Subject: [R-390] Rectifier Tube Sub

I am to buy a SP-600 JX-26 within the next few months for a very good price. I hear that the radio will be in very good shape, with suspect caps being replaced, etc. It really looks like I'm going to get a great radio.

My question is on the 5R4 series of rectifier tubes. My 4 references are pretty old and incomplete. I read through some of the HSN articles on the SP-600 and checked my tube supply. I have a good bit of 5R4GA's, but I can find no reference on them as substitutes. Same goes for the few 5R4WGB's and 5R4GYB's that I have now. Would someone let me know if I can use them, especially the more plentiful 5R5GA's.

Also, does anyone have any leads on top and bottom covers for the SP-600?

Any other tips would be appreciated. I will probably do a 800-8 ohm conversion right away for headphones and speaker output. I guess I'll replace the 6BA6's with 6GU5's as they are pretty cheap right now. I have a good stock of 6AL5's that I almost gave away a few years ago. Guess it's tube hoarding time again.

Date: Fri, 18 Aug 2000 21:01:47 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Rectifier Tube Sub

Good move, you won't be disappointed Barry. I know there will be more than one answer on this, but here is my .0002 cents worth.

5R4GA Rectifier Tube and Substitutions:

5R4GB

5R4GT

5R4GTY

5R4GYA
5R4GYB

and probably many, many more.

At present, I am using a Hammarlund marked 5R4GY in a SP-600JX-6/R-274B/FRR. Guess what? It's still working. I have NEVER had a 5R4 series tube go bad, and I have had 18 SP-600's pass through my hands. yes, substitutes abound, and yes, I have the 5AR4/GZ-34 on hand, but don't choose to use it. I do

make it a practice to replace the filter electrolytic in the SP-600's that I plan on keeping. (available from AES in Tempe, AZ.) Also, a good practice is to use the No. 5 Tap on the P.S. Transformer, that's the 130 volt tap. Some choose to use a 6GU5, others a 6BZ6 in place of the first rf amplifier tube (V1).Strictly a matter of choice, the 6BZ6 will give higher s-meter readings, and seem to be the tube of choice. I believe the best choice is the 6GU5, this will have to be re-peaked if replaced after an rf alignment. (only the front end) This is an extremely quiet tube and works great!! (My opinion)

Also, does anyone have any leads on top and bottom covers for the SP-600?

>>>Contact Hank Arne, he was having some made up.

.....800-8 ohm conversion..... for output.

>>>>use the Radio Shack 32-1031 transformer, use the 10 watt tap, closest to 600 ohm Or, use the Hammond 600 ohm to 4 or 8 ohm from AES. (works great)

Date: Fri, 18 Aug 2000 19:20:26 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Rectifier Tube Sub

5R4 sets the specs, the added letters only describe minor variations in envelope. G are tapered with stright top. GA and GB are straight, WGB have a stronger base that enclose more of the straight glass and mil spec for vibration and shock.

Date: Fri, 18 Aug 2000 21:49:28 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Rectifier Tube Sub

Jerry as usual sets it straight. I should have mentioned that the Hammarlund marked tube was a 5R4WGB, these tubes are damn near bulletproof. It is also an excellent replacement (if room permits) for the 5Y3 series tubes.

Date: Fri, 18 Aug 2000 21:33:10 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Rectifier Tube Sub

Most of the 5 volt rectifier tubes have the same pin connections. But some draw more filament current than others. Dropping a 5U4 in a 5Y3 socket will be overloading the transformer 5 volt winding by 50%, not an instant disaster but running that insulated filament winding warmer than normal will shorten the life of the insulation. To say nothing of the tube probably being starved for filament power. Its important to check the tube manual for the rated filament current when making such substitutions.

Date: Sat, 19 Aug 2000 01:31:37 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Rectifier Tube Sub

A 5U4 isn't a good sub for a 5Y3, I thought I said that the 5R4 was.

Date: Sat, 19 Aug 2000 08:38:54 EDT
From: Llgpt@aol.com

Subject: [R-390] Rectifier tube substitution

I have substituted 5R4 tubes several times for a 5Y3 with no ill effects whatsoever. The 5R4 draws no more filament current, but has bigger plates and runs cooler. Usually the major drawback is lack of room to use the 5R4 series, especially the WGB, WGY types.

Date: Sat, 19 Aug 2000 09:36:28 -0600
From: "B.L.Williams" <B.L.WILLIAMS@prodigy.net>
Subject: Re: [R-390] Rectifier Tube Sub

I have 2 of the WGBs left. I think I sold 3 to Carl a few months back. Sounds like I have enough 'for the duration' as Nolan would say. Now, time to stock on 6BE6's and some others. I have a big supply of 6AL5s from the same Air Force surplus deal on the WGBs and other variants. The top and bottom cover thing is annoying. Here I have the RF cover, top and bottom covers, and a big cabinet for the R-390A...and never use them. I got these with the 2 radios I bought. Now, I am getting a radio where I need the covers and can't find them! <snip>

Date: Sat, 19 Aug 2000 09:38:01 -0600
From: "B.L.Williams" <B.L.WILLIAMS@prodigy.net>
Subject: Re: [R-390] Rectifier Tube Sub

Thanks for the help. I'm glad I keep all tubes as a sort of policy around here. I got those as part of a deal years ago and thought them as worthless to keep around. Lesson learned here. I read that about the 130v stability Les. Guess that is a good thing to do when I get the radio. I guess I shoulda asked about getting a manual or two on the radio. Forgot, so I'm asking now. Photocopies are fine. I just remembered that I have the R-390 CD, so I'll have to look at those files and see what I have on the SP-600.

Date: Sat, 19 Aug 2000 09:40:05 -0500
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Rectifier Tube Sub

Yah, you said 5R4 was good. I was just expanding on the theme with care for filament current.

Date: Thu, 14 Sep 2000 08:14:52 -0400
From: "Gary E. Kaufman" <gkaufman@bu.edu>
Subject: RE: [R-390] 5814's

12AU7 and equivalents include:

Type

Heater

Special Characteristics

12AU7

150ma

12AU7A

150ma

Low microphonics
5814

175ma

ruggedized with complete redesign
5814A

175ma

above plus computer rated
5963

150ma

Computer rated,

not tested for noise, microphonics, section balance
6067

"Premium" 12AU7
6189

150ma

ruggedized 12AU7 GE 5 start type
6670

"Premium" 12AU7
6680

150ma

mobile rated (wider heater supply range)
7316

"Premium" 12AU7 for computer use
7318

175ma

"Premium" 12AU7
7489

"Premium" 12AU7 Audio use
7730

150ma

"Premium" 12AU7
ECC82

150ma

European nomenclature for 12AU7

I have personally tried 12AU7/a, 5814/a, 5963 and 6189 in various applications and they are all fine. I have no documentation for what makes the "Premium" types special. Perhaps someone else can fill in the boxes!

Date: Mon, 18 Sep 2000 12:07:32 +0200
From: "Johan Andersson" <Johan.Andersson@draminst.se>
Subject: Re: (n+1) [R-390] 5814's

Hi group, some more equivalent info on the 12AU7s I've gathered for the "SP-600 Tube Sub List": (NB: It's not exhaustive, I'm grateful for corrections/additions...)

B 329

Standard 12AU7
B 749

Standard 12AU7
CV 491

Standard 12AU7
CV 4003

Standard 12AU7
CV 4016

Ruggidized version
CV 8155

Standard 12AU7
CV 8221

Standard 12AU7
CV 9092

Ruggidized version
CV 10323

Standard 12AU7
CV 10666

Standard 12AU7
E82CC

Ruggidized European version
E 2163

Standard 12AU7
ECC186

Ruggidized European version
ECC802

Ruggidized European version
M 8136

Ruggidized version

Hope these two bits worth might help!

Date: Mon, 16 Oct 2000 16:51:47 -0700
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: Re: [R-390] <8 Mhz Low sensitivity...

From 4 June 68 through 10 Oct 75 I more or less make an occupation of feeding and caring for R390/A in very large numbers. As all these receivers were 25 years younger then than now, there could be few little things that just are not as up to snuff today as they we back then. I do not think the 1MHz and <8Mhz bands are on the short list. Any day any time back then a R390/A would get you 4UV sensitivity and 20:1 S+N / N With work the receivers would go 2UV or 4Uv and 30:1 I seen receivers that were at 4UV and 40:1 (not every day).

I just expect these receivers to do as well today. High bands will do better than the bottom 8. .5 -1 and 1-2 were as good as and thing else under 8. Any band under 8 would do 4UV and 20:1 signal to noise or we would not let it off the bench. Time after time its really an IF deck problem. you do need 150UV straight from the AN/URM-25 into the IF deck at 455KHz and a 30:1 signal to noise with -7 on the diode load. IF you do not have that go no further until you get the IF deck into shape. Back then it was tubes, tubes, tubes, and then the tubes. It was noise in tubes noise in the tubes and some times it was just noise in the tubes. Today we add old caps to the problem list.

Then in the RF deck, week bottom ends were noise in the tubes. Or most likely noise in the tubes. Some times it was alignment and noise in the tubes. We never did care what the tubes measured in the TV 7 tube testers because the tester did not check for noise in the tube. Hang an AC volt meter across the audio output and a 600 Ohm resistor for the load. Start measuring the voltage. Hang a DC meter across the diode load. Put 150 UV into the IF or 4 UV into the RF and start measuring. CW noise AM mod 30% Signal plus noise. Pick a tube any tube and swap every tube of the same type spare you have into that socket. set the IF gain to 7 volts on the diode load. (every tube will have different gain and forget that for now) measure the tubes signal to noise. (volts with modulation / volts with CW) Put the best value tubes to the front end and go around again.

New out of the box tubes will have more noise than used tubes. Old tubes will

have more noise than new new tubes. Put the best ones forward. Put the new ones at the end of the line. Throw the noisy ones in the trash. Heating them with a lighter will help take out gas and get the noise down a bit. This will not cure a bad tube, But it can help get you by until you can get a new tube. If you need one or two to make the set, light up all the better of the poor lot and test them all to get the best responding one or two you need to make the set. If you have not cooked a couple for experience try the bluest ones for starts. I use a cotton wick alcohol lamp to heat mine with. I have melted the glass and watched it implode. I have also cracked a few tubes going in to the heat to fast. I like to do them in the near dark to watch the glass turn red. I hate hot glass I can not see. Cooking them in the tube tester with a higher filament voltage does not work!! And that's the truth. I hated to install a new 6DC6 these new tubes would always be nosier than a 6 month (7x24) old tube. Jordan there is no know reason why your bottom 8 should not preform at least this good.

Today their are lots of old caps and resistors to deal with. 25 Years ago it was tubes, tubes, tubes. Today my biggest pain is still getting good tubes, good tubes and a set of good tubes.

I really wonder if the lack of gain below 1 mhz isn't built-in... perhaps to make up for the added QRN below 8 mhz, and due to the added mixer stage... I have tried massaging the tube line-up for all the mixers, which helped, but it is still less sensitive below 8Mhz...everything seems to check out OK as far as levels and values are concerned, so I really wonder...

Date: Sat, 21 Oct 2000 13:38:27 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] tube/receiver life (17.6K hours)

I just turned off my '67 EAC R-390A...it's ran long enough for now. It's going to take me a while before I can get used to seeing a darkened dial in that rack.

All of this talk about tube life and heat shields etc. just made me realize that it's been a week more than two years since I powered up my '67 EAC after I put it back together. That's 17,640 hours of 24/7 operation since October 13th of 1998. Oops, better add a day in there, we just had a leap year. <grin> Damn, time sure flies, huh? In that time frame it's been setting here in the shop running around the clock while experiencing ambient temperatures from below freezing to well over 100 degrees. I've had two problems with it. I slid it out of the rack after the first thirteen months to correct what I had thought was an AGC problem where it seemed to overload easily.

This problem was corrected by the replacement of four tubes. A 5654 (weak), a 5814A (gassy and could have been fixed) a 6DC6 (weak), and a 6C4W (weak). Other than the two rectifiers and the voltage regulator tube, these were the original 1968 date stamped tubes that were in the set when it was built. All of them tested OK when I checked them. I replace the rectifiers and the regulator because of previous bad experiences with those tube numbers. Two months ago, it died due to an open filament in the 6DC6 while I was sitting here listening to it. A new tube fixed it while the body was still warm. Right now, it works fine and exhibits zero problems. But, I suspect that I'll end up replacing a number of tubes in it. Probably every thing except the 3TF7. As high a mileage as they are I'd be paranoid of them even if they tested OK.

Hell, the thermal shock of powering if back up might fry half of them with my

luck. ;-(I attribute this long life to several things. The and primary one was the replacement of all of the paper capacitors in the receiver. In 25 years of messing with R-390A's, this is the first one that I've had for any length of time that didn't have a cap shorting and taking something with it or having to spend hours and hours troubleshooting some obscure problem that is almost always caused by a bum cap. Come to think of it, I might have been the first person to even consider replacing all of the paper caps in one. <grin> I think I just dislocated my shoulder patting myself on the back. ;-)

The second is that I used heat conductive shields on all of the tubes. The set had all of the original WPM black shields with the inserts when I got it. I replaced the ones on the rectifiers and the 3TF7 with extra tall NOS IERC shields and added the conductive base inserts to some of the "critical" tube sockets.

And no, In 25 years I have NEVER had a 3TF7 fail. The only replacements I've used were for sets that had missing ones or they were bad when I received the set. Running it on a variac at 115 volts probably had a lot to do with it too. My normal line voltage here is 125 volts. On a side note, the use of the Mobil-1 synthetic motor oil for the primary lubricant has proven to be a winner. It's easier to tune today than it was two years ago. I spent a hell of a lot more time checking everything when I put it back together than I probably needed to. But all in all, it was well worth it to me and I think that it was effort well spend. For what it's worth, I just checked the log on one of the R-1051B's and it's been running 24/7 since October 8, 1996. That's well over 35,000 hours. I cheat on them though and replace both of the tubes in each one every 6 months without even bothering to check them.

Date: Fri, 3 Nov 2000 08:02:16 -0800 (PST)
From: fred b <fb030663@rocketmail.com>
Subject: Re: [R-390] Tube reference

The best if you can find a copy is (was?) something called "Electronic Universal Vade-Mecum" a HUGE book about 600 pages of data sheets and pin outs. Next, I think would be the RCA tube handbooks of HB-3 series, if you can find a complete set,(I have two incomplete sets, but am only missing stuff like phototube, and watercooled, so no real harm.)

Others, Of course "Tube Lore"by Ludwell Sibley, a rather new one is, SAMS/ Prompt's "Tube Substitution Handbook", I think it's only a year or two old in the current version.

Date: Fri, 15 Dec 2000 17:45:38 -0600
From: KK5VR@arn.net
Subject: [R-390] 12AU7 and 12AU7A tubes

A friend of mine just gave me about 20, new in the box, 12AU7A's. Are these the same as the 12AU7's? If not, how do they differ? If they can be used, would I have to change all the 12AU7's to 12AU7A's in my 390A?

Date: Fri, 15 Dec 2000 18:52:49 EST
From: Llgpt@aol.com
Subject: Re: [R-390] 12AU7 and 12AU7A tubes

The suffix designators are.....A = quick heating elements, many times you will see for example.12AU7WA..... this means ruggedized with quick heating

elements. This was a JAN (Joint-Army Navy) designator.

Date: Fri, 15 Dec 2000 20:17:32 -0500
From: "JM/CO" <jmerritt2@capecod.net>
Subject: Re: [R-390] 12AU7 and 12AU7A tubes

The "A" suffix (also "B", "C", etc) denotes mechanical improvements /changes, and does not refer to electrical characteristics. The 12AU7-A will be a perfect replacement for the 12AU7, and, no, you don't have to change them all, just the dead ones.

Date: Fri, 15 Dec 2000 19:51:38 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 12AU7 and 12AU7A tubes

>The "A" suffix (also "B", "C", etc) denotes mechanical improvements /
>changes, and does not refer to electrical characteristics.

Sometimes they do. I don't remember if it was the 12AU7 or the 12AX7, but one of them was a low hum variant. Maybe it was the industrial numbered 12AU7, the 5814 that used the A for low hum. My brain hurts right now, sorry. ;-) nolan

Date: Fri, 15 Dec 2000 22:48:53 -0500
From: "JM/CO" <jmerritt2@capecod.net>
Subject: Re: [R-390] 12AU7 and 12AU7A tubes

You may be thinking of the 7025, which is a low hum version of the 12AX7, most commonly used in guitar amplifiers.

Date: Fri, 15 Dec 2000 22:17:56 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] 12AU7 and 12AU7A tubes

The 12AV7 is a low noise 12AX7. Both audio tubes. The 12AU7 wasn't used as much for low level audio amplifiers because stage gain was too low.

Date: Sat, 16 Dec 2000 06:52:40 EST
From: Llgpt@aol.com
Subject: Re: [R-390] 12AU7 and 12AU7A tubes

<< You may be thinking of the 7025, which is a low hum version of the 12AX7,.....

According to the book " Tube Lore ", the 12AU7A is a low microphonic 12AU7.

IMPROVED VERSIONS OF TUBES "An A or B version of a tube is improved over the basic model and will replace it (except for some Wester Electric tubes which are incompatible from " A " to " B "). However, many " A " versions of the mid-'50's are improved ONLY in that they warm up in a controlled length of time. This is important in series-string TV sets but meaningless in parallel-wired equipment. Improvementss in other types may or maay not matter, depending on the use: 6AF4A is simply shortened physically; the 12AU7A is a low microphonic type; the 12AX7A is a low noise, low hum variant.

Date: Sat, 16 Dec 2000 07:54:35 +0000

From: blw <ba.williams@home.com>
Subject: Re: [R-390] 12AU7 and 12AU7A tubes

HSN has a bit about the order of desirability for the 12AU7 and 12AX7. I forget the details at the moment. I know the 12AX7 is pretty expensive nowadays.

Date: Sat, 16 Dec 2000 10:52:47 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] 12AU7 and 12AU7A tubes

>You may be thinking of the 7025, which is a low hum version of the 12AX7,
>most commonly used in guitar amplifiers.

No, I've got a couple of 7025's around here somewhere and know about them. It was something to do with the "A" version for one of the 12A_7 types if signified a low hum version. I'll head inside in a bit and dig out the tube manuals and dig a bit. My curiosity is aroused now. <grin>

Date: Sat, 16 Dec 2000 12:59:55 -0500
From: "Gary E. Kaufman" <gkaufman@bu.edu>
Subject: RE: [R-390] 12AU7 and 12AU7A tubes

Here's the listing of 12AU7 types I posted to the reflector back in Sept. The 12AU7A is an exception to the usual "low hum" rule for the "A" suffix. In this case it was for low microphonics. Western Electric also was famous for having "A" versions that were entirely different tubes - for example the 350A is an 807 like tube, the 350B is a 6L6G type, the 274A is a 4 pin 5Z3 like rectifier, the 274B is an octal base rectifier etc. (see earlier post for this list)

Date: Sat, 16 Dec 2000 12:38:22 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: RE: [R-390] 12AU7 and 12AU7A tubes

I never really noticed they were different internally. I'll have to look and see. I did know about the difference in heater current.

5963 150ma Computer rated, not tested for noise, microphonics, section balance

I've got a bunch of these earmarked for use after all of the normal 5814/12AU7 types are consumed, if I live that long. <grin> I've heard conflicting reports on using them for audio/radio type applications. Have any of you guys used them? What kind of results did you have?

Date: Sat, 16 Dec 2000 16:58:04 -0500
From: "Gary E. Kaufman" <gkaufman@bu.edu>
Subject: RE: [R-390] 12AU7 and 12AU7A tubes, also AES sale flyer...

I've used 5963's with good results. Most computer rated tubes are quiet and non-microphonic. As I understand it they just were never spec'd or screened for noise. The 5687, another computer tube has received wide audio use as they are still common and inexpensive. AES has a new sale flyer out, also up on their web page www.tubesandmore.com. There's a bit for the R390A - I spotted 6626 (ruggedized, high stability 0A2) \$1.40 6AK6 for \$2.10 5654/6AK5W for \$1.30

and 5749/6BA6W for \$1.40 There are a other few boatanchor tubes included in the list including 6485(Computer rated 6AH6) for \$0.50, and 8425A (premium 6AU6A) \$3.00 and 6883B/8552 (6146 for 12v use) at \$4.60 I suspect we'll never see the 3TF7, 26Z5 or 6DC6 on a sale flyer again!

Date: Fri, 05 Jan 2001 15:21:08 -0500
From: "Ray Vasek, W2EC" <w2ec@attglobal.net>
Subject: [R-390] INFO: Intermittent problem

Here's an intermittent problem I encountered last night that might be of interest to others with similar intermittent problems.

I fired up my Johnson Invader 2000 last night and, when I held the key down in CW to perform the tune-up, the rig started key intermittently, even with the key down solid. It would key for second or two, then un-key, like I'd let up on the key. It kept cycling this way with about 2 second variations in the key on/off sequence until I let up on the key. I first suspected just dirty key (actually a Vibroplex bug) contacts so burnished them with a piece of paper but the problem remained. I then checked the bug on another transmitter and it keyed fine so eliminated the bug as the source. Then I switched the Invader to AM mode to eliminate the keying circuit and the same on/off cycle returned when I hit the PTT to bring up AM mode. This rig is used a lot and had worked fine the night before, this was the first time I'd seen this. It failed in either the low power Invader 200 mode or high power Invader 2000 mode.

To make a long story short, I isolated the circuits common to those involved in the keying of AM and CW and settled on either the driver or the oscillator as most likely culprits.

I settled on the 12AU7 crystal oscillator to check first and quickly swapped it out. This solved the problem right away, so figured I'd test the defective tube to see what the readings came up as. I let it warm up for a minute and the readings for both parts of the tube were well above spec. I swapped this tube back into the Invader and checked it out and the rig came up fine. Figured by then all I had was a dirty contact on the tube socket and by swapping tubes I had cleaned up the problem. I left the old tube in and went back to loading up the rig to get on the air. A short while later I shifted frequency from 40 meters to 80 meters and went to retune the rig and the failure started again. I wiggled the tube around, but this didn't seem to solve the problem so I swapped it out again and stuck it back in the tube tester.

This time I kept it in for a while and kept switching back and forth between the first half of the triode and the second half. After about 5 minutes of "on" time, I found one of the triode sections began turning on and off, all by itself. The second half stayed fine. Looking closely at the tube thru the dark getter flashing, I could see that one of the filament sections was turning on and off!

Wiggling the tube had no effect, it wasn't a bad tube pin, but the filament section itself apparently had some form of break that after the filament got hot, it would open up causing that tube section to shut down.

Then as the filament cooled, it would close and heat the filament again, renewing the cycle. I pulled the tube and connected just the filaments themselves so I could ensure the pin/socket wasn't the problem and sure enough after about 5 minutes, the on/off cycle started. Seems like the filament

was acting like a flasher unit with a pretty reliable cycle rate, couple seconds on, couple seconds off.

I thought this might be an interesting fault to share with others.

Date: Mon, 22 Jan 2001 11:34:21 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: [R-390] Re: greetings de dd8bd

>Roger, what does "zippo" mean (could be in German something like
>"Rei_versclu_")? Is it a certain type of tube shield ? Or some type of coilar
>around the tube, I saw somewhere ?

Before the wonderful day of throw away lighters and when smoking was fashionable, one use to have a lighter that was "refillable" with lighter fluid and flints. A popular (wind proof) model was a brand name Zippo.

Now back to blue tubes (gassy). Blue, or gassy or noisy (not yet showing blue under its current operating conditions) tubes can be helped by roasting them at low heat (over a Zippo lighter). This heats the stuff in the getter and thus will pull a bit more of the gas out of the tube envelope and trap it in the getter material. Strange as it may be, placing the tube in a tube tester and running the filament voltage up to double or triple voltage just does not have the same effect as roasting the tube over low heat. Do be careful. You can apply too much heat to fast and crack the glass. I have also over heated a tube to red glass and had it melt into the tube elements. Heat the tubes from the top while holding the pins.

Date: Wed, 24 Jan 2001 06:07:20 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] Re: gassy tubes

>Now back to blue tubes (gassy). Blue, or gassy or noisy.....

I've used this method many times for gassy tubes. The Zippo works a lot better than a butane lighter. I suspect that it's got something to do with the soot helping to prevent hot spots in the glass. I've found that it's a lot easier to crack the glass envelope with a butane lighter.

>Strange as it may be, placing the tube in a tube tester and running the
>filament voltage up to double or triple voltage

Correct. You have to be able to play the flame over the getter I tried an experiment last year involving a 6" lens and sunlight that failed. I was hoping that I could heat the getter from the "backside" with the concentrated sunlight. It didn't work. I was looking for a method that would work with octal based tubes where the getter was in the base of the tube.

>Do be careful. You can apply too much heat to fast and crack the glass.

Correct.

Date: Tue, 30 Jan 2001 15:15:57 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: RE: [R-390] Tube Heaters/Zippo Lighters

Your best noise (gas) test is in **circuit tube comparison**. Put the signal generator in. Get (ie: measure) the power out. (Voltage across 600 ohm resistor). Swap tubes and find the ones that provide most gain and least noise. Take the second choice tube to the Zippo. If roasting makes it perform quieter you were successful. You can quit while you are ahead or try to gain a bit more. Real gassy tubes will glow blue in the dark. These are very nice looking. But are also the source of noise. Put 455 at 150UV into the IF deck with a signal generator and compare the audio output power between CW and 400HZ tone at 30% modulation. With -7 volts on the diode load the output should exceed a 1/2 watt. The modulated signal should have a 30 db gain over the CW signal.

For the total receiver with 4UV in the receiver should have 20 db.

Swap a tube. changing the order of the 5749's will change the noise. Put the bet ones forward.

Put the best 6AK6 in the audio path you use (line or local).

Put the best 5814's into the audio path. Second best into the AGC path and the poor one into the Crystal oscillator.

Put the very best 5749's (6AK6) you have into the PTO and BFO.

Try swapping all the 6BA6's you have into the 1st IF stage. You will quickly see their differences. Put the best ones into the receiver. Repeat this with the 5749's that come out and all the spares again. Put the best one into the receiver. A couple go rounds and you quickly get all the tubes of one type grades. I have a set that have been roasted back to life that I pop in for test tubes. Them I can put all the other tubes back in a socket one at a time and rank them from best to poor.

Date: Fri, 2 Feb 2001 16:17:30 -0500
From: "Warren, W. Thomas" <wtw@rti.org>
Subject: RE: [R-390] Tube testers

Check out what Roger in San Diego said about juggling tubes around for best noise performance. He's posted that a couple of times.

WHERE'S ROGER TO WEIGH IN ON THIS TOPIC?

Date: Fri, 2 Feb 2001 17:03:41 -0500
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] Tube testers

I test the 6C4 tubes in V204, with V203 removed. I just insert the tube, let it warm up a bit, and listen to the noise level or measure it from the Local Audio output with an AC VTVM. I had a really noisy R-390A just yesterday that had a noisy 6C4 that I found this way. Putting a quiet one in it's place improved the sensitivity by about 15 dB. You can do the same for the 5749W tubes in the IF deck. Just put the tube you want to test in the last stage it's used along the signal chain, and pull the tube from the previous stage so that no signals and no noise from earlier stage have any effect.

Date: Fri, 2 Feb 2001 17:13:42 -0500
From: "Jim Miller" <jmille77@bellsouth.net>

Subject: Re: [R-390] Tube testers

I have found that certain 6BA6's that tested good did not perform well in one of my radios (75S3B) due to grid leak I think. One way I could tell a bad tube was listening to AGC action. If too much popping and pumping of the AGC, a tube grid was probably biasing more positive than it should, or acting like a rectifier. The only way I could locate the bad tube was to use a very high impedance VTVM and measure the no signal grid voltages.

Good tubes had a more negative quiescent grid voltage than "bad" tubes, as compared to voltage callouts on the schematics. So I now have to hand select AGC controlled tubes by actually measuring their grid voltage in the radio! By the way, they had plenty of gain and conductance otherwise.

Date: Fri, 02 Feb 2001 17:16:33 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Tube testers

That's precisely what a Grid Circuit Tester does. It checks for grid emission that makes control grids go positive. I think I posted the schematic of one last year. I know I traced it out and then scanned it for someone. I've know TV shops to ignore the big tester and use only the grid circuit tester, it found more troubles far faster than the big tester that ignored grid emission.

6BA6 is S-line receivers are run hard and regularly fail with grid emission making the s-meter go backwards and AGC not working.

Date: Sat, 3 Feb 2001 09:44:12 -0800
From: keith <khgrant@ix.netcom.com>
Subject: [R-390] Tube sources?

I know this has come up before, but I'd like to find sources for replacement tubes for my R390A. I also have a question about tubes marked NOS. How well do stored tubes hold up over many years? What is the probability that a NOS tube will be functional? If you need one good one, do you buy three or four at a time (ignoring the need for stockpiling spares)?

Date: Sat, 3 Feb 2001 14:24:24 -0500
From: "John F. Bunting" <w4net@carneconn.com>
Subject: Re: [R-390] Tube sources?

In my experience, they hold up very well. I know for a fact, that Antique Electronic Supply and Fair Radio will provide replacements with no questions if they arrive DOA. I'm sure most of the other vendors will also make good on them as well.

I've had some old NOS transmitting tubes go gassy or lose vacuum after long storage, but rarely had problems with octal, 7pin min and 9 pin min. Sometimes an open filament or heater from vibration during shipment, but never gassy.

Date: Mon, 5 Feb 2001 08:13:46 -0800
From: "Roger L Ruskowski" <rlruszkowski@west.raytheon.com>
Subject: Re: [R-390] Tube sources?

How well do stored tubes hold up over many years?

I installed a pair of 1943 6C4 out of the box into my R390/A last summer. They were / are as good as any 6C4 I have ever used in and R390/A. And back in 68 - 75 I had lots of R390/A to take care of. Shelf life on tubes is longer than I have lived.

Then I picked up some Raytheon 6BA6's in December. Out of the box these things were noisy beyond use. The tube checker says they are in good shape. Its not the age of the tube that will get you. Its their original manufactured quality. Quiet tubes are quiet and noisy tubes are just the pits. Its always a case of test and try to find the best low noise ones.

Date: Mon, 5 Feb 2001 10:48:56 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: [R-390] Noisy Tube Identification

>I have noted your many helpful posts to the 390 reflector. Can you explain in simple terms >what you mean by a noisy tube? Thanks in advance.

I simple terms, NO. (I assume we hear this as background white noise in the speaker). Yes this is true.

>Which ones are the likely suspects?

All of them.

>What equipment/procedure I need to use to identify same.

A signal generator (This could be a off the air signal). An AC volt meter. A 600 Ohm Load (resistor). A DC volt meter. I want to try swapping tubes for best results. I seem to remember a test/swapping procedure you or someone outlined, but I have been unable to find it in the archives.

OK Skip, in not so simple terms here it goes. You can hear the noise difference. But my ears have been bad since I was a kid and had some nasty ear infections. So I meter my noise. Hang an AC voltmeter on the line side of the local output terminal strip. The headphone side has a resistor in the circuit and provides a lower output. Strap a 600 ohm load resistor across these two terminals to give a proper load. If you have the Power meter shown in the TM use it. If your meter has a DB scale on it then use it. You can read AC volts across 600 ohms and convert that to DB as reverenced in the TM for use with the TS585 Power meter. 1 watt across a 600 ohm load is about 24.5 volts RMS AC Hang the DC volt meter across the diode load and set it up to read the -7 volts DC. Set your signal generator up to output 455Khz at 150 micro volts and 30% modulation. At 1000Hz you should get almost a watt on the local audio out with -7 volts on the diode load. With 400Hz modulation you will get about 0.85 - 0.9 watt out due to the band pass of the audio deck. With the signal generator modulation on or off the diode load should read at the -7 volt level. With the signal generator modulation on the local audio out should be almost a watt or over 1/2 watt. With the signal generator off the audio output should be more than 28 DB lower than when the modulation is on. The goal it 150 Micro volts at 455 into the IF deck. -7 volts on the diode load. More the 1/2 watt of audio on the local output out (.9). Plus a 30 db difference between modulated signal to CW signal. If you can not get this then you have bad tubes and you will need to change tubes out until you get at least a half watt or 17.32 volts. There are 3 6AK6's 1 IF 1 local audio 1 line

audio. Pop the line tube out. Put it in the IF deck 6AK6 socket. Turn the modulation on. read the AC (audio Power) meter. Is the level higher or lower than the original tube? Turn the modulation off. Is the meter reading now higher or lower than the original tube? Put the tube with the highest meter reading (noisy tube) when the modulation is off in the local Audio tube socket.

Compare the other two tubes by swapping them into the If socket again. Put the poor one into the local audio tube socket. Compare any other 6AK6's you have. Put the poor one into the audio deck again so you can compare the that one to the other again.

Put the very best on in the IF deck Put the second best one into the audio path you will be using (line or local) put the third best one into the other audio socket. Save the fourth best one to start your testing with the next time.

Set up the generator and adjust the If level for -7 volts as necessary.

Pull the PTO and BFO 5749's (6BA6's). Start swapping these and any other spares you have into the first IF 5749 tube socket. You are going to look for the low number with the generator set to CW. Rank all the 5749's you have (PTO, BFO, 1st IF, spares). Put the best one into the 2nd IF. put the second best one into the 3rd IF. and next into the 4th IF. Now retest and rerank all the out of socket 5749's again. Put the poorest three into the IF deck and rank all the best ones again. Save the very best one for the PTO. Save the second best one for the BFO. Put the third best one into the 1st IF and then next best into the 2nd IF. Continue until you have the 5749's all reinstalled.

Pull all the 5814's and check them in the local audio tube socket. Put the best two into the audio deck. Put the next best ones into the IF deck. Use the next best ones in the calibrator sockets in the RF deck.

Set up the generator and adjust the If level for -7 volts as necessary.

The goal is 150 Micro volts at 455 into the IF deck. -7 volts on the diode load. More the 1/2 watt of audio on the local output out (.9). Plus a 30 db difference between modulated signal to CW signal.

If you can not get this then you have bad tubes and you will need to change tubes out until you get at least a half watt or 17.32 volts. The goal is 150 Micro volts at 455 into the IF deck. -7 volts on the diode load. More the 1/2 watt of audio on the local output out (.9). Plus a 30 db difference between modulated signal to CW signal.

If you can not get this then you have bad tubes and you will need to change tubes out until you get at least a half watt or 17.32 volts.

You may have the quietest tubes you have in the best places you can get them and still not pass this test. You are in the between that rock and hard spot again. You need more tubes. Your receiver needs to pass this test or you will never get the full receiver 20:1 ratio. Do what you can and go on. Your receiver is still working. It just is not up to this very best.

Put the signal generator into the antenna input and set it up some where over 8 Mhz at 4 micro volts. Swap the 6C4's around. The 0.5 - 7.99 is not used. Find your best 3 6C4's

Put the best one in the 2nd IF. put the second best one in the 7 to 7.999 socket and the third best into the last mixer.

Swap the 5654's (6AK5's) into the Crystal oscillator deck. and find the best two. Put the best one in the crystal deck. the second best into the 17Mhz oscillator.

Swap all the 6DC6's you have and find the best one. The goal is less than 4 Micro volts in the antenna. -7 volts on the diode load. More the 1/2 watt of audio on the local output out (.9). Plus a 20 db difference between modulated signal to CW signal. Now with you quietest tubes all installed in the best sequence, go to Chuck Ripple's pages and set up the IF gain as Chuck has it detailed.

Then do a full IF and RF alignment as shown in the manual and again follow Chuck's procedure for doing the variable IF stages.

Now again go to Chuck Ripple's pages and set up the IF gain as Chuck has it detailed.

See Skip, Its simple, all you have to do is.....

Strange, brand new tubes are noisier than used tubes. It can help to leave the R390/A on for about 3 months after you install a mess of new tubes. Even 1 month will help. We would get a year out of a new tube and some times 18 to 24 months for the IF Audio and non signal path chain (AGC, Cal oscillator). ASA was running 24 x 365 and some times 366 days a year. So there a lot of hours in a tube for the casual user. If you do put in some new tubes I would let the receiver stay on for at least 2 weeks. It does seem to help. Of course the 6DC6 right up front would always be the biggest noise factor. We just swapped those every 6 months. At the next two monthly the receiver would get a in rack operational check. At the 3rd monthly (quarter) we would redo the RF alignment. fourth, and fifth monthlies were in rack operational checks. Then again at 6 months we did the full service. This was 4 to 8 hours on the bench. I was doing a pair per trick shift. Both receivers spared out and returned to the rack before the end of the shift. I would load 2 receivers on a cart and do them both together. I now take a whole Saturday to do a receiver. It takes time to find the right tubes. I just can not go to the supply room and get them off the shelf.

Date: Mon, 5 Feb 2001 18:56:50 EST

From: Llgpt@aol.com

Subject: [R-390] correction to earlier post on tube noise test etc.

The group, An earlier post of this was wrong, I slipped on the tube socket to use on the test for the 6C4's, the below is correct.

Here's an easy method of checking for noisy/weak tubes in the R-390A using the receiver.

1. Selecting 5749/6BA6 tubes for noise....remove the tube from V-501. Turn on line level meter adjust to vU mark, or a mark you make note of. Try the various 5749/6BA6's in V-502. Note the meter readings after a two minute warm up. Then use the quietest as V-501 and second quietest as V-502.

2. Try all three of the 6AK6's in the V-504 socket, after warming each for two minutes, check the carrier meter reading. The higher the reading the better the

tube. Use the best in V-504, second in V-603 and third in V-604.

3. Again, with V-201 tube removed, the 6C4's can be tested for noise in the V-202 position. use them in this order, quietest in V-202, second in V203 and third in V-204.

4. V-701 should be an example that has little drift.

5. V-505 select the tube with the highest diode voltage with the bfo on.

Date: Wed, 07 Feb 2001 02:35:56 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] testing tubes for noise

>1. Selecting 5749/6BA6 tubes for noise....remove the tube
>from V-501. Turn on line level meter adjust to vU mark, or.....

That's a lot of work, Les. There has to be a simple method that can be performed yielding a standardized figure of merit that can be used for selecting the "best" tube. What about powering up the filament only off of a battery, and then measuring current/voltage/resistance between the elements with good quality instruments? If we're looking for simple leakage between the elements as a source of noise it seems that this should work.

Come to think of it, I have a Sencore LC-3 tube leakage tester around here that I was going to re-cap. I've never even plugged it in, it was one of those things that was too cheap to pass up. Anyone have a copy or scan of a manual for the beast? Anyone ever use one?

Date: Wed, 07 Feb 2001 03:46:46 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] military testing methods f/tubes

OK, got it. mil-std-1311b is the answer. Go here:
<http://www.dscc.dla.mil/Programs/MilSpec/DocSearch.asp>
Enter 1311b in the search box and hit "go"

Then click on the "parent document" and you can download a nice 3 meg 650 page Adobe file containing all of the military test methods for tubes.

Date: Wed, 07 Feb 2001 12:33:06 +0100
From: Kurt Brandstetter <kurt.brandstetter@teleweb.at>
Subject: Re: [R-390] military testing methods f/tubes

I found this document not via search 1311b and "go", found it at:
<http://www.dscc.dla.mil/Programs/MilSpec/listdocs.asp?BasicDoc=MIL-STD-1311>

Date: Wed, 7 Feb 2001 07:36:46 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] military testing methods f/tubes

Thanks for the find. Wanna have some more fun? Search on "1131b" as I did by mistake. Lo' and behold, a document on storing and reforming capacitors.

Delving through the 656-page tube document -- not one instance of "zippo", hmmm. There's a section on "neutron irradiation of tubes" which is must reading. We may have a serious problem, though. Will any of our tubes will pass the "Permanence of Marking" tests on page 75? ;-)

Date: Wed, 07 Feb 2001 20:02:12 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] testing tubes for noise

Its difficult to detect tube noises with simple equipment at the levels that are significant in the RF and early IF stages. It takes the gain of the rest of the receiver to make that noise detectable. Noise can come from loose connections, odd grid wire geometry that leads to electron oscillation in passage, resistive layers in the cathode emitting surface, and other sources. None of these would show measuring current/voltage/resistance between the elements.

That Sencor checker is probably more of a gas and grid emission tester than a leakage tester. Certainly leakage can contribute to noise.

Date: Fri, 09 Mar 2001 12:03:04 -0600
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Tube transconductance measurement

>I.....how a tube's transconductance is measured?

Not quite.. plate CURRENT change per unit of grid VOLTAGE. (Or in the general case, the current change at the second tube element for a given voltage change at the first tube element.) Resistance is E/I Conductance is $1/R = I/E$

> Is it a DC characteristic or AC?

The basic idea is about changes, so think of it as a small signal AC measurement. It can be measured by taking two measurements at steady state conditions: that is dc measurements. But in tube testers, a common way is to set a known plate load resistor, put a known ac voltage on the grid and measure the resulting ac voltage at the plate. Current output vs voltage input. The "gain" comes from having a resistive (or other impedance) load in the plate circuit. Some tube testers use no DC for any measurements, they do the whole thing with AC voltages and the tube under test runs sort of like a half wave rectifier. this is a cheap but workable method. Other tube testers, like the Hickock Cardmatic, have regulated, programmable DC supplies for ever element and apply a very small AC voltage to the grid.

Date: Sat, 10 Mar 2001 04:02:57 -0800
From: "Larry Shorthill" <rfssi-shorthill@mindspring.com>
Subject: Re: [R-390] Tube transconductance measurement

Transconductance of a receiving tube (say a pentode) is a "small signal" measurement and is technically measured at the chosen operating point of the tube. That is, if the plate voltage is V_p , the screen voltage is V_s and the plate current is I_p at a given grid voltage V_g , that is the operating point. To define the actual transconductance, which as you pointed out is the ratio of small changes in I_p (sometimes called ΔI_p but more correctly called the differential of i_p -- note the lower case letters to denote small signal AC vs the upper cases for DC) for small changes in V_g (called ΔV_g or more correctly

the differential of v_g). All of this is done holding V_p and V_s constant. To elaborate further, $g_m = \frac{d i_p}{d v_g}$

where d is the differential operator (I don't want to use Greek symbols here). Engineers look at derivatives such as this as results of small changes of one parameter with respect to small changes of the other parameter and don't get too bogged down in the math niceties.

In practice, put the desired DC plate voltage on the plate terminal by using a voltage source or power supply of the proper value (that is the plate operating voltage that you want to use) on the plate and another one of the proper value on the screen -- assuming that these are under the max values for the tube, turn up grid bias until the plate current is where you want to operate the tube. Now, superimpose a small ac voltage on the grid and measure with an ac ammeter the change in plate current caused by this. Keep in mind that no voltages except the grid are moving because we are feeding the plate and screen from power supplies. The ratio of i_p to v_g for small v_g is called the transconductance which is the reciprocal of resistance. This term is noted as g_m . For practical purposes, to get gain from the tube, there must be a voltage developed on the output. This is across a load resistor R_L .

The voltage gain is, for all practical purposes, $g_m \times R_L$.

That is to say that output voltage $v_p = i_p \times R_L$

and input voltage is v_g . The ratio $v_p/v_g =$ voltage gain which is $(i_p/v_g) \times R_L$ which = $g_m \times R_L$

or the transconductance of the device at the operating point times the load resistance. This rule applies to solid state devices as well. OK, now how do you estimate g_m in practice given a data sheet that only gives you one value and it isn't where you want to operate the tube. Well, assuming that you have the plate characteristic curves for the tube, including a full set of screen curves (heh, heh) you can determine the static operating point on the curves. Find or interpolate the curve that shows plate voltage vs. plate current for the screen voltage you plan to use. Choose the point on that curve that gives the approximate operating point you want to use (i.e., $I_p, V_p @$ chosen V_s). Usually this will be in about the center of the diagram for class A operation). This will correspond to some V_g that is typically a negative voltage. By choosing a value of V_g that is some increment above and/or below this operating V_g you can determine the change in I_p that will result.

For example, say the tube is operating at $V_p = 250$ V, $V_s = 150$ V, $I_p = 10$ mA for $V_g = -5$ V. That is the operating point for this tube in this circuit. Note that V_p is not the plate supply voltage, but the rather the plate operating voltage. If $R_L = 10$ K then with 10 mA thru it, there would be a 100 V drop across it and the supply voltage would be 350 V.

OK, now lets go up to the point on the curve corresponding to $V_g = -4$ V (or choose your number based on the curve you have) and note the change in I_p , assuming that V_p didn't change at all (still holding at 250 V). This change in I_p (say +3 mA) for a +1 V change in V_g gives a transconductance of 3mA/1V or .003 mmhos or 3000 micromhos. I think modern transconductances are called Siemens or some such, but it's the same no matter what it is called. If the tube is pretty linear in this region, by going to $V_g = -6$ V you should see a drop in I_p by 3

mA. Life isn't like this of course since these are not really very linear devices over much of their operating range. That's why you choose the operating point and vary the value a very small amount (called small signal for a good reason).

The gain is then $10K \times 3 \text{ mA} / 1 \text{ volt}$ or 30. This isn't too bad for a pretty simple circuit. Keep in mind that the real load isn't just the resistor in the plate, but rather that resistor in parallel with the input load resistance or impedance of the circuit that it is attached to on its output.

As you pointed out, actual tube testers don't work this way but they approximate the process. Elaborate tube characteristic curve tracers and transistor curve tracers were developed by Tektronix and others to plot out the actual operating characteristics of these devices gave a much better understanding of the actual capability of the tube. It's a shame that more people don't have access to these tools anymore.

Date: Mon, 19 Mar 2001 01:18:04 -0500
From: rbussier@lexmark.com
Subject: Re: [R-390] general tube questions

I have a question concerning tubes used as RF amplifiers in our beloved boatanchors. The highly regarded 75S3B/C used a 6DC6 in the RF amp. This is the same as the 390A, right? (No books here in my office). Is there any reason why this is a better tube than say a 6BZ6? Looking at the Drake R4C (which is a good radio also) it uses a 6BA6 in the RF stage, I know that a 6BZ6 is a direct swap. I swapped the 100 Khz calibrator tube in my 75A-4 from a BA to a BZ and have quite a bit more signal on the higher bands. Lastly, I have a R-1051B and the only 2 tubes in it are two BZ s in the RF stage. If the DCs are quieter, one would think the 1051 would have used them. I realize that on the lower HF bands, it's a moot point, but some of the older radios lack sensitivity on 10 Meters. Just wondering, here at work by myself (pulling 10 hour, 3rd shift)..... Any comments???

Date: Mon, 26 Mar 2001 17:21:42 -0500
From: Thomas W Leiper <twleiper@juno.com>
Subject: Re: [R-390] R-390a Purchase

> What's the harm in leaving them in standby?

Beats me...maybe the theory is that the high voltage peaks and breaks down the filter caps. Mine run 24/7 and I never cared about extended standby, sometimes weeks on end. I buck my line down to 114V with a 1 KVA transformer to feed the racks, and nothing ever blows up, and I try to pull each radio out at least once a year to check tubes for weak ones. None in several years, and one of my SP-600s hasn't been touched in a decade of continuous operation. I'll tell you the rig that has a constant appetite for tubes is the R-392. No matter what I do with voltage and cooling those things need at least a couple tubes a year.

Date: Fri, 20 Apr 2001 08:49:11 -0700
From: "Kurt" <radiouser@uswest.net>
Subject: Re: [R-390] 6DZ4 vs. 6AF4

Howard W. Sams Tube Substitution Handbook shows a 6AF4 as a sub for the 6DZ4 but notes that it may not work in all circuits.

Date: Fri, 20 Apr 2001 14:24:27 -0400
From: Al Solway <beral@videotron.ca>
Subject: Re: [R-390] 6DZ4 vs. 6AF4

Try this site. <http://hereford.ampr.org/cgi-bin/tube> Good luck. Al

Date: Fri, 20 Apr 2001 12:18:10 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] 6DZ4 vs. 6AF4

On line datasheets:
<http://fido.wps.com/www.wps.com/archives/tube-datasheets/index.html>

Date: Mon, 23 Apr 2001 16:25:30 -0300
From: "Guido E. Santacana" <laffitte@prtc.net>
Subject: [R-390] Check Tubes First!!

After quite sometime left unattended I finally went over the audio problem of my EAC R390A. I checked every resistor and capacitor in the audio circuit and replaced C609 just in case. The problem of low audio persisted. Guess what! I left the tubes for the last check up. Turned out that one of the filaments in one of the 12AU7s had burned out. I usually check tubes first but not this time. In more than 95% of the cases the tubes are ok and we develop a strong confidence in them.

So, next time CHECK TUBES FIRST regardless of your bias against doing it.

Date: Mon, 16 Jul 2001 10:04:36 -0700
From: "Roger L Ruskowski" <rlruszkowski@west.raytheon.com>
Subject: [R-390] Zippo's

Barry Hauser on rejuvenation: I have done this once or twice on tubes like 201a's with success, but it is a procedure that can only be repeated a limited number of times. That's what I've seen the procedure on -- old tubes like the 01A's. But there was the "Zippo" thing a while back.

Now the question is:

- A. The tube has low output
- B. The tube is gassy and thus noisy
- C. The tube is noisy
- D. The tube is shorted
- E. The tube is open

From the bottom up.

If the tube is open and thus lost its vacuum file it under trash and complete the haz mat disposal forms.

If the tube is shorted, rap the tube on the bench until problem is solved or the tube opens. If the tube open see paragraph above.

If the tube is noisy file it under trash. No haz mat disposal form is needed.

If the tube is gassy, apply a zippo, The zippo is lower temp than a bic or propane torch. Thus a zippo has less thermal shock. The idea is to heat the getter stuff (done if manufacture with rf) and thus pull the gas out of the vacuum.

If the tube output is low, then the over voltage on the filament will help get emissions up again. (No has mat needed for these emission) (FCC licence will be needed if emissions exceed certain levels)

Just bumping the voltage up on the filaments t heat the getter will not work well. You warp things in the tube from the filament heat generated inside the tube element stack.

The zipo heat goes to the outside and get to the getter first. The getter chemistry gets hot and sucks things out of the vacuum (gas). This works nice on those tube that glow blue

Put a blue one in a tube tester and go over voltage on the filament and watch the blue color.

Now prop the tester up on end and apply a zipo to the tube with the filament at normal voltage. You can watch the blue color fade.

It is best to heat tubes with the zipo when the filament is cold.

Tubes have lots of problems. There is no one way fix for every thing. First understand what problem has your tube and then apply the proper fix in the correct dose.

Jerry, tires to explain this to us all very exactly and gets a rant from us. Then we ask where he went.....

Date: Sun, 26 Aug 2001 20:14:58 +0000
From: blw <ba.williams@home.com>
Subject: [R-390] Tube questions

Got some questions on tubes: What does the GB prefix mean, such as the GB 6DJ8? Also, I can't find any references on these tubes: 7984 and 8233. Can somebody let me know what these were used for?

Date: Sun, 26 Aug 2001 21:20:36 -0700
From: Dan Merz <djmerz@3-cities.com>
Subject: Re: [R-390] Tube questions

Barry, 7984 is a beam power amp tube, 46 watts, 13.5 volt filament, a compactron for VHF transmitters, 8233 is power amp pentode, 10 watts, 6.3 volt filament for power/video, not sure what the GB is (Great Britain??) (Glass Bulb ??), exhausted the easy sources, GE tube manual and Tube Lore, Dan.

Date: Mon, 27 Aug 2001 07:31:08 -0400
From: Bob Camp <bob@cq.nu>
Subject: Re: [R-390] Tube questions

You might check with Nolan. It may stand for Good old Boy :) If it was at the end of the number it's a glass bulb. When they converted the metal shield RCA's over to glass they often put GB at the end of the number. I can't think of to many times when they put something at the start of the number. The English CV stuff and the usual things on transmit tubes are about the only ones that comes to mind. I would *assume* it's the same as a 6DJ8 and go on and use it.

Date: Mon, 27 Aug 2001 07:57:11 +0000
From: blw <ba.williams@home.com>
Subject: Re: [R-390] Tube questions

Thanks. The only references that I have are the Sam's Substitution books 5 & 14, RCA Receiving Tube Manual, and an unknown manual that is very good but has the covers torn off and I have no idea of the publisher. Still has a lot of data though. Only some of the first few introduction pages are missing. I went back and checked on the tubes that I was sorting through this weekend and noticed that the GB tubes are Sylvania Gold Brand. GB 6DJ8, GB 5654, and GB 5728. I guess I had so many new tubes that I didn't notice the few that were in the Gold Brand boxes. I came across a lode of free tubes on Friday and spent Sat and Sun sorting them out. The ends of the boxes are stamped with the numbers as well as the tubes. Thanks to everyone for the help on the scope tubes and the GB prefix.

Date: Mon, 27 Aug 2001 09:19:12 +0000
From: blw <ba.williams@home.com>
Subject: Re: [R-390] Tube questions

Thanks. I guess I'll keep these as they are used in power amps and scopes. Maybe I'll run across a VHF xmitter one day. The guy who donated these tubes also has a Bogen M-120 tube amplifier. I forgot to ask what he wanted for it, but it has 600 ohm down to 8 ohm inputs. He wasn't giving that away for free. Didn't see the tube layout. The metal case is scratched up and has surface rust. If he doesn't want too much I think I'll buy it to restore and use for the boatanchors. It should be just right for R-390As and SP-600s.

Date: Mon, 27 Aug 2001 11:58:49 -0500
From: "J. Kincade" <w5kp@swbell.net>
Subject: Re: [R-390] Tube questions

I run a Bogen R-60 stereo receiver/amp in the shop, all tube early stuff. Outstanding receiver. The boatanchor receiver rack is switched (3 inputs) to a Bogen 30 watt tube PA amp with a huge Vu meter on the front. It sounds great with the two 390A's and the JX-17. A fellow just can't take all that full, warm tube sound and put it through a bunch of cold devices made from burnt sand!

Date: Mon, 27 Aug 2001 20:58:12 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] Tube questions

One of the tube companies used the GB as "their" identifier kind of like Amperex used Bugle Boy, GE used Five Star, RCA used "Command" etc. I don't remember which one but if you don't get a reply from anyone, holler back and I'll pull some of my spare tubes. I know that I do have some labeled with the GB, I just don't remember which company it was.

>Also, I can't find any references on these tubes: 7984 and 8233. Can
>somebody let me know what these were used for?

I don't have the manuals handy. The 7894 doesn't ring a bell. I've got a couple of things that use that tube number. The 8233 was used in the little 100W military RF amp for the T-827 series of transmitters. It is also used in one of the Tektronix

vertical amplifier plug in's for my old 564B storage scope. It's an overkill tube for a ten MHz scope.

Date: Mon, 27 Aug 2001 21:03:10 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] Tube questions

>and noticed that the GB tubes are Sylvania Gold Brand.....
That's it! :-)

Date: Mon, 10 Sep 2001 14:44:08 -0700
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] 390a 6360 audio

> ...I have a lot of 6DJ8'sI never looked those up as subs for anything.....

Tek 500-series scopes use a lot of 6DJ8s. Tek started out with 6BQ7s, ran into reliability problems, and canned every last one. I only have one thing that uses a 6AH6: a TS-810/U marker generator.

> I'm using 6J6's in the 2nd and 3rd mixers, and 12AT7's for the 5814's in the AF deck. The 12AT7 is supposed to be quieter than the 12AX7. The audio crowd just about worships the 12AX7, so prices are jacked up.

Are those 12AT7s working ok for you? My set turned out to have one in V601, and I traced some strong-signal audio distortion to there. The 12AT7 was biased at a very low operating point because its μ is higher than the 5814's, and it was cutting off on the negative peaks from the detector. If the 6AH6 makes a decent sub for V603/V604, I'd like to know. I have several lying around, and no spare 6AK6's.

Date: Mon, 10 Sep 2001 19:53:43 +0000
From: blw <ba.williams@home.com>
Subject: Re: [R-390] 390a 6360 audio

You got the wrong Barry. I'm the other other Barry. It happens all the time. (g) I read the 12AT7 sub in Hollow State Newsletter. I don't have the issue # at the moment, just a photocopied sheet that I keep as reference near the manuals. Paul Zecchino wrote about using them for audio gain. I've been running them for several years now with no problems. I did see several of them go bad on an AF deck that had major problems. It ended up frying one of the resistors on the daughter board (forgot the resistor location at the moment). That deck is not in use until I replace everything on it. I'm attributing short tube life on that deck to other problems like original caps, out of tolerance resistors, etc. I just got a message from someone else who said that the plate voltages on the 12AT7 would indicate fast burn out of that tube, but the original 2 have lasted a long time so far. He suggested the 12AV7 as a possible sub. I haven't looked at the few books I have yet, but I do remember having some of those stored away. I can see why the 12AX7 would be a choice to use. I'm lucky to have a good many on hand if I ever decide to go to either.

That need for 6DJ8's is going to drive me nuts until I find out why I wanted them in the first place. Maybe it is for another piece of gear and not the R-390A. Well, I got a few now if I ever recall why I wanted em. That's why I keep my tube notes

near the manuals....except in this case.

The subs for the 6AK6 listed in 2 Hollow States Newsletters are: 6AU6, 6BA6, 6HR6, 6HS6, GB 5136, and 7543. I think there are others, but I lost my best links to tube pages when my harddrive crashed a while back. The 6AK6 is only \$2.00 each from Gary Brown at

http://Tubes_Tubes_Tubes.tripod.com/tubestubestubes/

He was recommended a long time ago by someone on this list. I can't find any substitute for the 6AH6. I don't know how to do a backwards search....like search all of the 6 volt tubes to see if any are listed a using the 6AH6 as a sub. Maybe I should do an OCR project this winter from my substitution books for one big database, or find a good website that has more complete data.

Date: Fri, 28 Sep 2001 02:21:25 -0400
From: eengineer <eengineer@erols.com>
Subject: [R-390] R390A tube chart

I have updated the tube chart on my website. If anyone knows of other substitutes, please let me know so I can document them. Thanks for the look-see!

<http://users.erols.com/eengineer/tubes.html>

Date: Sun, 30 Sep 2001 08:26:16 EDT
From: DCrespy@aol.com
Subject: Re: [R-390] R390A tube chart

One tube sub that I have successfully used, is a 6CB6/6CB6A/6676 for the 6DC6. The 6CB6 was used in a lot of VHF gear (repeaters or aircraft radios), and I am told is actually a lower noise tube. I honestly could not tell the difference. Anyway this should spark a few comments back to the list! I took a look at the chart (nice job), and realized that the subs listed so far are the mil spec version tubes.. So this may not relate to the list you are developing.

Date: Sun, 30 Sep 2001 11:35:57 -0600
From: blw <ba.williams@home.com>
Subject: Re: [R-390] R390A tube chart

> One tube sub that I have successfully used, is a 6CB6/6CB6A/6676 <snip>

My books show the 6CB6 as a good sub for the 6DC6. I haven't had the need to try one yet. They better work because I got a case and a half of them NIB a month ago.

Sam's Sub Book #14 shows, in order, subs for the 6DC6 being 6AW6, 6BZ6, 6CB6/6CB6A, 6CF6, 6DE6, 6DK6. The following may not work in all circuits: 6AG5, 6AU6, 6AU6A, 6BC5. A Hollow States Newsletter says to use the 6BJ6 or 6662.

Another writer to HSN says that sensitivity increases dramatically using the 6BA6/5749 for V201 (RF amp). Another HSN chart shows 6HQ6, 6HJ6, 6GM6.

The Ray Osterwald mod articles in ER has some sub data.

He says that the RF deck allows for the 6GU5, 6GM6, or 6JK6. 6GU5 is very quiet. Greatest sensitivity was the 6JK6. 6GM6 matches the AGC characteristics better.

I just wrote Jeff that I'll send my substitution info to him when I get it compiled from various sources, comments, etc. I need to do this anyway as I have to dig through all that when I want to know something. Thanks for the 6CB6 info. That kind of stuff is always appreciated here.

Date: Mon, 1 Oct 2001 08:07:26 -0700
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] New Purchase

About the 6CB6. I looked it up in RC-19. It's sharper cutoff than the 6DC6, which will change the gain distribution for various amounts of AGC, and might be more vulnerable to undesired strong signals.

You may or may not see a difference in operator perception. The fact that they designed in a voltage divider for V201's AGC suggests that if you tweaked it you might wring out an extra pittance of S/N. Likewise if you sub a 6BZ6, which goes the other way with a cutoff more remote than the 6DC6. For it you would probably eliminate the divider. Only if you love tweaking, of course :-)

ISTR some discussion in the Final Engineering Report or similar doc, where they were choosing between the 6CB6 and the 6DC6. The 6CB6 was quieter, but they liked the 6DC6's AGC action better. And there's nothing exactly like it. I wish some popular model of TV had used it. I have boxes of the other two.

[snip] > ...check the tubes...

I temporarily subbed a very weak 6C4 in the 1st mixer just to see what would happen. There was only a slight drop in sensitivity, a few dB. Of course, that "weak" was read on an emission tester. Such a tube would work fine in any application that does not demand a lot of plate current. Or linearity.

Date: Mon, 01 Oct 2001 20:39:44 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] R390A tube chart & PUZZLEMENT!

Do you let the tester get nice and warm for about fifteen minutes before testing tubes? The rectifier tube inside contains mercury and it likes to be vaporized before being placed under load.

I suspect it's an Ohms thing that's causing the TV-7D/U short readings. Apparently the neon lamp is on the verge of firing and if there's variation from one similar type tube to another, the lamp may light or not, depending on what will or won't nudge it to fire.

The ceramic wafers must be contaminated with something that's sufficiently conductive to contribute to the false shorts. I wonder if the black greasy stuff has graphite in it. (Ooooh, noooo!)

What if you trace out the circuit and isolate the contacts that you think are

suspect and clean the ceramic in that area really well? Use two or three tubes that indicate a suspected false short. If one or more of them start to short test OK, that should be an indication that 1), you have a good "indicator" tube rather than one that actually has a short, and 2), that you're on the right track for getting the ceramic clean. (I'd unplug from the line first before poking around in there.)

I'm not sure what cleaner/solvent to suggest. Perhaps a surfactant rather than a solvent? If the above suggestion fails, then take the tester outdoors and spray with Simple Green and a distilled water rinse followed by light dabbing of DeOxit on the contacts and lube applied to wear points with a syringe? This is just an idea, not a proven method. I hope this prompts further (better?) suggestions. Easy treatments to prescribe, I know, but difficult in reality because the components are crammed so darn close together. Let us know how you do. Lots of fun by the fire on a nippy fall evening.

Date: Mon, 1 Oct 2001 19:03:07 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] R390A tube chart & PUZZLEMENT!

I remember having a phantom short response in my TV-10/D that would show up even with no tube in the socket. I tried moving the ferrite beads away from the socket tabs and routed the wiring carefully so as not to pinch it when I returned the front panel to the case,..... not really sure what fixed the problem but it was one of the two.

Date: Tue, 2 Oct 2001 06:43:42 -0700
From: "Kurt" <radiouser@uswest.net>
Subject: Re: [R-390] R390A tube chart & PUZZLEMENT!

I use a 539 for my tube testing, similar in design to the TV-7 series. I find that the line voltage setting is quite critical when making the short test. If the line voltage setting is the least bit high it will show a short when one is not present.

Date: Wed, 3 Oct 2001 19:27:40 -0400
From: "Russ Schroeder" <w2dyy@rochester.rr.com>
Subject: Re: [R-390] R390A tube chart & PUZZLEMENT!

Have you performed the obvious test - check the "shorted tube" with an ohmmeter? So far, any shorted tubes I have found indicate a short between pins with an ohmmeter. Could also do the test with the filament powered if you suspect a temperature induced failure.

Date: Wed, 5 Dec 2001 02:14:04 -0800 (PST)
From: MICHAEL OBRIEN <mikobrien@excite.com>
Subject: [R-390] tv-7/u problem and ca-4 tube data

My fair radio r-390a is backup and sounding good I took all your tips and used some of them on my receiver. replaced the meters and some if and audio caps, swaped out the if deck for my spare as the 2nd seemed bto be more sensstive (alignment ?) Set the end points and did the lankford mod. All this gives me more courage to work on my 2nd r-390a which is in worse condition. <snip>

Date: Mon, 10 Dec 2001 08:51:56 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: Re: [R-390] "Vintage" 6C4

I picked up three of these old 6C4's last year. These are in my receiver now. They are the best ones I have found in several years. Just less noise than newer ones. Clearly the age of a good tube has no bearing on its performance. If the vacuum has held for this time, its likely a good tube in a lot of other aspects.

From: "Bill Smith" <billsmith@ispwest.com>
To: "Kenneth Crips" <w7itc@hotmail.com>, <r-390@mailman.qth.net>
Subject: Re: [R-390] My R390A lives again!!!
Date: Sat, 29 Dec 2001 23:07:47 -0800

Both V508 (next to the ballast tube) and the PTO (V701) tube should be 12 v tubes. The filament supply voltage is 25 volts. V508 and V701 can be lowly 12BA6's. Has been running here this way since I put tubes in the R390 when it was obtained. Pins 2 and 7 of the ballast tube socket are jumpered. Thanks to Gerald, K6QY for help setting up this one.

Date: Fri, 04 Jan 2002 13:48:05 -0500
From: Al Solway <beral@videotron.ca>
To: Joe Foley <redmenaced@yahoo.com>,
"r-390@mailman.qth.net" <r-390@mailman.qth.net>
Subject: [R-390] [Fwd: Confirm Stock]

The attached is answer from Radio Electric Supply to my request for 26Z5 availability. You are right. There is most likely little if any stock for the 26Z5 anywhere. The only options is solid state diodes or a sub for the 26z5. Al

Radio Electric Supply wrote:

>> Sorry, no stock available at his time on 26Z5 tubes. Thanks again,

From: "Michael P. Olbrisch" <kd9kc@elp.rr.com>
Subject: RE: [R-390] [Fwd: Confirm Stock]
Date: Sat, 5 Jan 2002 01:36:24 -0000

I am the tube bank custodian for NM Army MARS.
We have dozens of 26Z5s in the bank.
I cannot sell them, or give them away.
BUT if you are a member of ARMY MARS, perhaps you can get your SMD to contact our SMD and do a transfer. It is a slim chance, but it is something

Date: Fri, 4 Jan 2002 19:46:20 -0600
From: mikea <mikea@mikea.ath.cx>
Subject: Re: [R-390] [Fwd: Confirm Stock]

Does it have to be _Army_ MARS? Can you xfer to Navy MARS?

From: "Derek Cohn/WB0TUA" <vibroplex@mindspring.com>
Date: Sat, 5 Jan 2002 11:23:57 -0600
Subject: [R-390] 26Z5 tubes

A friend of mine (Mike - WB0SND) has a vacuum tube business. I called him after I saw the postings about 26Z5s. He says he has a few in stock. A couple of thoughts:

* These aren't cheap tubes as they are very hard to find

* He's a little on the grumpy side but his merchandise is very high quality

Here's his web site: <http://www.vacuumtubes.com/>

I'm posting this for the guys who absolutely want the tube and don't know where to get one. Hopefully, someone will find something they need from him. Happy new year to everyone!

Date: Sat, 05 Jan 2002 17:13:23 -0500
To: "Derek Cohn/WB0TUA" <vibroplex@mindspring.com>, <r-390@mailman.qth.net>
From: Kim Herron <kherron@pop.voyager.net>
Subject: Re: [R-390] 26Z5 tubes

Mike's a good friend of mine, also. Now, I've never considered him grumpy. Determined, yes...grumpy...NAH!! He does indeed have good tube stock and it is very much more reasonably priced than several other sources. He also has a lot of tube tester info for the fellow who lucky enough to get that elusive TV-2 only to find it has NO info with it. He can even supply you with the calibrated 6L6 to calibrate your very own Hickok tester. Yessir, Mikey is GOOD people

Date: Sat, 05 Jan 2002 19:52:08 -0600
Subject: Re: [R-390] 26Z5 tubes
From: blw <ba.williams@charter.net>

I don't mean to be bad mouthing friends of people, but I just got an answer on his price for 26Z5s. Are you ready? \$35 each. Not a set, but each. I was feeling a bit bad about finding 3 of them for \$11 each a while back, but not anymore. He can keep his stock of 26Z5s as far as I'm concerned.

Date: Sat, 05 Jan 2002 22:14:02 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] 26Z5 tubes

I don't think you'll have to be concerned for long -- the \$35 26Z5W's will probably soon sell out, along with \$45 NOS 1L6's for the Zenith T/O's (wherever they are). Either somebody better take up glass blowing, or break out the silicon diodes, like Les says. Unless you can find some used 26Z5W's - with some tread left on 'em. I suppose they would only cost around \$10-15? How about a 25Z6? 25Z5? Double or nothin'?

Date: Sat, 05 Jan 2002 21:09:53 -0600
Subject: Re: [R-390] 26Z5 tubes
From: blw <ba.williams@charter.net>
To: <r-390@mailman.qth.net>

Yeah, I think you are right. I have one with the ballast and one without. The without came jumpered and with 12BA6s. I can't tell the difference.

Date: Mon, 07 Jan 2002 11:07:45 -0600 (MDT)
From: Richard Loken <richardlo@devax.admin.athabascau.ca>
Subject: Re: [R-390] 26Z5 tubes

>..... Unless you can find some used 26Z5W's

The news only gets worse. The 26Z5's are not that hard to toast when you are restoring a receiver. I recommend becoming at least a partial witch and using solid state subs until the radio is fully restored and then put the revered 26Z5's back in but keep a pair of spares on hand (not one spare, two spares...)

I have a pair on NIB 26Z5's around here that I bought from Fair for a fair price some five years ago. Guess I will use them to pay for a year of my retirement in a decade or two. :)

6082's on the other hand... I would not mind finding at least two of those under a table some place. It would be worth while to design a solid state regulator for the R390 and put those hot and uncommon 6082's on a shelf.

From: "Biddle, Richard" <s-biddle@ti.com>
Subject: [R-390] 26Z5W - 12BW4 replacements
Date: Mon, 7 Jan 2002 12:16:31 -0600

There is a good article on using the \$4 12BW4 in place of the 26Z5W on http://www.mines.uidaho.edu/~glowbugs/r390_psmod.htm

From: "Lavick, William" <LAVICWI@mail.northgrum.com>
Subject: RE: [R-390] 26Z5 tubes
Date: Mon, 7 Jan 2002 13:52:17 -0500

Lowell Thomas (k6kc@lightspeed.net) was selling NOS JAN 6082's a while ago for about \$4.50 each. You might give him a try. He is a real gentleman to deal with. He didn't have any 26Z5's the last time I dealt with him.

Date: Wed, 02 Jan 2002 20:35:32 -0500
From: Al Solway <beral@videotron.ca>
Subject: [R-390] Re: 12BW4 substitute for 26Z5

Thanks for coming back with your suggestion. I have a download of an article by Dexter Francis, N0YJL, describing the 12BW4 change in detail. This is most likely the way I will go. So thanks again.

>You might consider replacing your 26Z5's with 12BW4's. I find the latter
>at about \$3 (US) each at hamfests. I find that the voltage drops from 240
>vdc with 115vac input to about 231 volts dc. No big deal there. There is some
>re-wiring needed, but not bad. The wiring for replacements has been
>described several times and if you really need the directions, I'll dig
>through my past e-mails and find them I'm very satisfied with the changes I've
>made on a couple of 390A PS's.

From: "Don Reaves" <w5or@home.com>
Subject: RE: [R-390] 26Z5 tubes
Date: Mon, 7 Jan 2002 17:00:57 -0600

Wonderful job, Barry! I just received a batch of back issues missing from a lapsed but now restarted subscription, and these include the start of your stewardship. Lots of good stuff to read on that old fashioned media called paper. The 6082 ss sub might be essential when no more 6082's are to be found.

> Check out #52 of the Hollow State Newsletter -- reversable SS mod for 6082's

in the non-A.

Date: Mon, 7 Jan 2002 15:45:02 -0800 (PST)
From: Rodney Bunt <rodney_bunt@yahoo.com>
Subject: RE: [R-390] 6080 in place of 6802

R-390 people, 6080's can be used in place of 6082's in the R-390 (NON A), if you series the filament for both tubes....OR you could put a single Diode in series with the filaments if you have no aversion to "sand state" devices in your R-390 (NON A)

Date: Mon, 7 Jan 2002 16:08:29 -0800 (PST)
From: Rodney Bunt <rodney_bunt@yahoo.com>
Subject: Re: [R-390] 6802 - and heat dissipation...

The reason that the 6082's are HOT is that they are dropping the input voltage to 285v x the current consumed by the R-390. Therefore power dissipated is $(325 - 285) * .3A = 12\text{Watts}$. This amount of heat would have to be dissipated in the "solid state regulator" anyway. I agree that the heat from 4 filaments would not be introduced into the receiver with a solid state regulator. Remember that when the R-390 is in "standby" there is no current being drawn from the HT, so the input voltage would rise to approx 360v+, that is 75v across the "collector - emitter" a big ask for a Transistor, then again Power MOSFET could be used

PS: Just think of the ZENER chain to get 285v for the "series regulator" !!!
Then again you could use tubes for that!

Date: Mon, 7 Jan 2002 17:16:06 -0800 (PST)
From: Rodney Bunt <rodney_bunt@yahoo.com>
Subject: Re: [R-390] 6802 - and heat dissipation...+ standby

Quite right, the HT is 185v, that is a lot of watts.... My understanding of "not using standby" is the "poisoning" of the cathode, with filament current and no HT to "pull away" the electrons. Note also how bright the "regulator" tubes glow when in standby, NOT GOOD ! The Hallicrafters SX-101A has the VFO tube filament "ON" AND a "heater resistor" under the circuit at all time even when the "power" switch is in the OFF position, they use a series resistor in the filament to drop the heater current. Is there a message for us, in this circuit design ????

Date: Mon, 07 Jan 2002 20:40:17 -0600
Subject: Re: [R-390] 26Z5W - 12BW4 replacements
From: blw <ba.williams@charter.net>

Has anyone actually done this? If so, how does it work?

Date: Mon, 07 Jan 2002 20:29:53 -0500
From: tgrieco <tgrieco@optonline.net>
Subject: [R-390] sp-600-jx-17

Recently purchased this unit and seems to be drifting. I do not leave it on 24/7. How long should it take to stabilize from off? Any particular tubes that may need looking at?

From: Llgpt@aol.com
Date: Mon, 7 Jan 2002 21:27:38 EST

Subject: Re: [R-390] sp-600-jx-17

Try replacing the OA2 voltage regulator tube, a weak one will cause drift. Also, look at the bottom of the power supply transformer, if your voltage is over 117 volts, I would suggest moving it to the 139 volt tap. Les Locklear

Date: Mon, 7 Jan 2002 21:46:31 -0500
Subject: Re: [R-390] sp-600-jx-17
From: twleiper@juno.com

>..... OA2 voltage regulator tube, a weak one will cause drift.

Add to that regulator issue...make sure the dropping resistor is within spec. They often drift high and cause poor regulation. You should have little to no drift on that rig, however it is not unusual for the BFO to move around a bit making SSB a little tough on a long term basis. But the rest should be solid.

From: "Kurt" <r390auser@home.com>
Subject: Re: [R-390] 26Z5W - 12BW4 replacements
Date: Mon, 7 Jan 2002 21:22:50 -0700

Barry and All: I have done this conversion and it works just fine. The B+ voltages are within three volts of the published values. Kurt Holbrook

Date: Mon, 7 Jan 2002 21:14:15 -0800 (PST)
From: Rodney Bunt <rodney_bunt@yahoo.com>
Subject: Re: [R-390] 6802 - standby

Harry, I knew that you shouldn't do it, but never really knew why. This is the best explanation of the phenomenon I have ever heard. Fills in a gap in my knowledge that I have had since

>

> >My understanding of "not using standby" is the "poisoning" of the cathode, with filament current and no HT to "pull away" the electrons. For what its worth, here is what I was told when doing yeomans/apprentice work at TeKaWe (Telephon-Kabel und Draht Werke) in postware Nuremberg, way-way back in 1948. I was working in the vacuum tube department. Getters (the silvery-shiny deposit on the inside of the tube, is used to absorb or trap any heavy molecules that might otherwise bombard the coating on the cathode. Electrons themselves cannot damage the function of the cathode coating. With no B+, they just form a cloud, loitering so to speak, around the cathode. The impurities caused by outgassing or sputtering of metallic molecules is what is deadly for the cathode. Anything emitted from a hot metal surface like the anode will, due to its positive charge be hurled toward the cathode and gradually "poison" it. Golly, how I remember these exciting days. Having a dozen new, one-of-the-kind miniature tubes mounted up on the vacuum manifold. Learning the delicate touch of glass blowing. After evacuation, I had to slip a 5 turn 1/2-inch copper coil hooked to a 1000W LF transmitter (I got zapped more than once by absentmindedly touching the coil) ... over each tube in turn to get it red-hot to drive out any impurities, then finally getting the getter pill to evaporate and leave the silver halo. At that point, any clumsy move or jerking would break the small glass stem and air would rush in. In a millisecond a weeks work of the lab guys in the white coats would be trashed. They were not amused when this happened. Hope you dont mind a little reminiscing

Date: Tue, 08 Jan 2002 08:08:36 -0600
Subject: Re: [R-390] 26Z5W - 12BW4 replacements
From: blw <ba.williams@charter.net>

Thanks for the info. That sounds good to me unless anyone sees a problem with this method. I checked my inventory and I don't have any 12BW4s. I thought I would have a few around here. I checked for subs for the 12BW4 on NJ4P's tube database website at

<http://hereford.ampr.org/cgi-bin/tube>.

There are no subs for this tube. I guess we should start hoarding them before the word gets out and they reach the \$35 price of 26Z5s.

Date: Tue, 08 Jan 2002 11:31:01 -0600
From: Dave Metz <metzd@intelos.net>
Subject: Re: [R-390] 26Z5W 6V4 also works

In the Hollow state newsletter #17, there is a way to use 6V4's. I used it once and it works fine. The only negative is that this tube is a bit taller and while it still clears the bottom cover, it's close. Looks to me like there are several good alternatives to this increasingly scarce tube.

Date: Tue, 8 Jan 2002 16:15:18 -0800 (PST)
From: Rodney Bunt <rodney_bunt@yahoo.com>
Subject: Re: [R-390] sp-600-jx-17

I run my SP-600-jx-17 on the 260v tap, for use in AUSTRALIA. We nominally have 240v. But I haven't seen it that low for some time. In Western Australia it is nominally 250v but often seen way over 265v where most commercial equipment has a melt-down. PS: if the input volts are too high, then the OA2's get very hot, and very bright !!! No wonder they drift, and stop regulating....

From: Llgpt@aol.com
Date: Tue, 8 Jan 2002 19:19:05 EST
Subject: Re: [R-390] sp-600-jx-17

Exactly, the power is 124 volts, with the 130 volt tap connected, drift is almost non existent on mine. Plus, as you said, the OA2's run cooler.

From: "Barry L. Ornitz" <ornitz@tricon.net>
Subject: Re: [R-390] 6080 in place of 6802
Date: Tue, 8 Jan 2002 19:35:00 -0500

> 6080's can be used in place of 6082's in the R-390 (NON A), if you series the filament for both tubes....

The 6080's filament is rated for 6.3 volts at 2.5 amps while the 6082 filament is rated at 26.5 volts at 0.6 amps. Two 6080 tubes with the filaments connected in series would require 12.6 volts to run the filaments - not 24 to 28. Adding a single diode in series with the filaments will not do the trick either. For the umpteenth time, the RMS voltage of half-wave rectified AC is 0.707 times the RMS of the original waveform. The misconception that adding a diode in series will allow a 6 volt tube to run on 12 volts appeared in several early tomes on the R-390 receivers and sadly it still persists today. In the case Rodney suggests,

the 6080 tubes would have over 9.3 volts RMS on the filament of each tube leading to very short life.

From: "Barry L. Ornitz" <ornitz@tricon.net>
Subject: Re: [R-390] 6080 in place of 6802 - RMS ???
Date: Tue, 8 Jan 2002 20:39:40 -0500

Rodney, You need to go back and understand the true meaning of RMS- root mean square. You have to square the waveform before the averaging, then take the square root of the result. Adding the diode in series gives half the power, but you have to take the square root to get the equivalent voltage. Thus the figure 0.707 or the square root of one half.

> Rule of thumb is, if you apply the voltage for half the
> cycle, then you get half the current over a full cycle (AVERAGE).

This is correct. You get half the power. But remember that RMS is the voltage that produces the same power as if it were DC. But power is V^2/R . Note the squaring. Half-wave rectified 26.5 volts AC produces the same filament temperature as 18.74 volts DC or 18.74 volts RMS.

Feel free to look this up in any electrical engineering text.

From: "Howard Rawls" <howard@cconnect.net>
Subject: Re: [R-390] 6080 in place of 6802 - RMS ???
Date: Tue, 8 Jan 2002 21:55:47 -0500

Hey Rodney, I used a diode to drop halve the filament voltage on the 6BA6's in my R-390A..... it worked so good I forgot it was in there.....and just recently changed it.....after over 20 years of trouble-free service.Absolutely no problem with short tube filament life. Of course, if you are after really really really loooooonnnnggg life, I guess it is a bad idea, like the fellas say. ;-)

Subject: Re: [R-390] 6080 in place of 6802 - RMS ???
From: "Roger L Ruskowski" <rlruszkowski@west.raytheon.com>
Date: Wed, 9 Jan 2002 10:22:31 -0800

I follow all the logic in these arguments and see Zero Point Energy here. If we push an AC voltage across a diode to develop a positive pulse we get more than 1/2 the available power on the far side of the diode. If we push the same AC voltage across a second diode to develop a negative pulse we get more than 1/2 the available power on the far side of the diode. If we filter the positive pulse to a DC average and if we filter then negative pulse to a DC average the working power potential between the two DC voltage is more than the input power. Put all the good mis-applied math away, and understand you do not get more out than you put in. If you argue that the DC pulsed power out of diode is greater than 1/2 in a positive polarity then you must accept that the DC pulsed power out of diode is less than 1/2 in a negative polarity

If you apply 12.6 volts to a diode and 6.3 volt filament in series the filament sees the correct power whether the diode provides a positive or a negative pulse to the filament diode junction.

If you apply 25.2 volts to a diode and two 6.3 volt filaments all in series the filaments you see the correct power whether the diode provides a positive or a

negative pulse to the filament diode junction.

The tube change in the R390 power supply regulators works. Using a diode in the 3FT7 socket with two 5749's works. In each case two 6.3 volt filaments are placed in series with a diode and powered from 25.2 volts (or what ever it says in your text). The diode blocks 1/2 the power. 1/4 of the power is dissipated in one tube filament. 1/4 of the power is dissipated in the second tube filament. The thermal cycle of the tube is longer than 1/60 of a second and the filament yields a near stable source of heat for the tube cathode. The one 1/2 of the power blocked by the diode is a true power not used. In the original circuit the power was converted to heat. For the 3FT7 ballast tube the heat provided a voltage regulation function. For the R390 series regulator tube the heat was wasted in a pair of tubes that did not work by design to the tubes full capability.

From: David Wise <David_Wise@Phoenix.com>
Subject: RE: [R-390] 26Z5W - 12BW4 replacements
Date: Wed, 9 Jan 2002 10:25:47 -0800

Another possible replacement is the 12CT3 or 25CT3. Like the 6V4 it's a little taller than the 12BW4 (2-7/8" vs 2-3/8") but should fit. To use a pair of 25CT3s, move 1 to 2 and {3,8} to 9. That's it. To use a pair of 12CT3s, do the above and rewire 4/5 to put the heaters in series. Pins 1, 3, 7, and 8 are labeled "IC" (Internal Connection) and can't be used as tie points. If you're willing to inspect your 12CT3s to confirm that 1 and 7 are actually NC or plate, jumper 1-2-6-7, move {3,8} to 9, and put the heaters in series. This arrangement will accept 12BW4s and _those_ 12CT3s. Obviously this merits a big CAUTION in the radio's maintenance book.

The xCT3 may have an availability advantage, as RCA Receiving Tube Manual RC-29 (1973) lists them as "active" while 12BW4 is "replacement only". If you do any of these mods, PLEASE put a big warning on the PS not to install 26Z5s. Otherwise the next poor schmuck will Do The Right Thing and... BOOM.

From: "Barry L. Ornitz" <ornitz@tricon.net>
Subject: Re: [R-390] 6080 in place of 6802 - RMS ???
Date: Wed, 9 Jan 2002 13:44:42 -0500

The thermal time constant of the 6080's filament is on the order of 10 seconds. Any variations in filament temperature due to pulses occurring 60 times a second will be pretty negligible (close to 30 dB down).

- > Also, because of the 1/2 wave DC there is a
- > possibility that the structure is able to dissipate
- > heat just as effectively at the higher voltage for the
- > shorter period of time as it would at AC.
- > Or does RMS power explain it exactly in practice?

Again the thermal time constant determines this. The temperature the filament reaches will be determined by the RMS value of the waveform applied as long as the period of the waveform is much shorter than the thermal time constant. The thermal time constant of many small receiving tubes is on the order of 20 seconds.

- > Just how do they establish the rated voltage/power?

From the needed temperature for proper electron emission... At low filament temperatures, a tube's emission is solely determined by the filament temperature (the principle behind temperature limited diodes used as noise generators for testing receiver noise figure). With oxide coated cathodes, like those used in the 6080 and most modern tubes, cathode emission is far more than adequate for normal operation. So the cathode temperature is chosen as a compromise of high electron emission versus filament life and excessive "boil-off" of the oxide emitters. Because tube filaments operate at lower temperatures than do the filaments in incandescent lamps, tube life versus filament voltage is not quite as sensitive as it is in lamps. However the relationship between lamp life and lamp voltage is well documented and is a good thing to understand. Chicago Miniature Lamp, Inc. gives the following relationship:

$$\frac{\text{Life at Operating Voltage}}{\text{Life at Rated Voltage}} = \left(\frac{\text{Rated Voltage}}{\text{Operating Voltage}} \right)^{12}$$

[Doing equations in ASCII is difficult, but the second ratio is raised to the 12th power. The voltages are all expressed as RMS. Read this in a fixed width font.] Basically this says that raising the voltage by 10 percent shortens the life to less than a third the normal life. Likewise, dropping the voltage by 10 percent more than triples the lamp life. [As an electrician, I am sure Joe realizes that 130 volt bulbs last far longer than do 120 volt bulbs.] This is also why those 24 volt bulbs are better replaced by 28 volt bulbs in the R-390 series. This improvement in life is not without its costs though. The rated light output drops with operating voltage. In the case of a 10 percent reduction in voltage, the light output is only about 70 percent of what it was at full voltage. The light is somewhat more yellow due to the lower filament temperature. But as I said earlier, this equation does not directly apply to tube filament voltages with their lower operating temperatures (at least with oxide coated cathodes; it holds fairly well with high-power directly heated filaments). However it does show that excess filament voltage is not a good thing. Deviations of the filament voltage in small receiving tubes of up to 10 percent are generally acceptable, but for transmitting tubes, especially directly heated filament types, it is best to keep the deviations within 5 percent.

Subject: RE: [R-390] 6080 in place of 6802 - RMS ???
 From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
 Date: Wed, 9 Jan 2002 11:03:52 -0800

Barry Ornitz, I agree with this group has changed. You are right.

Take two 6080's and put them in series at 12 VAC.
 They draw 2.5 amps and the heaters dissipate 30 watts.
 The effective resistance is 12Vac / 2.5 amps = 4.8 ohms. OK
 The effective power is 30 watts (12 VAC x 5 amps).

Now double the voltage with no diode.
 Take two 6080's draw 5 amps and the heaters dissipate 120 watts.
 The effective current is 24 vac / 4.8 Ohms = 5 amps
 The effective power is 120 watts (24 VAC x 5 amps).

Now add the diode.

What ever happens now happens 1/2 the time.
Barry said so. 1/2 the time it will work. 1/2 the time it will not work.
This is a half wave rectifier. 1/4 the power.
120 watts is back to 30 watts.

The applied voltage is 24 volts 1/2 the time. This averages to 12 volts.
The applied current is 5 amps 1/2 the time. This averages to 2.5 amps.
An average 12 volts time and average 2.5 amps is an average 30 watts.

Before you leap on that RMS average and .707 and PI pile again, remember that if you turn that diode around and get a half wave rectifier of the opposite polarity you do not get more or less power out of the circuit. Therefore the final results is either way the diode goes in the circuit the output must be equal and by logic 1/2 of the input. Fellows have operated these circuits for years, with or with out math and understanding. The Provda is and it is us who must come to understand nature. Roger KC6TRU

From: "Gary E Kaufman" <gkaufman@the-planet.org>
Subject: RE: [R-390] 6080 in place of 6802 - RMS ???
Date: Wed, 9 Jan 2002 14:36:53 -0500

When I received my R390 someone had put in 6080's. They were running extremely hot and were rather scorched. I assumed that they were there in error and substituted 6082's. These ran poorly, with the B+ never rising fully. After much headscratching I ultimately discovered that the filaments were in series and the diode shorted! Apparently neither 6080's or 6082's like 12.6v ...

Subject: Re: [R-390] 6080 in place of 6802 - RMS ???
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Date: Wed, 9 Jan 2002 11:38:32 -0800

>This is a half wave rectifier. 1/4 the power. 120 watts is back to 30 watts.
>Just pray that the diode doesn't short out... Might be a good place for a fuse...
>Tom

Tom, You got it, this sand state stuff can never be trusted. You know you can not protect the sand state diode with a fuse. Murphy says the diode will always fail first to protect the fuse. We just have to live with some risk in our life. I am using 12BY7 myself for the 3TF7.

I did have a jumper in the socket and used 2 12BA6's for the BFO and PTO. But a diode poked into that socket would much simpler to install. I do like the 6BA6 5749 tubes better than 2 12BA6's. When I when through my last noise reduction drill over Christmas, I found I had no way to judge the noise of the 12BA6's in the PTO and BFO circuits. By using the 6BA6's, I was able to select 2 very quiet 6BA6 tubes and use one in the PTO and one in the BFO. Selecting 6BA6's in the first IF tube socket for best noise is more sensitive than using the BFO or PTO socket.

From: "Barry L. Ornitz" <ornitz@tricon.net>
Subject: Re: [R-390] 6080 in place of 6802 - RMS ???
Date: Wed, 9 Jan 2002 17:41:15 -0500

Unfortunately I must agree with Bill Hawkins and the several people who sent me private email. The dumbing down of Amateur Radio is amply demonstrated

by this group. Few seem to understand even the most simple relationships between voltage, current, and power.

One more time. We have two 6080 tubes with their filaments in series hooked to a 25.2 volt RMS AC source with an ideal diode in series with both. But since the RMS seems to be confusing people, let us say we have 25.2 volts DC and a switch that opens and closes very rapidly with a 50 percent duty cycle. The result is the same. The tube can be viewed as a resistance of 2.52 ohms (6.3 volts divided by 2.5 amps). With 6.3 volts applied to the tube filament, the heater develops 15.75 watts (6.3 volts times 2.5 amps).

Now with the first half of the AC cycle (the switch is closed), the voltage is divided between the two tubes and each tube sees 12.6 volts. From Ohm's law, it draws 5 amps (12.6 volts divided by 2.52 ohms). Now this power is 63 watts (12.6 volts times 5 amps). Note how this is exactly 4 times the power the filament is rated for.

You could also calculate this by using the total voltage and the total resistance. 25.2 volts divided by 5.04 ohms equals 5 amps. 5 amps times 25.2 volts equals 126 watts for both tubes. With the next half cycle (switch open), the tubes receive no voltage. So the heater power is zero. Average the two and you see each tube filament is heated with 31.5 watts (63 watts divided by two). This is twice what the filament is designed for. For both tubes, the combined heater power is 63 watts (126 watts divided by two).

Now ask what would be the steady voltage that would produce the same heater power if the current flowed continuously. The answer is 8.909 volts. Calculate this by the following:

$$\begin{aligned} \sqrt{2} &= 31.5 \text{ watts} * 2.52 \text{ ohms} = 31.5 \text{ volt-amps} * 2.52 \text{ ohms} \\ &= 31.5 \text{ volt-amps} * 2.52 \text{ volts/amp} = 79.38 \text{ volt-volt} \end{aligned}$$

Take the square root and you get 8.909 volts. Knowing this, calculate the tube current as 3.535 amps (8.909 volts divided by 2.52 ohms). Multiply the two together to get the filament power and you get 31.5 watts as we calculated earlier. This is twice the rated filament POWER for the 6080, and you will damage the tube. Will it burn out instantly? Probably not, but the tube life will be severely degraded.

Between the explanation Bill Hawkins wrote and this, if you still do not understand, you really need to go back and study.

Date: Wed, 9 Jan 2002 21:56:02 -0600
From: mikea <mikea@mikea.ath.cx>
Subject: Re: [R-390] 6080 in place of 6802 - RMS ???

No, I definitely was not pulling your leg. I was demonstrating by experiment, in the manner of all good empiricists, that the tube cathode and filament could not possibly cool down enough that the resistance would change materially. Probably the mechanical stress on the filaments isn't very much: they're insulated, and pushed as a bundle into the cathode, or so I remember from my dissections of dead 6SN7s and 12A(U,V,X,Y)7s. Really low-noise gear tends to use DC on the filaments to reduce the possibility of AC hum leaking through from the filaments and the filament power supply.

IIRC, there is a preference for AC over DC (or vice-versa) in tubes in which the filament is also the cathode. IIRC, it's DC, but I could be wrong. Certainly the most negative part of the filament would "wear" (lose emission) faster if it were DC-heated, while an AC-heated filament would be more likely to lose emission more evenly. Barry Ornitz may have a better idea of what happens here, and I'd be happy to hear what he has to say on the subject.

Ah! A short Google search on "power tube" filament supply yields lots of relevant hits. One of the more interesting ones is about the Burle S94000E Power Tube. Its filament supply must provide 3.5 VDC at 4200 Amperes. Yes, that's Four Thousand Two Hundred Amperes to heat the filament. This is a _big_ tube: it weighs 325 pounds out of its crate, and 870 pounds crated. The tube's data sheet says:

A DC filament supply is required. Filament excitation with an AC supply may generate mechanical resonances in the filament structure. A three-phase, full-wave rectifier supply is recommended.

The operating region on the voltage-current chart tops out at about 90 A with a drop across the tube of 20 KV. At 30 KV, the current is reduced to "only" 65 A or so. This is typical of large power tubes, judging by what else I found on Google. Still, I hope Barry O. will give us the benefit of his education and experience.

From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Date: Tue, 15 Jan 2002 09:53:50 -0800
Subject: [R-390] 6DC6 Replacement

Warning Solid state devices discussed in this post. POST NOT SUITABLE FOR ALL READERS. What ideas are there for plugging a transistor into the 6DC6 RF amp socket of the R390/A. I am looking for: equal or better sensitivity. equal or better gain. lower device noise to produce an over all receiver improvement in the signal to noise whatever. Good 7 pin metal relay cans exist to house (conceal) [shield] the device. Considering the nature or the RF deck underside, I am going for a plug and pray modification into the tube socket on the top side. What's been kicked around and deemed undoable because it violates nature?

Subject: Re: [R-390] 6DC6 Replacement
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Date: Wed, 16 Jan 2002 09:25:17 -0800

Fellows, Alright! I must confess that I have had similar evil thoughts. WARNING---SAND STATE THOUGHTS TO FOLLOW!!!!
I have found Bill Noonan W6WJN in San Francisco. He really did the tubsters. Bryce Ringwood, wrote me with some attachments we can not get through the reflector mail. "I made a solid-state set in the '70s that worked something like this. It was(is) sensitive and low-noise, but really REALLY bad with nearby strong signals." nearby strong signals is not a DX objective so we can skip over those things. We can hang a bridge rectifier and load across the feed line. Any signal that exceed .6 volts we can limit off across the bridge and into the load. I'll keep the finding here so we can share the knowledge.

Date: Wed, 16 Jan 2002 19:50:01 -0500
From: Bob Camp <bob@cq.nu>
Subject: Re: [R-390] 6DC6 Replacement

More or less in the order asked:

> I am looking for: equal or better sensitivity.

Certainly a reasonable thing to want.

> equal or better gain.

Probably not a good idea to go for more gain. You will degrade the radio's performance.

> lower device noise.

Good idea, but it's the same as sensitivity.

It would probably be a good idea to add similar or better AGC action and higher intercept point(s) to the list. The R-390A is already challenged in the intercept point race, and several radios of the same era (R-390 not an A) beat it in RF selectivity. If you degrade the AGC things only get worse in this department. So how to come up with a solution:

1) A reasonable RF FET these days has at least 4X the gain of a 6DC6. Noise figure is not too hard to beat with a FET.

2) There isn't much that will run at high voltage anymore. The days have long past when you could get RF small signal parts that ran on 120 volts or so. The large signal stuff has enormous input and output capacitances.

3) The input and output capacitances of a single FET are a bit higher than a 6DC6 so if it's a plug in mod you will have to get creative.

I suspect that leads you pretty quick to a cascode JFET arrangement. That would get the output and feedback capacitances up into a reasonable range. Output admittance might be an issue but I doubt it. That gets us to AGC. Probably time for some kind of op-amp and PIN diode arrangement in the middle of the cascode. Sounds kind of messy. In order to get all that running and not mess up the second and third order intercepts you would need to fiddle around quite a bit.

From: "Kenneth Crips" <w7itc@hotmail.com>
Subject: Re: [R-390] Tube cutting 101
Date: Wed, 16 Jan 2002 19:07:18 -0700

You are cutting the glass almost the same way glass cutters do it. By the way I found a source of batteries for the man pack radio that was mentioned here, the note however was intercepted as having a suspicious header. I am not sure what I did but if I broke a list rule My apologies.

Date: Thu, 17 Jan 2002 10:41:16 +0200
From: "Bryce Ringwood" <BRingwoo@csir.co.za>
Subject: Re: [R-390] 6DC6 Replacement

(Warning ! - Sand and deceased gramniverous quadrupeds mentioned) A few observations:

1. The problem I generally have with sand is interference from nearby (or sometimes quite far removed) strong stations causing intermodulation effects. Both my homebrew and a well known commercial sand receiver suffer badly. Thus far, I haven't had any problem with tubes. Even the much maligned (in the '70s) EF183 gave me great performance.

2. I don't understand the concept behind 'intercept points' and their measurement very well. Perhaps one of you could explain in terms a non electrical engineer can understand ? Hope this doesn't become another 6082 saga.

3. If it doesn't glow it doesn't go. The orange LED should be supplemented with a white LED in series with a capacitor to give that lovely white glow when you first switch on. White LEDs cost a bit more, but its worth it.

4. Some tubes are supplied with plastic pin straighteners - these just need the right diameter wire poked through the holes and glued to make a header on which a small PCB can be mounted.

6. Many tubes will outlast their owners. This is just an FLP ("Fun Little Project"). Making an tube radio solid-state makes no sense other than doing it for its own sake. People who take their fun seriously will buy a solid state radio.

7. What was 5?

Date: Thu, 17 Jan 2002 08:42:30 -0500
From: "Ray, W2EC" <w2ec@attglobal.net>
Subject: Re: [R-390] Tube cutting 101

I seem to recall a method where you use a small wire that you hook up to a 12 volt car battery until its glowing good and hot, then quickly wrap it around the tube where you want the break to occur and dip it quickly into water. The hot wire heats the tube at the break point and the rapid cooling snaps it cleanly off. Anybody remember/try this technique?

Date: Thu, 17 Jan 2002 07:52:10 -0600
From: mikea <mikea@mikea.ath.cx>
To: r-390@mailman.qth.net
Subject: Re: [R-390] Tube cutting 101

I was wondering when someone would propose this. It works very well for bottles, jars, etc. -- as long as they aren't made of zero-TC glass or quartz. A length of Nichrome toaster element would work very well, as long as it doesn't turn out to be fragile.

From: "rbethman" <rbethman@home.com>
Subject: Re: [R-390] Tube cutting 101
Date: Thu, 17 Jan 2002 09:38:01 -0500

I seem to remember being taught to wrap a piece of string around the object, soak it with lighter fluid, ignite it and let it burn out. Then the quick dip into cold water. Just another twist on the same routine.

From: "john page" <n8blb@hotmail.com>
Subject: RE: [R-390] Tube cutting 101

Date: Thu, 17 Jan 2002 12:13:53 -0500

I have had mixed luck with a small file. I etch a line around the tube and then tap the tube with a screwdriver handle. Most of the time it will break clean. John

From: "Richard Biddle" <theprof@texoma.net>
Date: Sat, 26 Jan 2002 09:54:03 -0600
Subject: [R-390] 26Z5 vs 26Z5W

Is a 26Z5 and a 26Z5W the same animal? I found a source for 26Z5 (no other information) for supposedly \$7.00 each. My tube references don't seem to address this beastie.

From: Llgpt@aol.com
Date: Sat, 26 Jan 2002 20:21:46 EST
Subject: Re: [R-390] 26Z5 vs 26Z5W

Same tube, the W indicates ruggedized filaments. Unless you are operating it on a ship the 26Z5's will do fine.

From: "ea2ig" <ea2ig@tiscali.es>
Subject: Re: [R-390] 26Z5 vs 26Z5W
Date: Sun, 27 Jan 2002 02:52:17 +0100

Yes they are the same tube, the W means it is for the military.... Can you pass the information of your source ?

From: "Richard Biddle" <theprof@texoma.net>
Subject: Re: [R-390] 26Z5 vs 26Z5W
Date: Sun, 27 Jan 2002 13:23:58 -0600

I ordered a couple of the \$7.00/ea 26Z5 from <http://www.alltronics.com/>
I have bought stuff from them before, but never tubes. We shall see.

From: "Gary E Kaufman" <gkaufman@the-planet.org>
Subject: RE: [R-390] 26Z5 vs 26Z5W
Date: Sun, 27 Jan 2002 20:21:41 -0500

Unfortunately a Hickok tester won't work properly with the 5Z3, and it also draws 1A more on the 5v. OTOH a pair of 1N4007's in the base of a junked 83 work very nicely, for about \$0.20 .

From: "Joe Grossbauer" <wa9msd@ggnet.net>
Subject: RE: [R-390] 26Z5 vs 26Z5W
Date: Fri, 1 Feb 2002 15:13:41 -0600

FYI, I ordered a couple of these tubes Monday from Alltronics (\$8 each per their Website) and spoke with the owner directly.

He mentioned that he had orders for over 90 of these tubes and that he had no problem with stock (take that to read he has more but not sure how many more). BUT he warned me that he has to retrieve them from his warehouse and test them so he said he would not be shipping orders until Feb 8th or 11th. So if you ordered any of these be patient they will be on their way soon.

From: "Kenneth Crips" <w7itc@hotmail.com>
Date: Sun, 10 Feb 2002 15:14:32 -0700
Subject: [R-390] Source of 26Z5W?

<http://www.die-wuestens.de/roe.htm>

The above site lists 26Z5W, I think, for less than ten bucks each. The sight is a little hard to read, even in English.

From: "Richard Biddle" <theprof@texoma.net>
Date: Tue, 12 Feb 2002 18:48:23 -0600
Subject: [R-390] [R-390A] Alltronics 26Z5W

I receive my order from Alltronics today. Along with neat "stuff" were the 26Z5 tubes I ordered. They were marked 26Z5W but I couldn't make out any other markings. Tubes were packed in an envelope, not a box, possibly they are used tested. I haven't tested them myself as yet. I think my wife may decide to shoot the UPS driver if he brings me anymore boxes:)

From: "Joe Grossbauer" <wa9msd@ggnet.net>
Subject: RE: [R-390] [R-390A] Alltronics 26Z5W
Date: Wed, 13 Feb 2002 10:29:28 -0600

I also received my order. The tubes were not in boxes but were very well packed. I did not expect them to be new (not at this price) but when I talked to the owner of Alltronics he said they may or may not be new but all are tested. I popped a couple in my TV-7 and they tested REAL GOOD. BTW the Website priced the tubes at \$8.00 but I was only charged \$7.00 (nice surprise!). I don't know how many more he has but I might try and order a couple of more.

Date: Fri, 15 Feb 2002 07:44:10 -0500
From: "Ray, W2EC" <w2ec@attglobal.net>
Subject: Re: [R-390] replacement tubes

FYI, I just bought two 6082W to keep as spares for my R-391, from Lowell Thomas (k6kc@lightspeed.net).

Cost was \$5.50 each plus USPS Priority shipping (\$3.50 coast to coast). Very pleasant dealing with Lowell and tubes arrived quickly, NOSIB (New Old Stock In Box for those not familiar with the acronym).

From: "Greg Werstiuk" <greg_werstiuk@msn.com>
Subject: RE: [R-390] TUBES
Date: Fri, 15 Feb 2002 09:38:47 -0800

When I started in the electronics industry in the mid 70's, among other products, I sold receiving, industrial, camera and specialty tubes (Amperex, Amperite, Eimac, Genelec, Mullard, RCA, Sylvania and probably a few I've forgotten). Only RCA and Sylvania manufactured receiving and industrial tubes in North America (U.S. and Mexico). RCA dropped out of that business in the early 80's. I believe Richardson bought their facility. I seem to recall Sylvania also exited the business during that time frame but I can't swear to it.

From: "Mike Melland" <w9wis@charter.net>
Subject: Re: [R-390] TUBES

Date: Fri, 15 Feb 2002 14:39:21 -0500

>>In the dim recesses of my fading memory, I seem to recall plans
>>announced about five years ago by Western Electric

All this talk of tubes had me thinking over noon. I just returned from lunch with the LTC that is the commander of our regional ROTC units based here at the college I work at. Earlier I learned he was a "signals" officer and he's been very helpful scrounging parts for me for various receivers, including my R-390A. I asked about the military supply of vacuum tubes and he tells me that they had a warehouse full of new tubes at the last base he was assigned to two years ago. He informed me that many of the tubes were routinely surplused as they got older and rotated with fresh stock. He informs me that many of the current tubes in US Army stock were made by Philips in Germany. Must be NATO purchases ??? Interestingly he was in the Gulf and actually had to request R-390A's be sent there from Germany. Apparently according to him some of their sophisticated receivers had trouble with static damage due to charges from all the blowing sand ??? I don't know if he's kidding me or not on that..... but he sure is familiar with the R-390A for a guy that entered service probably in the late 1970's or early 80's.

Date: Fri, 15 Feb 2002 13:56:59 -0600
From: mikea <mikea@mikea.ath.cx>
Subject: Re: [R-390] TUBES

I think he's not kidding, based on the word I've got from some troops who were there. You'd think that W-J and the other premium military manufacturers would stick a 1 Meg resistor between the antenna connector center pin and ground. I guess that's just too easy and makes too much sense.

Date: Fri, 15 Feb 2002 16:57:17 -0500
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] TUBES

Mike - Not a story, but fact. It's not to say that all the Harris gear went down, but some did, as well as other gear. Not only did they have to ship some R-390As in but they also asked for a load of KWM2-As. Somewhere I have the information in writing. Seems the static was only part of the problem, the sand over there is almost like dust and did well at clogging filters and other nice gremlin-type stunts. I almost think ER had an article in it at one point shortly after the Gulf War...

From: "CORYHINE" <CORYHINE@msn.com>
Subject: Re: [R-390] TUBES
Date: Fri, 15 Feb 2002 15:59:35 -0600

He wasn't kidding! The Harris "Pacer Bounce" \$15,000 KWM-2A replacement radios all went down from sand static. As well as all the solid state receivers, I imagine. They were shipping KWM-2A's over from a lot of different bases. Word is that there is an inventory of k-2's somewhere in CA..... Don't have personal knowledge, but I think one of the old Collins repair guys was pulled out there to look them over. Anyhow, Phillips may well be still building tubes for europe.....So, it looks like they do still use the old radios....wonder if they are very quietly having some built in Europe????

From: Llgpt@aol.com
Date: Fri, 15 Feb 2002 17:03:36 EST
Subject: Re: [R-390] TUBES

<< Not a story, but fact. It's not to say that all the Harris gear went down, but some did, as well as other gear.

I almost think ER had an article in it at one point shortly after the Gulf War...

>>Electric Radio Magazine No. 104 December, 1997 page 12.

From: "Kenneth Crips" <w7itc@hotmail.com>
Date: Thu, 21 Feb 2002 00:48:02 -0700
Subject: [R-390] Software

RE: <http://www.ee.ualberta.ca/~schmaus/elect/tdex.html>

I have finally found software designed to inventory vacuum tubes. not only that, it has a data base of tube spec's, a substitution guide etc. The price is \$29. Does it look like it is worth the price?

From: "Kenneth Crips" <w7itc@hotmail.com>
Subject: Re: [R-390] Software
Date: Thu, 21 Feb 2002 01:04:24 -0700

Incidentally go to the left side and click on the software button. <http://www.ee.ualberta.ca/~schmaus/elect/tdex.html>

Date: Thu, 21 Feb 2002 10:16:38 +0200
From: "Bryce Ringwood" <BRingwoo@csir.co.za>
Subject: Re: [R-390] Software

Would there be any interest in a Windows version ? (Including pinouts and characteristic curves)?

From: "Helmut Usbeck" <vze2gmp4@verizon.net>
Subject: Re: [R-390] Software
Date: Wed, 20 Feb 2002 08:36:41 -0500

If it does what it says then it looks like a pretty good addition. There is a refund available if one is not satisfied.

From: "Helmut Usbeck" <vze2gmp4@verizon.net>
Subject: Re: [R-390] Software
Date: Wed, 20 Feb 2002 08:43:50 -0500

From what I see of the programs, it's not too intense with graphics, so it most likely should run in a dos mode under 95 or 98. I have several programs that didn't run well or not at under 95 or 8 and work well with xp. If the author would release the source code it could be compiled to run under Linux which would be nice.

To: <r-390@mailman.qth.net>
Date: Tue, 26 Feb 2002 09:01:21 -0600
Subject: [R-390] [OT] Hard to Find Tubes (HP-410B)

Sorry for the off topic post but I thought some may find this interesting with all the tube talk going on here lately.

I replaced my HP-410B a while ago with a much later one.... I had a spare 2-01C probe for the ood one but my newer one needed a EA53. I about died when I looked in all the usual places for a spare EA53 and found that "if" you could find one they were selling nos for up to \$100 each ! Heck my spare 2-01C is selling for between \$30 and \$60 it seems.....

I finally found a web page of a tube dealer in Sweden. He had a nos EA53 listed in Swedish currency and for kicks I sent an email asking what it converted to in US Dollars.

Get this..... \$8 US Dollars ! Total with shipping was \$13.80 including a \$3.50 fee for an order under \$30 Euros! Amazing..... sure must be more EA53's over there then here <grin>.

Now I'm checking to see if they have or can get a spare probe tube for my favorite VTVM.... a 1970 General Radio 1806-A, an amazing instrument but with the very small 7266 ceramic diode in the probe. And.... I checked ... he didn't have any 3TF7's or 26Z5W's <grin> but lots of nos European and other military types. Owner's name is Ralf.... fast email, fast shipping, nice guy. YMMV...

RBN Trading HB
Karvagen 5
SE-976 31 Lulea
Sweden

<http://go.to/radiotubeshop>

Mike, W9WIS

Subject: Re: [R-390] General R390 Help
From: "Roger L Ruskowski" <rlruszkowski@raytheon.com>
Date: Mon, 1 Apr 2002 09:03:29 -0800

Leroy, If you have to part with a 100.00 or so AUS or US for a tube tester for your R390. why not hack an old 5 tube AM radio and a meter into a tube tester? If you can find a 12 volt filament transformer with a center tap (6.3) and a 100 - 300 volt B+ winding you can build a tester. As you only need to test a select number of tubes, you can wire one socket for each type. A couple switches for the dual triodes can be keep it simple. Testers are relative. You can look at the tube manual (on line some where) and find the expected current for a grid voltage. Most testers tie the tube up as a triode (for short tests) and vary the grid voltage to get a mid scale meter reading. The real test for R390 or A tubes come from use in circuit and judging the noise. These are all relative test. This one is better than that one. And you use the best of what you can get. The exact value is not known. Most tube testers just weeds out the shorts and real dead emitters.

From: G4GJL@aol.com
Date: Thu, 9 May 2002 08:49:54 EDT
Subject: [R-390] 3TF7 Failed in service

Contrary to observations made from time to time by others on the reflector, I have had a 3TF7 Ballast fail **WHILST POWERED UP**. The 390A here was powered up, but muted with the break-in facility for a period of 4 hours, during which the ballast failed. I dont have a spare, and have just undergone abdominal surgery,

so I dont feel like lifting the rig or working on the rig to make a solid state replacement. Instead, I made a makeshift repair with a 33ohm and a 10ohm resistor in series, jammed into the tube socket on the appropriate pins. Dont flame me...it works! I'll do better when I am!

Date: Thu, 9 May 2002 06:36:58 -0700 (PDT)
From: "Tom M." <courir26@yahoo.com>
Subject: Re: [R-390] 3TF7 Failed in service

You can use 12V (12BA6) tubes for the BFO and PTO tubes, and short the dead ballast tubes. Works like a charm.

Date: Thu, 23 May 2002 23:27:16 -0500
From: Mahlon Haunschild <mahlonhaunschild@cox.net>
Subject: Re: [R-390] New (to me) R-390A

Many thanks for all the messages of support; I really appreciate them. Ran the tubes across the Hickok 539C this evening. Good thing I was buying all of those \$1 - \$2 tubes in the flea market; I needed to outright replace eight of them, including the 6DC6 and all three of the 6C4s. Reckon the receiver might actually work now ;) Found a 6AB4 in place of the 6C4 in the third mixer socket.

My first technical question for the list: how the heck does one remove V207 without removing the slug rack and camshaft running across the top of the tube shield?

Date: Fri, 24 May 2002 11:00:57 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] New (to me) R-390A

Ah, yes, V207 lurking under the hardware...

The shield and tube will come out OK. Depending on how big one's fingers are, the neighboring tubes and the crystal oven may have to come out first. I think a heat dissipating tube shield uses less headroom than a spring loaded shiny one.

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] New (to me) R-390A
Date: Fri, 24 May 2002 12:00:25 -0400

I've been able to get V207 out and in again without removing any hardware -- maybe nearby tubes. If you have an IERC heat dissipating shield, they're friction fit. Just grab the top edge with a needle nose pliers and pull up -- maybe with a bit of wiggle action. The shiny bayonet ones are generally easier. Just put a small screwdriver into the one of the spring retainer slots and rotate -- make sure you're going in the right direction. It will pop up, then fish it out with the needle nose or a bent paper clip. OH -- just remembered, before starting, work the tuning knobs to raise the slugrack for maximum clearance.

After you've got the shield off and out of there, you can use one of those wire tube pullers, or I've found the tong type to be even better. These look like kitchen tongs, but with "tooobuler" shaped ends coated with that tool handle rubber dip. They were originally made for use as tube pullers, then repackaged (by GC for example) as tongs for use in etching PC boards. (Just don't squeeze

too hard ;-). Another trick is to use some adhesive tape -- electrical, duct, scotch, whatever and work it onto the sides of the tube, then pull up while gently wiggling. The same method may be used to lower the tube into position, then press down on the top (with some kind of cushion so the "nibbie" doesn't puncture your index finger.)

If the tube or tube shield are stuck, well that's another story.

Date: Sat, 25 May 2002 10:10:08 -0500
Subject: Re: [R-390] New (to me) R-390A
From: blw <ba.williams@charter.net>

My radio has been in a rack for a long time. I usually leave a few inches for cooling space on the top with enough room to get my hand inside. I can get all of the tubes out, including V207. The problem I had was orienting the tube correctly when putting tubes back in since I couldn't see well. I scanned the line drawing of the top and bottom layouts of the radio. I use these sheets to write notes when I test all of the tubes, etc. The most useful thing about using prints of the layouts is using notes on each tube base how the tube should go in. I drew almost complete circles to indicate the pins for each socket. I look at the sheet and orient the tube right before trying to push it down into the tube base. It takes all of the guesswork out of putting the tubes back in. Saves a lot on bent pins and saying bad things that cause family members to come see what is wrong.
the other other Barry

Date: Sat, 25 May 2002 09:15:48 -0700
From: Craig McCartney <craigmc@pacbell.net>
Subject: RE: [R-390] New (to me) R-390A

Barry, Here is another way to align the tube 'blind' that works with the type of tube sockets in the R-390A. There is a tit on the rim of the shield attached to the socket. You can feel it with your finger. Use the same finger to find space of the 'missing' pin on the bottom of the tube. Align these two points and the tube will plug into the socket. This was taught to me by a Master Sargent on my first day in the field with the USAF in the 60's. Funny, in one year of tech school nobody mentioned it. Craig

Date: Tue, 28 May 2002 16:48:11 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] New (to me) R-390A

>My radio has been in a rack for a long time.
> ... The problem I had was orienting the tube correctly

The tube shield bases have a nib that sticks up at the top edge, located between the first and last tube pin. You can feel it with your finger even if you can't see the tube socket. (I have seen a tube shield base installed wrong, though.)

From: "Spence Barton" <ence-ack@rio.com>
Date: Thu, 30 May 2002 16:24:36 -0700
Subject: [R-390] Tube List For R-390 (non A)

Can anyone point me to a tube list for the R-390? I found many for the A but none yet for the non A.

Date: Thu, 30 May 2002 18:44:41 -0500
From: Don Reaves W5OR <w5or@comcast.net>
Subject: RE: [R-390] Tube List For R-390 (non A)

This is what I have on the R-390. Can anyone confirm? My manual is not readily available.

R-390 NON-A
Tube

Qty
3TF7/RT510 1

6AJ5 3

6AK6 3
6BH6

1

6BJ6 7

6C4W 2
12AT7

1

12AU7 6

5651 2
5749/6BA6W 2

6082 2

Date: Thu, 30 May 2002 20:37:06 -0400
From: Andy Williams <andywilliams@pobox.com>
Subject: RE: [R-390] Tube List For R-390 (non A)

I have a list of tubes & IERC tube shields available as an Excel spreadsheet.
Email me if you want a copy.

Date: Thu, 30 May 2002 22:13:43 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] Tube List For R-390 (non A)

Hi, all, Here is a list of the tubes in the R-390 (non A) taken from TM-856 plus some hints on substituting 12AU7s:

V201 6AJ5

V202 6BJ6

V203 6C4

V204 6C4

V205 6C4
V401 6AJ5

V402 6AJ5

V501 6BJ6

V502 6BJ6

V503 6BJ6
V504 6BJ6

V505 6BJ6

V506 6AK6

V507 12AU7

V508 5749/6BA6W
V509 6BJ6

V510 12AU7

V511 12AU7

RT512 3TF7 (ballast)
V601 12AU7

V602 12AU7

V603 6AK6

V604 6AK6

V605 6082
V606 6082

V607 6BH6

V608 5651

V609 5651

V701 5749/6BA6W
V801 26Z5W

V802 26Z5W

V901 12AU7

V902 12AU7

Substituting the 12AU7 with 5814A: The 12AU7 can be substituted in some cases with the 5814A. Be aware that its filament current draw is slightly higher than for the 12AU7; i. e., 150 ma (12AU7) versus 175 ma (5814A). This will pose a problem for the R-390 because most of the tubes filaments are wired in series off the 26.5 VAC.

You can substitute 12AU7s where they are not wired in series with another type tube as long as you replace BOTH 12AU7s with 5814As. Here is the list of the series filament circuits in the R-390 (non A):

V202 V203 V204 V205
6BJ6 6C4 6C4 6C4

V401 V402 V201
6AJ5 6AJ5 6AJ5 (Only three tubes here @ 18.9 VAC plus four chokes wired in series.)

V501 V502 V503 V504
6BJ6 6BJ6 6BJ6 6BJ6

V505 V506 V511
6BJ6 6AK6 12AU7

V507 V510
12AU7 12AU7 <--- OK to use pairs of 5814As.

RT512 V508 V701
3TF7 5749 5749

V601 V602
12AU7 12AT7

V603 V604 V607 V509
6AK6 6AK6 6BH6 6BJ6

V901 V902
12AU7 12AU7 <--- OK to use pairs of 5814As.

Each row represents a filament series circuit. The 12AU7 in V511 should not be substituted with the 5814A as the latter's filament voltage will drop and voltage will increase across V505 (6BJ6) and V506 (6AK6). V601 (12AU7) should not be substituted since V602 is a 12AT7. The 12AU7s in V507 and V510 can be substituted, but use 5814As for BOTH. The same applies to V901 and V902. These are the only instances where the 5814A will work properly.

Whew!! This was a lot of effort to get us back on topic. :-)

Date: Thu, 30 May 2002 23:19:29 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: [R-390] R-390A (non nonA) Tube List

Thanks for the compliment. The R-390A tube list isn't as complicated. Only V505

(5749) and V701 (5749) filaments are in series together with the ballast tube RT510 (3TF7). All the others are wired in parallel. The 5814A can be substituted with the 12AU7. The 12.6 VAC filaments are center tapped and wired at 6.3 VAC. The R-390A tube list:

V201 6DC6

V202 6C4

V203 6C4

V204 6C4

V205 5814A

V206 5814A

V207 5654

V401 5654

V501 5749

V502 5749

V503 5749

V504 6AK6

V505 5749

V506 5814A

V507 5814A

V508 5749

V509 5814A

V510 3TF7

V601 5814A

V602 5814A

V603 6AK6

V604 6AK6

V605 0A2

V701 5749

V801 26Z5W

V802 26Z5W

There you have it. If someone says, "RYAN, GET A LIFE!" I'll delete him! :-)

From: "Spence Barton" <ence-ack@rio.com>
Subject: Re: [R-390] Tube List For R-390 (non A)
Date: Thu, 30 May 2002 20:25:23 -0700

Thanks to all who responded with help.

From: "Glen Galati" <eldim@worldnet.att.net>
Subject: Re: [R-390] Tube List For R-390 (non A)
Date: Fri, 31 May 2002 00:43:00 -0700

Something looks fishy on this tube list. Is there a model of the R-390 that used the 26Z5W V801& V802? I don't have my manuals here-but my R-390 does not have any.

Date: Fri, 31 May 2002 04:38:42 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] Tube List For R-390 (non A)

> Something looks fishy on this tube list.

Grrreat Caesar's ghost! I think you may have the L@@K!! PEEEEK!! RARE!! non-tube power supply in your R-390! OK, maybe not... All seriousness aside, your power supply may have been modified to solid state rectification. I think this is a common Navy mod involving taking out the 26Z5Ws and squishing the tube shield bases so you can't stick the tubes back in. Then a pair of diodes is installed underneath. My latest rig (actually an R-391) came with diodes and I took them out. B+ goes high unless a voltage dropping resistor is added. Voltage regulator circuits work a little less hard at normal B+ voltage as well. I feel the tubes don't like to have B+ introduced before their filaments even start to glow. True or not, having 26Z5Ws back in there makes me feel better. :-)

Date: Fri, 31 May 2002 12:19:57 +0200
From: "Bryce Ringwood" <BRingwoo@csir.co.za>
Subject: Re: [R-390] 3TF7

They can't ask more than about \$43 - that's what they cost new. The nice lady at Amperex will give you a quote. Wonder why they still make them ? Getting fed up with people buying up all the nuvistors too. Can't they use FETs in microphone amplifiers ? Grumble.

Date: Fri, 31 May 2002 16:47:25 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] Tube List For R-390 (non A)

Hi, Roy, Thanks for pointing out the discrepancy in my R-390 tube list of 20 June 2000 which I wrote for Paul Anderson (cited below). It lacks V901 (12AU7) and V902 (12AU7) for the cal/osc module. A pair of 5814As will substitute OK.

Thanks also for reminding me of the 6C4 substitution issue. Chuck Rippel discussed this some time ago, but I forgot the details. Have I got it right? 6C4, 6C4WA, and 6100 = good? 6C4A = bad? So far, my tube lists posted the other day are holding up as far as accuracy goes. Please pore over them and let us know any errors. The total should come to 33 tubes for R-390 and R-391 and 26 tubes for the R-390A including the ballast tube in each instance. 73 de Norman KG4SWM

From: Llgpt@aol.com
Date: Fri, 31 May 2002 18:16:19 EDT
Subject: Re: [R-390] Tube List For R-390 (non A)

<< Thanks also for reminding me of the 6C4 substitution issue. Chuck RippeI discussed this some time ago, but I forgot the details. Have I got it right? 6C4, 6C4WA, and 6100 = good? 6C4A = bad? >> That's it as far as I know.....others??

Date: Fri, 31 May 2002 18:29:22 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] Tube List For R-390 (non A)

I got an e-mail from someone who recommends also the CV-133 and the 6135 as subs for the 6C4. They're supposed to be quieter and have gold pins. My TV-7D/U tube checker list shows the 6135, but not the CV-133. Any info out there on this?

From: Llgpt@aol.com
Date: Fri, 31 May 2002 19:37:31 EDT
Subject: Re: [R-390] Tube List For R-390 (non A)

<< CV-133 and the 6135 as subs for the 6C4.....

I have heard of the 6135's, but not the CV-133....of course, lots of British tubes will interchange with ours, but the tube books don't always show them.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] R390/Solid State
Date: Thu, 8 Aug 2002 16:31:53 -0700

The last thing you need to worry about wearing out in an R-390/R-390A are the tubes. How many have you had to replace so far? You'll wear out the knobs before you go though the thousands of hours available in standard tube life, and the R-390 series treat tubes very gently.

From: Llgpt@aol.com
Date: Thu, 8 Aug 2002 19:38:33 EDT
Subject: Re: [R-390] R390/Solid State

33 R-390A's and 1 R-390 over a period of 23 years, I probably have replaced less than 100 tubes, and that's counting old on the pallet 390's that were missing tubes.

From: "WF2U" <wf2u@starband.net>
Subject: RE: [R-390] R390/Solid State
Date: Thu, 8 Aug 2002 19:56:43 -0400

I bought my 2 R-390A's in completely original condition 18 years ago from a ham who was a retired AF officer. One is a 1955 Collins and the other is a Motorola. He used them for a number of years as he got them from a direct surplus sale. I've been using them almost daily since I got them and I never had to replace a tube. One of my R-392's has been in my possession since 1981 and the person who owned it before me had it for almost 15 years. It's been in

frequent use for at least 35 years so far and it's still on its original tubes. Another receiver I own, a 1955 vintage German Siemens E305 professional HF receiver I got in 1969 and is also frequently used still has the original Siemens tubes in it and as far as I can tell, it still performs great. I did an alignment procedure on it in 1981 to make sure everything is according to the specs...

73, Meir WF2U
Landrum, SC

Subject: RE: [R-390] R390/Solid State
Date: Thu, 8 Aug 2002 19:04:58 -0700

If anyone wants to replace the tubes more often they need only halve the value of the cathode resistors. Then it might 'age' them faster... How about those old horizontal sweep tube 'linear' amps from the late 60's and early 70's? Drive 'em hard, replace tubes daily. But think of the cheap Watts/dollar...

From: DCrespy@aol.com
Date: Mon, 12 Aug 2002 22:20:55 EDT
Subject: [R-390] Solid State "Tubes"

QEX, August 1997, pg 17, "Synthesizing Vacuum Tubes", by Parker Cope W2GOM. Solid state plug-ins for tubes (ie. "tubesters") using FETs. No mods to the radio. Write me if you can't find 7 or 9 pin "headers". Now, can we talk about something else?

Date: Sat, 17 Aug 2002 21:43:06 -0400
From: Scott Bauer <ody@radicus.net>
Subject: [R-390] Tube testers and other babblings

Most of you don't know me. I am new to the list. I recently bought a very nice 390-A from a gentleman here on the list and am completely hooked on the 390-A. I really love this radio. I then got on ebay and bought a ton of tubes. I then realized that I had no way of finding out the condition of the tubes that I am buying as "NOS & NIB". So I bid on and won a B&K Dyna Jet tube tester. Now, after it is too late, I have a few questions. Please remember that I know practically nothing about tube gear and tubes. So with all of the babble out of the way, This is what I would like to know. Is the B&K tester worthy and accurate ? If not, is there a certain tester that would serve me better? All of the tubes I have bought look new. Should I test them all? Does testing the tubes put wear on them? Most of the tubes I bought are JAN tubes. Some are GE. I also got some 5814A's made by National Gold Line. Is it OK to use the National tubes if there are some JAN's or GE's already in the radio or does it matter if one would mix and match? Lastly, some of the tubes that I bought are dated back to the 40's. Should I save these? It seems that they would be collectible. Thanks for any advice.

Date: Sat, 17 Aug 2002 19:07:42 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Tube testers and other babblings

>
> Is the B&K tester worthy and accurate ? I.....

A tube tester will not INSURE that a tube will work in a certain circuit, it will only tell if the tube is "working". The TV-7 military surplus tester is a good alternative,

yours should be Ok, too. The thing about military surplus equipment is that it could be given to a high school graduate with a couple of electronics courses under his belt and the appropriate manual and he could get the job done. So, now is the time to get some tube oriented manuals so you can "catch up" on the technique for testing tubes. Or,..... just ask more questions here, they will come up as you get more into this area of the hobby.

> All of the tubes I have bought look new. Should I test them all? Does
> testing the tubes put wear on them?

++++++

Yes, somewhat, not seriously though. You only need to test them when you get ready to use them. You might take a sample of the tubes just to determine if the whole load got dropped or shipped poorly. It'd be best to test tubes of the same type to keep from wearing the switches out on your tester, they don't make them anymore either.

>

> Most of the tubes I bought are JAN tubes. Some are GE. I also got some
> 5814A's made by National Gold Line.

++++++

Its considered rude to rub your good fortune in our faces like this,..... unless, of course, if you paid a rediculously high price for them, then,.....of course, it would NOT be rude of US to laugh our butts off.

Is it OK to use the National tubes if there are some JAN's or GE's

> already in the radio or does it matter if one would mix and match?

++++++

NO, definitely NOT, the National tubes will RUIN your radio, send them to me, I will dispose of them so that no other radio tech will make the same mistake.

> Lastly, some of the tubes that I bought are dated back to the 40's.

> Should I save these? It seems that they would be collectible.

++++++

NO, we don't "collectible" anything here especially tubes! Only audiophools do that.

Date: Sat, 17 Aug 2002 20:12:15 -0700

From: Dan Arney <hankarn@pacbell.net>

Subject: Re: [R-390] Tube testers and other babblings

The best tube tester you have is the R-390 itself. Plug n Play. One good set of tubes and a good set of spares should in most cases out live you with all things being equal.. A Dyna-Jet was normally a TV tester. It will be fine to check filaments and general condition.. A TV7/B or so is a good tester but kind of pricey for the occasional user. Mix and match. There are certain positions that the 5XXX series tubes should be used in. All of the tubes are getting harder to get but in most cases still available. There are some sellers out amongst the wherever that think they are Gold plated. If you plan on saving them for a retirement investment then my friend you are barking up the wrong tree. Maybe 3TF7's or sort. Current tube prices are a lot more stable than the stock market which could very likely bust its guts very soon.

Download a copy of the Y2K manual.

Once the nasty caps have been done and the radio tweaked, put your tubes in a box in the closet and then quit fooling with the radio and enjoy it for many years..

There are guys on the list that have had them running for 24/7 for many years. AS you have heard if it works don't fix it. Enjoy it. Hank

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Tube testers and other babblings
Date: Sat, 17 Aug 2002 23:44:36 -0400

You didn't mention the model -- like "your mileage" they vary, but quite a few are good. The last tube tester made of any (I think) was the B&K 747. Do you have the manual including calibration instructions? Tube charts? Might help the list assist you if you let us know on the model. May well be good enough, however, as I recall, B&K also made some cheap emissions testers (i.e. not mutual transconductance). If they're not already installed, you might want to chase down some "socket savers" -- primarily for the 7- and 9- pin sockets, unless it's one of those tester designs with multiple "quick-test" sockets of the same type. In that case, wear may have been spread out over a bunch of the 7- and -9 pin sockets.

> All of the tubes I have bought look new. Should I test them all? Does
> testing the tubes put wear on them?

As long as the tester is OK, not much harm in testing them all, but keeping them on the tester too long is not a good idea. You should test just prior to use, however, you might want to test them all so you will know how many good tubes you actually have on hand. A few things to keep in mind:

1. Make sure the shorts lamp(s) work and always do the shorts test first and make sure you watch and don't blink. Unless the tube is of the do-not-tap type (like expensive 1L6's, and maybe the 26Z5W's) tap on the tube to watch for flashes. If there is a short -- don't go any further with that tube, it may well damage the tester. A shorted replacement tube can also damage your receiver.
2. Triple-check that you have it set to the correct filament voltage. Also a good idea to test in order of filament voltage -- where applicable -- all the 6 volt, then 12, then whatever. In other words, don't test the 26Z5W's first and then go to the others, if you think you might forget to flip the fil. switch.
3. Set it up to check a number of tubes of the same type, as Joe suggested, to save wear and tear on the switches.
4. Keep the tube in long enough only to do the shorts test and then if OK, the quality test as long as it takes to get a stable, or good enough reading. Don't park the tube in there and let it sit or fall asleep with the quality test on.
5. If the tester hasn't been calibrated, test the tester with known good tubes to get a general idea. If it tells you a variety of good tubes are bad, it needs work or at least recalibration. If it tells you all of your tubes or all of a type are shorted, that's another problem.

> Most of the tubes I bought are JAN tubes. Some are GE. I also got some
> 5814A's made by National Gold Line. Is it OK to use the National tubes if
there are some JAN's or GE's already in the radio or does it matter if one would
mix and match?

No, however, some like to optimize by swapping tubes of the same number around between sockets -- tube tweaking. Also, it's best if the PTO tube is not

too hot/strong. If it reads middling, leave it in there.

- > Lastly, some of the tubes that I bought are dated back to the 40's.
- > Should I save these?

Yes -- you may experience an expanding interest in hollow state gear and some rather gothic looking black wrinkle radios may materialize on your bench. If not you can sell or trade them.

- > It seems that they would be collectible.

Yup, as I mentioned, BC-312's, BC-348's and some ol' Hallicrafters, etc. like to "collect" them. I can tell because, when I open them up, that's what's inside. ;-)

Those are not particularly collectible in the real sense. Older tubes from the 20's -- silvery 4-pin globe shaped ones may be, even if not working. Not necessarily all that expensive, though.

- >
- > Thanks for any advice.

Y' welcome

Date: Sat, 17 Aug 2002 20:57:53 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Tube testers and other babblings

Leave them in the tester long enough to let the tube get up to operating temperature, I've had several that tested good cold go bad when warmed up.

Nah, handling is tough on boxes, etc. I'd test a good selection of spares for quick emergency changes or hot swaps but you'd have to test them just before using them anyway to see if they went gassy.

The military testers have jacks for plugging a headset in parallel with the shorts lamp to listen for loose elements or microphonic tubes. Good idea!

- > 2. Triple-check that you have it set to the correct filament voltage. Also
- > a good idea to test in order of filament voltage -- where applicable -- all
- > the 6 volt, then 12, then whatever. In other words, don't test the 26Z5W's
- > first and then go to the others, if you think you might forget to flip the
- > fil. switch.

+++++

ARGH! Good one, I did that!

- > 5. If the tester hasn't been calibrated, test the tester with known good
- > tubes to get a general idea. If it tells you a variety of good tubes are
- > bad, it needs work or at least recalibration. If it tells you all of your
- > tubes or all of a type are shorted, that's another problem.

+++++

Another good point about the military stuff, the manual will have a good troubleshooting section, also lots of people have worked on them.

- >
- > Those are not particularly collectible in the real sense. Older tubes from
- > the 20's -- silvery 4-pin globe shaped ones may be, even if not working.

> Not necessarily all that expensive, though.

+++++++

Oh, yeah? How much you give me for the ones I have?

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] Tube testers and other babblings
Date: Sun, 18 Aug 2002 00:03:37 -0400

> The best tube tester you have is the R-390 itself. Plug n Play. <snipped>

For quality, I agree. For shorts? Listen for the snap, crackle & pop? Watch and sniff for the smoke? A lot of NOS tubes, let alone pulls, have developed shorts along the way as they've been resold, re-packed and shipped over and over again. Fortunately not too many, maybe, but enough that I wouldn't want to risk collateral damage using the receiver as the first tester. When I first get a rig in, I check all the tubes. Even if it was supposed to be working before the trip. Well, I have to admit, I skipped that step on a BC-314 a few weeks ago. Guess what?

From: "scott" <polaralined@earthlink.net>
Subject: Re: [R-390] Tube testers and other babblings
Date: Sun, 18 Aug 2002 08:54:51 -0400

Your B&K tester is a good middle quality mutual conductance tester that should serve you well. 99 out of 100 of your NOS tubes will be OK. Test them and if they all test strong then don't worry about the testers calibration. Most testers I have come across, the calibration has been pretty good. You don't have to go crazy stocking up on tubes. Everyone seems to think that these darn things burn out like mad when if you put a fresh set in they would last for many many years running 24/7. I have seen original tubes in 60 and 70 year old radios that test just fine. And yes you can mix and match brands, and yes a tube from the 1940's or even 1920's can be just fine.

From: "Bob Camp" <ham@cq.nu>
Subject: Re: [R-390] Tube testers and other babblings
Date: Sun, 18 Aug 2002 09:19:54 -0400

Hi About the only thing I can add to what's been said so far: Often I get tubes in batches from very odd sources. Some better than others. This makes for some fun when testing them since a whole batch may be bad. Each time this happens I really don't know if it's the tester or the tubes. Here's a solution: Take a couple of tubes that you have a lot of. Three is a nice number. Run them in the radio for a few days to burn them in. Then measure them in the tube tester. Record the readings and store them away. Some time in the next few years you will pull out the tester, test a few tubes and then ask the question - are all of these bad or is it the tester? Then you pull out the reference tubes and you have an answer. Of course this only works on a tester like a TV-7 that has a meter scale with numbers on it rather than a three zone good / who knows / bad scale.

Date: Sun, 18 Aug 2002 09:36:31 -0400
From: JAMES T BRANNIGAN <jbrannig@optonline.net>
Subject: Re: [R-390] Tube testers and other babblings

You make a good point. I have been a fanatic about collecting spare tubes, so I can have supply in depth. But as I think about it, I have replaced very few "bad" tubes. Even transmitting tubes will last a very long time if you don't abuse them.

Date: Sun, 25 Aug 2002 15:24:35 -0400
From: Scott Bauer <ody@radicus.net>
Subject: [R-390] Tubes

I wonder if there is a book that will teach me enough about tubes to understand them a little better. I have recently been buying tubes on line and some of the descriptions are too much for me to understand. Such as " getters" and stuff like that. There are several different styles of 5814a's. One auction has 3 different types in it. I'm sure there is something in the on line manual but... I am using a dial up modem and can't keep the phone tied up for a long period of time. I also want the book as a reference to use as I have this box of almost 150 tubes and want to throw out the TV tubes if there are any.

From: Helmut Usbeck <vze2gmp4@verizon.net>
Date: Sun, 25 Aug 2002 16:03:11 -0400
Subject: Re: [R-390] Tubes

That's an easy question, but could be hard to answer. Old electronic text books are good. Looking around my book shelf over here I'd say an easy start would be something like the RCA receiving tube manual, any of the various editions , reprints are available. The first 60 or so pages are on tube basics. It is also presumed that you've got some electron theory under your belt. It does make for a better understanding. After that the skies the limit on book learning. Radiotron Handbook is excellent. I'd stay away from from 90% of web sources. Most of what I read makes me blanch. That's one curse of the web...too easy to communicate knowledge, including garbage, which often comes out the other end as gospel. One thing I do know is you can never learn enough about electronics and it can be enjoyable. Regards, Helm.

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Sun, 25 Aug 2002 16:56:20 -0600 (CST)
Subject: Re: [R-390] Tubes

I wouldn't. There are vintage TV collectors out there too. Ebay them and make yourself a couple of bucks.

Date: Sun, 25 Aug 2002 21:04:30 -0400
From: "John L." <larry.asp@sympatico.ca>
Subject: Re: [R-390] Tubes

Get an old copy of an ARRL "Radio Amateurs Handbook" from the 50s. That's one of the best resources there is / was - then and now. They are easy to find too. Be careful though - you might wind up starting a collection.

From: Helmut Usbeck <vze2gmp4@verizon.net>
Date: Sun, 25 Aug 2002 22:03:09 -0400
Subject: Re: [R-390] Tubes

Silly me...I only have 7 copies of different years sitting in my library. Yes excellent source regards, Helm.

Date: Fri, 6 Sep 2002 11:44:30 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: [R-390] Done to death, delete at will: 6DC6 surrogates

I picked the word "surrogate" with care. These are not substitutes. They are enough to keep you on the air while you look for a 6DC6.

For reference: 6DC6 (5500, 12.5V=3D50umho)

RC-29 is inconsistent about cutoff ratings, some are at various currents, others at various transconductances. A couple of these are from memory. Others don't have any cutoff data. Except for the 6AS6, I didn't check max ratings. Remember, it's temporary and who cares if you burn it up. A lot of these are TV tubes, so if you have a box of pulls, odds are you have a few. Some of these didn't exist in 1952; I bet they'd have picked the 6GM6 or 6DE6 for example. Out of the list below, I tried a very weak 6BZ6, a 6EW6, and a 6HZ6. All worked, but of course not as well as the real thing. I didn't check sensitivity, IP3, cross-modulation, or what-have-you. Don't expect the same carrier readings in any case, because the AGC is different. I worried about oscillation with the 6EW6, but I didn't see any.

7CM pinout (same as 6DC6):

6AS6 (way over max ratings)

6BH6 (low gm, too sharp)

6BJ6 (low gm, too remote)

6BZ6 (8000, 19V=3D50umho. Runner-up to 6DC6 in Cost Reduction Report.)

6CB6 (8000, 6.5V=3D20uA)

6CF6 same as 6CB6

6DE6 (8000, 9V=3D20uA)

6DK6 (9800, 6.5V=3D20uA. Used in large numbers in Tek 500-series scopes.)

8136 same as 6DK6

6EW6 (14000, 3.5V=3D20uA)

6GM6 (13000, 15V=3D60umho)

6JH6 (8000, 19V=3D50umho)

6JK6 (15000)

7EN pinout (same except internal shield connected to cathode instead of G3):

6DT6

6GX6

6GY6

6HZ6

These tubes are designed so G3 can be used as a second control grid. All have lower gm than the 6DC6. I didn't write down their cutoffs. I think they're all sharp. Some RF decks have pins 2 and 7 wired together. These decks can also use a slew of tubes with the 7BK pinout, which includes 6AH6, 6AG5, 6BA6, and 6BC5, and another pinout I forget which, which is like 7BK but with K and G3 swapped.

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>

Date: Mon, 30 Sep 2002 16:25:59 -0500

Subject: [R-390] Gassy Tube?

I have two of the same kind of tubes (6CW5) and I think one of them is gassy. I can put them in the tester and observe the cathode-to-control-grid voltages. With the bias set to about 2 volts, when I depress the "test" button (applying HV to the plate), the grid voltage goes up to about 4 volts for one tube, but the other one

goes to about 7 volts. Would gas be responsible for this difference between the two? If so, which one would be the gassy one? I *think* it would be the one with the lower voltage, but I'm not sure. Is this a valid thing to try to check? I know that "in circuit" is the best test of a tube, but when the problem starts, I'm not sure what's causing what. Several voltage points begin to go haywire and I'm not able to isolate it. I do know that if I swap the tubes, the phenomenon seems to "swap positions" so I'm pretty sure I've isolated it to a bad tube, but I'm just curious which one. I'm going to order two NOS tubes, but I would like to know if the above tests are conclusive of anything.

Date: Tue, 01 Oct 2002 00:46:13 -0400
From: Scott Bauer <ody@radicus.net>
Subject: [R-390] Tube box source?

Hi, I have a bunch of tubes that are loose and wonder if anybody knows of a source to get those empty, plain white boxes. I need the size. that will fit 5814A, 6AK6 etc.

From: "John KA1XC" <tetrode@worldnet.att.net>
Subject: Re: [R-390] Tube box source?
Date: Tue, 1 Oct 2002 08:39:32 -0400

Antique Electronics Supply aka AES has these. URL is www.tubesandmore.com

Date: Tue, 22 Apr 2003 21:01:33 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Re: IERC tube shields and tube temps...a field expedient...

Enormous chunk of wasted bandwidth follows 1200 baud modem users proceed at your own risk :) This gets a little complex. On the thermometer question it depends on what you want to measure. An IR thermometer will measure the temperature of the inside of the tube IF the glass used is transparent at IR AND you know the emissivity of the thing you are pointing at. Since the thermometer responds to light you have to know how much gets through the glass and "what color" the thing you are looking at is. You can check both things out, you just have to break a couple of tubes to do it. If you want to measure the pin to glass seal temperature then you need a nice little thermocouple. Now for the complex part. Tubes wear out for a bunch of reasons:

- 1) Filaments go open circuit
- 2) Gas
- 3) Filaments loose emission
- 4) A grid goes open or short.

In receiving tubes (rather than rectifiers or power amp tubes) filament emission is not usually a big deal. The tube will work pretty well even with a well worn filament. Gas can come from the stuff inside the tube, but in modern (post WWII) tubes usually if it's gassy it's because it leaked. Grid open and shorts usually are from shock and vibration. Filament open's are a function of how often the tube is turned on, and exactly how power is applied. A fast power on *may* actually be better for some tubes than a slow power on. Still with us High temperature affects outgassing from stuff in the tube, and leaks in the glass to metal seal. Unless it is combined with shock and vibration it should not affect grid problems. This assumes the grid is not glowing orange.... Filament opens and cathode emission don't seem to correlate well with a modest change in the tube

temperature. The filament is running in a fashion that it self regulates it's temperature. Once it is at temperature it will run there for a good long time. Again provided that there is little or no shock and vibration. All the yack above about filaments assumes that you run them to the same voltage each time *AND* that it is roughly what it should be. The filament has a bit of a memory affect so varying the filament voltage all over the place does some weird things.

Finally the tube shields (at last ...) Tube shields will affect the temperature of the upper glass bulb and of the plate. Indirectly the grids may be cooled a little. The temperature at the glass to metal seals may not change much at all with black versus shiny shields. A full contact shield might reduce the temperature a bit, but it could also raise it a little. Air flow would have an affect on the outcome here.

But what about the data you ask Yup the data is out there and it's correct. The tube shields do have an affect on the life of the tubes in an R-390. Good Navy data and no reason to doubt it. A couple of questions:

- 1) Does you radio see as much shock and vibration as the shipboard radios the Navy ran the tests on?
- 2) Did they toss the tubes when they failed on a tube tester or failed in the radio?
- 3) Do the tubes you use fail at the rate that the Navy tubes did?
- 4) Did the radios have tube or solid state rectifiers?

The last question is the most interesting. Even in 24/7 type service I don't see anything close to the Navy failure numbers. I also do not run tube rectifiers so maybe all their failures were rectifier tubes. What's more to the point, back in the 1980's your government and mine went out and bought tubes for "essential equipment" to keep it running for something like another 20 years. The good old R-390(both A and not A) *must* have been on the list. The mountains of tubes we see on eBay are a result of them surplussing these tubes. You can find all the tubes except two - the ballast tube and the rectifiers. I can understand the ballast tube, it's a different category and probably didn't get covered in the order to buy the vacuum tubes. The rectifier may have been left off since the solid state conversion was an approved modification. If that's the case then they didn't go through anything close to the number of tubes they thought they would. I suspect that most of us on the list have more than ten sets of spares. Heck I'm probably not that odd in having a couple hundred of some of them. Hall of fame land may be in the multiple hundred sets range. We're all out grabbing these tubes and they are still dirt cheap. There have to be an ocean of them out there. We don't run as many radios as the Navy did, but then they didn't plan on a 500 year supply of tubes either.

Bottom line - fancy tube shields are neat and they do look slick. For a truly presentation grade radio they are the only way to go. If you put a couple hundred bucks into the front panel then they are cheap by comparison. For a use it every day and I don't care what it looks like radio, save your money

Take care, Bob Camp

Date: Tue, 22 Apr 2003 22:20:23 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Re: IERC tube shields and tube temps...a field expedient...

Even with an indirectly heated cathode the contact between the filament and the cathode is very good. The insulation (vacuum) around it is also really good. The result is that the cathode gets to the filament temperature and isn't affected very much by what's around it. The self regulation of the filament still keeps things going at a constant temperature. Given that then tube shields aren't going to have much of an affect. The getter (hopefully) stays nice and cold through the process. By that I mean that you don't want it to melt or worse yet vaporize. Generally you pick getter material so that this is not going to happen in any reasonable combination of conditions. As long as you stay below melting temperature it's hard to say exactly what the getter will do as a function of temperature. It's affinity for crud goes up as temperature increases, but so does the tendency of the crud to turn back into a gas. Is it better hotter or colder ? - depends on the material and what you are trying to "get". You hope the guy who made the tube knew his stuff. If he did have a choice then I'd guess he optimized for a bare tube with no shield. Take Care! Bob Camp

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Wed, 23 Apr 2003 15:25:53 -0400
Subject: [R-390] IERC Tube Shields et. al.

Don't forget other common failure modes: heater to cathode short, grid emission. Grid emission results from electron-emitting coating migrating from cathode to grid. In applications with appreciable grid circuit resistance this emission will cause grid to go positive and upset bias point. In our beloved R-390 series one IF tube having grid emission can pull AGC line, decreasing or defeating gain control action and causing all controlled tubes to draw excess plate current.

Date: Thu, 24 Apr 2003 10:56:50 -0400
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: [R-390] Tube Failures

The heater to cathode short is a good one to know about. I had a humongous amount of hum when I turned the limiter on, but not when it was off. I eventually found the problem to be the tube. It tested OK (previous posting about testers with forked tongues is true!) but when I replaced it the problem vanished. With the high impedance circuit, even miniscule AC leakage into the cathodes was enough.

Date: Thu, 24 Apr 2003 11:18:05 -0400
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] Tube Failures

Surprised it didn't show a short on your tester, Gord. But this is an excellent example of why a tube tester is a great tool for getting you into the ballpark, but also how/why swapping tubes is still the only way to be certain. Even a good tube tester can't give you the critical results that the hands-on approach gives. Someone on the Collins list was just mentioning how a complete re-tubing of their KWM-2 was not the great idea they thought it was. Apparently two new Phillips 6AZ8s were too hot for the rig and caused oscillations. His revised view is to replace one tube at a time, remember where each tube came from, and have some known-good replacements to use as substitutes. Replacing the Phillips with RCAs cured the problem. Good stuff.... de Todd/'Boomer'
KA1KAQ

From: "JM/CO" <jmerritt2@capecod.net>
Subject: Re: [R-390] Tube Failures
Date: Thu, 24 Apr 2003 17:03:42 -0400

Heater to cathode leakage is an insidious problem which the vast majority of tube testers out there are not capable of detecting. Even the venerable TV-7 and TV-10 series cannot detect this problem. This is one very good reason why serious tube people will own (and be prepared to pay for) the Hickok 539 series. Chuck N1LNH

From: "Dave Faria" <Dave_Faria@hotmail.com>
Date: Thu, 5 Jun 2003 11:08:58 -0700
Subject: [R-390] Low Noise Tubes

How would you select tubes for low noise and get performance???

Date: Thu, 05 Jun 2003 12:09:56 -0400
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] Low Noise Tubes

The first RF tube sets the noise floor for the entire radio. If you pull the RF tube you should hear a decrease in noise. If not there is work to do. Start with an alignment, check voltages and replace components as necessary. Jim

Date: Fri, 13 Jun 2003 11:39:16 -0500
Subject: [R-390] fixin' gassy tubes
From: blw <ba.williams@charter.net>

Thought this tip from Nolan would be of use to someone, somewhere, some time.....found it while searching for something else. Barry

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I had a few more than a half dozen inquiries wanting more info about my mentioning "fixing" gassy tubes, so here's an explanation of the method I use. I've been doing this for ages and have had a pretty good rate of success. Sometimes a tube will break while doing this. Your mileage may vary... It's a very simple procedure involving the use of a glove, a Zippo cigarette lighter, and a tube tester. I suppose that eye protection would be a good idea. Also a fire extinguisher if your're a little clumsy. <grin> I wouldn't advise doing this to any tube containing radioactive isotopes. You wouldn't want have one break and possibly contaminate you or the shack. I make it a point to test all applicable "amplifier" tubes for gas anytime I plug a tube into the tube tester. I've had some odd ball problems with gear in the past that ended up being caused by gassy tubes. At any rate, lets say that I just pulled one of the 5814A's out of the R390A and it tested as gassy. The first step is to leave it in the tester for about ten minutes at it's normal filament voltage to get the envelope good and hot. Think of it as preheating. Next, while wearing a suitable glove, I pull the tube out of the tester and using the Zippo, play a flame over and around the getter of the tube, evenly for a few moments. I've never measured the amount of time that it takes, it's just something that you'll develop a feel for after you've done it a number of times. The Zippo coats the tube with a layer of soot while doing this. This is good. It helps prevent hot spots and helps to decrease the odds of stress cracking the tube. I have had a lot more tubes break heating them with a butane lighter than with a Zippo. A candle would probably work OK too. If you think you heated it enough, wipe it off and plug it back into the tube tester and test it for gas again. Maybe it's fixed, maybe it ain't and needs another treatment, and

maybe the treatments just flat out ain't going to work on that particular tube. If you did heat it enough originally, you can often see a change in the appearance of the getter. But not always. Don't you just love something that's cut and dry? <grin> If it doesn't test gassy anymore, leave it in the tester for about a half hour and test it again to make sure. Usually gassy tubes show up a lot easier after they've run for a while. When doing octal tubes, sometimes the getter is in the bottom of the tube below the edge of the tube base. This is one reason that I don't like RCA 6K6GT's and prefer Sylvania or GE 6K6GT's. :-) The Zippo method isn't practical for tubes built like this. ;-(If you put your eye out, don't come crawling to me whining that I owe you an eye or something... my disclaimer below applies, nolan

*** Disclaimer: Opinions are my own and in no way reflect those ANYONE else!

This disclaimer does not cover misuse, accident, lightning, flood, tornado, tsunami, volcanic eruption, earthquake, hurricanes and other Acts of God, female misinterpretation, neglect, damage from improper or incorrect line voltage, improper or unauthorized use, broken antenna or marred cabinet, missing or altered serial numbers, electromagnetic radiation from nuclear blasts, sonic boom vibrations, customer adjustments that are not covered in this list, and incidents owing to an airplane crash, ship sinking or taking on of water, motor vehicle crashing, dropping the item, falling rocks, leaky roof, broken glass, mud slides, forest fire, or projectile (which can include, but not be limited to, arrows, bullets, paintballs, shot, BB's, shrapnel, lasers, napalm, torpedoes, or emissions of X-rays, Alpha, Beta and Gamma rays, knives, stones, sharp sticks, etc.) And lastly, Not warranted for any particular merchantability or use.

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From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Mon, 30 Jun 2003 08:20:30 -0700
Subject: Re: [R-390] Vacuum tube question

> When looking at the spec's for a tube what is more important as an indicator of
> it's output, plate dissipation, or grid dissipation?

Of its output capability? Plate dissipation. Grid dissipation only comes into play if you are running it very heavily Class C and driving the snot out of it. For most tubes, you can raise the power output by increasing the plate voltage (and current). For a tetrodes or pentodes, you can increase power output by raising screen voltage, even at lower plate voltages. However, screen grid dissipation comes into play and one must be careful of that especially in various linear modes. For pentodes, suppressor grid dissipation can become important if you are running positive voltages on it. Most circuits call for the suppressor grid being connected to the cathode, so then it doesn't become an issue.

Date: Fri, 18 Jul 2003 05:14:59 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Ballast Tube question.

This gentleman that just posted the following, is one fine gentleman. I acquired several 3TF7s, NOS, still in the military boxes. The same with the 26Z5Ws. He's good people, is a delight to deal with, and I recommend him HIGHLY. He also puts together and sells kits of tube spares for R-390As. As you can see, he's also VERY reasonable with his stated costs. I've never gotten a single bad tube from him:

>If anyone is interested, I have a limited supply of NOS 3TF7 available for \$25/ea >plus postage. Also have NOS 26Z5W for \$16/ea plus postage. Request a limit of >one 3TF7 and two 26Z5W per person so we can spread these around a bit.

>Other NOS tubes I have available:

6CB6A	2.00	JAN GE
6CB6A/6676	1.00	TRIGON (UK)
6H6	2.00	JAN GE (metal)
6K7	2.00	JAN GE (metal)
6U8A	4.00	JAN PHILIPS/ECG
6360	5.00	JAN AMPEREX

>Please contact me directly if you are interested. Thanks.

>Bryan Stephens KG4UPR

>bryanste@yahoo.com

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>

Date: Fri, 15 Aug 2003 11:20:57 -0500

Subject: [R-390] OT: Low-voltage tubes

I recently had to have a Zenith TransOceanic. This is the H500 model so it is still tube stuff (except for the selenium rectifier). My question is do these low-voltage tubes glow very much? These are types 1U4, 1U5, 1L6, and 3V4. I put them in my tester and did not notice any glow but without the glow, some still tested okay. Is this just a characteristic of these tube types? I realize this radio was meant to run off batteries so the energy consumed in lighting the tubes had to be minimal, but I was wondering if I should be able to see anything when they are operational?

Subject: RE: [R-390] OT: Low-voltage tubes

Date: Fri, 15 Aug 2003 10:20:57 -0700

From: "David Wise" <David_Wise@Phoenix.com>

Not that you would notice. The filament runs at the same temperature as other oxide-coated emitters, but it's too small to excite many of your cones. If you had a tele-microscope you could see it. By the way, treat the 1L6 with extra care, particularly if it has a strong gm reading. They're rare.

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>

Subject: RE: [R-390] OT: Low-voltage tubes

Date: Fri, 15 Aug 2003 12:57:13 -0500

I think the 1L6 may have tested good (I don't remember for sure). I'm pretty sure one of the 1U4s tested bad. We have a big hamfest this weekend (Huntsville HamFest). I'm going to look for tubes for it there. We usually have one or two guys there with a large tube collection.

From: Llgpt@aol.com

Date: Fri, 15 Aug 2003 12:38:58 EDT

Subject: Re: [R-390] OT: Low-voltage tubes

They are very dim. This is normal.

Date: Fri, 15 Aug 2003 15:40:04 -0400

From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] OT: Low-voltage tubes

Fun little radios, a lot of the guys (any girls?) on the list have them. Incredibly good sound and sensitivity when they're working right. Tubes don't glow like most others due to the low voltage. You'll enjoy it a lot. Try to find some spare 1L6's, though. Although not really rare, most of the NOS JAN surplus was bought up by a few dealers who now charge 'RARE' prices, mainly due to the interest in TOs over the last decade (IMHO). Like anything else, it depends how good you are at digging around and how impatient you are. Tip: Look for junkers at hamfests, flea markets, yard sales. You can get a complete unit pretty cheap, usually with the 1L6 included. I've found one at a yard sale, one at an antique shop, and a chassis with all tubes (and an R-390 S-meter) in a box of 'stuff'. Got my H-500 back in 1980 (before they became 'sought') for \$10, love it!

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] OT: Low-voltage tubes
Date: Fri, 15 Aug 2003 14:51:41 -0500

At first I thought this one was going to be a real dog but after a closer examination, I think it will clean up very nicely. I may have to recover it as the original fabric is very dirty and doesn't want to come very clean. Also, the adhesive is wanting to let go in places so it may just have to be done. Otherwise, it seems in good shape for its age. It should be a fun little diversion.

Date: Fri, 15 Aug 2003 16:08:07 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] OT: Low-voltage tubes

Beware:

- 1) The 1L6 is worth forty bucks if it is working.
- 2) IF you have an open filament in one tube, AND you run the radio on the power line, AND you then plug in a good tube, ALL The tube filaments will BLOW OUT. This is because the filament filter cap has charged up to a high voltage and will apply excessive voltage to the whole string when you plug in the last non-open tube.

> I put them in my tester and did not notice any glow.....

The total filament power is extremely low. Do your testing in the dark and use a magnifying glass to see the glow.

From: "Scott, Barry (Clyde B)" <cbscott@ingr.com>
Subject: RE: [R-390] OT: Low-voltage tubes
Date: Fri, 15 Aug 2003 15:13:24 -0500

Thanks for the advice. I probably would have done just what you outlined and blown the entire chain. I haven't examined the schematic closely enough yet to find the little Gotcha's. Hmmm, if the 1L6 is working, perhaps I didn't do too badly with this purchase. I'm eager to get home and test it now. I need to find out if I have other blown tubes that I need to look for tomorrow as well.

From: "Merle" <lal@cyberwc.net>

Date: Fri, 15 Aug 2003 16:30:54 -0400
Subject: [R-390] 1L6

FWI I have not had many problems with the famous 1L6 tube, I've restored several Trans-Oceanics over the years and found if the 1L6 tested okay but would not come up and work for you. I would change the selenium rectifier to a 1N4007 diode and the slight increase in voltage would bring the set back to life! Also there is an article (not for the pure ones) where you can construct a Solid State replacement for the 1L6 that will plug right in in place of the 1L6 makes sense to me !

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] OT: Low-voltage tubes
Date: Fri, 15 Aug 2003 16:34:49 -0400

Like '390's, the tube TO's are very hardy. Zenith promoted the fact that they were treated with moisture proofing. Many were purchased for use on boats or at the beach - or in a foxhole, maybe. I'm always amazed at the quality of the speakers. They've really held up. The combination of those speakers, which are suspension mounted or isolated -- and the very well made wooden cabinets makes for very listenable sound quality. I've been tempted to use one in "phono" mode as a sound system for a '390 or '392. Anyway, the "stag" covering can usually be restored with some glue and .. black shoepolish. Just glue down the areas which have become loose. Any frayed or missing small areas, like the corners can be detailed with some black paint or black "liquid rubber". Work it in and duplicate the pattern as the stuff sets. Clean the surface with a brush. Use only the mildest of cleaners, if any.

Polish as you would a good pair of shoes -- Kiwi paste applied with a soft applicator brush to work it into the pits in the stag. Then use a good quality shoe brush -- better if it has been broken in -- with soft natural bristles, not the stiff plastic type. If too stiff, the bristles may damage the stag finish. Brush in several directions to clear the excess out of the pits. Then buff with a soft buffing cloth. This increases the gloss on the raised part and brings back the look of the stag. As with shoe-polishing, let it set, come back and buff again. The shoepolish aroma will dissipate, and no, it won't come off on your hands. The shoepolish treatment restores the black and also helps preserve the cover. It is suggested in at least one of the owner's manuals. If it's bad enough, someone sells a close match to the original stag covering, but that's usually not necessary. There are some TO lists which are pretty good. One is "Transoceanic-Fanatic" on yahoo.

Subject: RE: [R-390] 1L6
Date: Fri, 15 Aug 2003 13:38:38 -0700
From: "David Wise" <David_Wise@Phoenix.com>

>I would change the selenium rectifier to a 1N4007 diode.....

Selenium rectifiers are known for increasing voltage drop as they age. If you wire in a 9V zener diode across the filament string you can avoid the "replace bad tube =3D total burnout" scenario. There's a really easy spot to do it; I can't remember the details, but it involves the Line/Battery switch. You'll figure it out if you look under the chassis and study the schematic. The SS 1L6 replacement cannot be aligned on the higher-frequency bands; too much Cin on the oscillator.

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] 1L6
Date: Fri, 15 Aug 2003 16:47:22 -0400

You can also use the loctal version -- 1LA6, which are still relatively cheap. You need to fashion an adaptor with leads as short as possible. A 1R5 will also work, but not at the higher frequencies. Good enough for basic testing or using the radio primarily on the BC band. The 50A1 ballast tube used in the later tube T-O's has also become pricey, like the 1L6 and the 3TF7.

Date: Wed, 20 Aug 2003 16:37:31 -0700 (PDT)
From: David Medley <davidmed82@yahoo.com>
Subject: [R-390] Another Conundrum

In the R-390 regulated power supply is a single 6BH6 tube. This is a pentode used as a DC amplifier. It is becoming expensive and difficult to find sometimes. The other day I found some on ebay NOS Amperex brand. The price was great. They duly arrived and the boxes were in great shape. Looked like new. So I plugged one in to the R-390 I was working on and to my surprise the 180v soared to 300v!! So I assumed that this was just a bad tube so I plugged another one in. Same result. So I looked carefully at the tube. Stamped 6BH6 like on the box but the tube was obviously not a 6BH6. Looked like some kind of dual triode. No resemblance whatsoever to the real thing. Made in Japan. So guys if you need a 6BH6 for your R-390 look carefully at the tube before you plug it in especially if it is Amperex made in Japan. 300v is very bad for your radio's health. Dave

From: ToddRoberts2001@aol.com
Date: Wed, 20 Aug 2003 19:47:54 EDT
Subject: Fwd: [R-390] Another Conundrum

Hi Dave, thanks for the warning about the 6BH6 tubes. Antique Electronic Supply (www.tubesandmore.com) currently have the 6BH6 tubes on sale for \$2.30 each. It pays to check their sales flyers from time to time as they may have many of the tube types we are looking for on sale.

From: "Schluensen" <schluensen@freenet.de>
Date: Fri, 6 Feb 2004 00:43:36 +0100
Subject: [R-390] Tube Set 390A

My 67 EAC needs a complete tube replacement. I will look here in Germany for the tubes - but if I can't get some tubes (3TF7) - did someone know a good shop in the US for our 390A tubes?

From: ToddRoberts2001@aol.com
Date: Thu, 5 Feb 2004 19:52:32 EST
Subject: Re: [R-390] Tube Set 390A

Hi Frank, as far as I know, Hank KN6DI has a good supply of the 3TF7 Ballast Tubes. Most of the other tubes used are fairly common 7 and 9 pin types except for the two 26Z5W rectifier tubes. If needed the 26Z5W's can be replaced with silicon diodes. Also someone on the e-place is currently selling a complete set of tubes for the R-390A minus the 3TF7. Antique Electronic Supply is a good source for tubes. 73 Todd Roberts WD4NKG.

Date: Thu, 05 Feb 2004 20:53:03 -0500
From: Christian Fandt <cfandt@netsync.net>
Subject: Re: [R-390] Tube Set 390A

A *complete* tube replacement? Did something happen to the existing tubes?? Breakage, theft or just to replace old with new? If just replacing all with new, you may be in for a complete alignment job. Prepare yourself for an adventure if you are not experienced :-). But why replace all with new? Unless this unit has been run hard and absolutely to death, there will be many existing tubes who may still perform very well in their present positions. Or maybe the unit was run accidentally at 240 volt mains while set at 115 volts for a short time which caused some tubes to fail? Been there, done that myself :(

The 3TF7 could be replaced, as an emergency measure at least, with a 12BH7. It just controls the filament current to that required by the PTO tube filaments. Or even replace the PTO tubes with 12BA6's and short circuit the 3TF7 socket by plugging a thin copper wire into the two appropriate socket pins. Those fixes are very easy to reverse if you prefer to have a 3TF7 -whenever you find one.

From: "James Miller" <JMILLER1706@cfl.rr.com>
Subject: Re: [R-390] Tube Set 390A
Date: Thu, 5 Feb 2004 21:19:30 -0500

Here is the Antique Electronic Supply Web site:
<http://www.tubesandmore.com/>
Also you often see complete 390a tube sets for sale on eBay.

Date: Sat, 14 Feb 2004 11:56:17 +0100
From: jrg.dk3ng@t-online.de
Subject: [R-390] Tubes for R-390

Don't know K5SVC. But you can get suitable tubes from Wilson Valves in England. He sells new ones and N.O.S. US tubes.

From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] Tubes for R-390
Date: Sat, 14 Feb 2004 09:22:12 -0500

Yes, he is a very good source for tubes. I've ordered from him several times, always get top quality tubes, and I've met him a few times at Dayton.

From: "Scott, Barry (Clyde B)" <cbsscott@ingr.com>
Date: Tue, 27 Apr 2004 13:29:43 -0500
Subject: [R-390] Need 6AS7G tube

Anyone know where I can get one 6AS7G? I bought two TEK561A 'scopes and both of the 6AS7G's were bad. I found one NOS at the local parts store, but need one more. These scopes will be used when I work on R390A's so there's the obligatory reference.

From: "K3PID" <k3pid@comcast.net>
Date: Tue, 27 Apr 2004 14:48:29 -0500
Subject: [R-390] [R-390]re Need 6AS7G Tube

There are 4 variations of the 6AS7G available from www.tubesandmore.com

with prices ranging between \$4 and \$11

From: "Chuck Ochs" <jmerritt2@capecod.net>
Subject: Re: [R-390] Need 6AS7G tube
Date: Tue, 27 Apr 2004 18:09:13 -0400

Use the 6080 instead. A common tube.

Date: Thu, 4 Nov 2004 08:40:19 -0800
From: "ELDIM" <eldim@att.net>
Subject: Re: [R-390] J104

Okay, talking on the subject of the R-390. Can anyone tell me if the two wire tube pullers on the rear accessory rack have Part Numbers, Stock Numbers, and oif they are listed in the R-390 Manual which I donot have a copy of? I saw a picture in one of the Operators TM. What exactly is the UG-421/U? I found it listed in the FEDLOG ,but did not find the UG-969/U listed. I thought that these were RF Connectors. Is that the funny screw-on POWER CONNECTOR? If so, then I stand corrected.

Date: Thu, 4 Nov 2004 12:21:32 -0500
From: "Patrick" <brookbank@triad.rr.com>
Subject: Re: [R-390] J104 and tube pullers

On the subject of tube pullers, talk to your local chiropractic and/or orthopedic doctor, the use them to place fingers in traction. They work great on tubes also.

Date: Thu, 4 Nov 2004 19:42:47 GMT
From: "dps4@juno.com" <dps4@juno.com>
Subject: Re: [R-390] J104

I bought the tube pullers from Fair Radio a couple of years ago. They called them military tube pullers, small and large. As I remember, they were reasonable, \$2.00 each.

Date: Thu, 18 Nov 2004 11:40:16 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] Collins Tube Info revision online

Well, months ago I had promised to rescan the tube info from the 1962 Collins commercial flier. FINALLLY I did.

<http://www.fernblatt.net/Collins/collinscat.pdf>

Hopefully I be neither beaten nor sued by the CCA. More to come.

Date: Thu, 18 Nov 2004 18:02:00 -0800
From: Leigh Sedgwick <bipi@comcast.net>
Subject: Re: [R-390] Collins Tube Info revision online

Thanks..the info on PTO's is great data too! Very much appreciated.

Date: Fri, 31 Dec 2004 14:41:18 -0500
From: <fraserb@quasc.com>
Subject: [R-390] Tube life/replacement?

Since I'm in the midst of my annual winter AM BCB Dxing season, I had a thought about the life of the tubes in my R-390A. How often were tubes replaced when in service with the various govt agencies? Were different tubes replaced on certain schedules? Were tubes regularly tested or just pulled and replaced? I use my R-390A for probably somewhat less than 200 hours a year. How long are the tubes supposed to last? How do you know when tubes are less than the minimum level required? Are there well known symptoms that indicate a certain weak tube? Lots of questions to start the new year!

Date: Fri, 31 Dec 2004 17:30:54 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Tube life/replacement?

We had a little thread going on this a while back. More or less to recap:

1) There are no "weak" tubes in the 390A design other than the rectifiers. Since most of the radios have been converted to solid state rectifiers by now this is not a big issue.

2) People seem to get amazing life out of a set of tubes in stationary service. Reports of 10 years of use in the mode you are running were not uncommon.

3) The world is awash in tubes for the 390A. Finding tubes if you have a failure is not going to be a problem. I probably have a thousand year supply sitting in storage. From what I have seen that's a small supply compared to others on this list

4) I seem to recall that I was going to come up with a simple tube tester for those who do not already have one. Another thing I need to get back to some day. If you have an extra couple hundred dollars you can grab one of the military tube testers at auction. They are not a perfect way to check a tube though. If you have a copy of any of the manuals they have a fairly complete voltage listing in them. Of course that assumes you have a voltmeter and some tube extenders. At least they are still pretty cheap to pick up. Most of the tubes used in the 390A are used multiple times. This makes tube swapping a reasonable approach. If you have a problem, swap a likely tube and see what happens. If the problem changes you have found a bad tube. I can see no reason to routinely swap out tubes. Any time you change a RF or IF tube you need to check the alignment. Also there is no reason to assume a new tube will be stable until you run it a while.

Date: Fri, 31 Dec 2004 16:31:53 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Tube life/replacement?

Well I know many list members that leave there R-390's on 24/7. They seem to be happier that way...the radio that is. That's 8760 hours a year! At 200 hours a year for yours that would be over 43 years of equivalent use. Now I would expect there would be a handicap for switching them on and off as you do as opposed to leaving the thing on so lets say you get 50% and round up that's 22 years. The owners that leave there sets on 24/7 report several years of operation between failures. Looks like tubes only used 200 hours a year would theoretically last a lifetime. Of course the thermal shock of switching them on and off may handicap the tube life way beyond 50%...maybe more like 90%. Any additional thoughts from the group!

Date: Sat, 01 Jan 2005 13:14:52 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Off Topic - Transistor R390A sounding good.

One of the more interesting mysteries of the world is the enormous number of transistor part numbers out there compared to the number of tubes. If you look at a tube manual from the R390 era you will find roughly 1/100 the number of tubes compared to the number of transistors and diodes in an equivalent solid state book these days. We don't worry to much about a particular brand of tubes in the 390 but the audio guys go a bit nuts on specific manufacturers of "classic" tubes. As far as I can see the R390 approach (don't sweat it) works just fine except when you have a tube that's just plain bad. I have never seen a problem that always happens with a specific brand of tube in a 390. If you look in your 390 there are a bunch of fundamentally different tubes in it. You are not going to swap a dual triode for a pentode and have much success. Even if you stick to triodes they come in a wide variety of bias and gain setups.

Bipolar transistors are different. You have two basic flavors NPN and PNP. Provided you don't run to much power, current or voltage do their thing ok. At a given current level the gain of most of them is very similar in a normal circuit. If you already have a bag full of diodes or transistors, try plugging one in and see what happens. It just may work and save you a major hassle.

The Lankford SSB mod on the 390A is an very good example of this. There are probably thousands of diode part numbers that will work just fine in the circuit. They are easier to find by body style than by part number. If the diode looks like it will work it probably will.

So if transistors are more like each other than tubes - why so many transistor types? Marketing rules

Date: Sat, 1 Jan 2005 14:26:38 -0500
From: "John KA1XC" <tetrode@comcast.net>
Subject: Re: [R-390] Off Topic - Transistor R390A sounding good-Audiophools

Dave the audiophool effect is most simply stated as "The more you \$pend the better it WILL \$ound" There are some funny quotes at the Audiophool BS page:

http://www.geocities.com/CapeCanaveral/Hall/8701/Audio_BS.htm

It appears that the very latest craze is cryogenically soaking your tubes, connectors, etc, for it will result in "A stunning improvement in every perceivable parameter".

<http://www.cryomusicsystems.com/>

Date: Sat, 01 Jan 2005 14:34:10 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Off Topic - Transistor R390A sounding good.

About all I can figure out is that different tubes overload in different ways. The guys I sell stuff to are all guitar amp people. They worry about what happens when they go into overload. About all I can say is that they can spot the "good" tubes in blind tests (I swap them and they tell me which one is best). I would

think we would have the same issue with front end tubes on a 390. If it's a significant issue we should be able figure out what the best front end tubes are. I think I have a couple hundred in stock. Time to prove they are the best

Date: Sat, 1 Jan 2005 14:21:18 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Off Topic - Transistor R390A sounding good.

Well I can't speak to the latest of the audio hype but I have been in and out of the audio business over the years and dabble in the tube guitar amp area as well and can tell you there are differences in tubes. In the guitar world tubes are used a little differently than in the rest of the world. Distortion is desired at times and how a tube handles being over driven has a lot to do with it's sound. As was mentioned by another poster, most guitar players who are familiar with tube amps can pick the desirable tubes by ear. What comes of that is that consistently what sounds good turns out to be certain brands in certain tube numbers. So those brands are sought after as a somewhat general assurance that the desired sound will be achieved. That's not to say that certain run of the mill tubes won't at times sound just as good but they don't consistently sound that way. How and when a tube breaks into distortion and what type of distortion is delivered makes all the difference. Most of the old Blues music that was recorded many years ago was done on old Fender Tweed amps and that sound is sought after today and hard to duplicate. That's why 12AX7's, 12AU7's, 6V6's etc of the right brand names go at a premium. If you have European varieties of those they seem to be the most sought after. Especially Telefunken and Mullard... Now those same tubes used the way we use them in radio gear probably won't sound much different than a half used up (soft in the guitar world) GE. So we are lucky we can get away with using just about anything. I agree that maybe the RF/IF amp tubes would make the most difference to hand select. In the audio world there are some tubes that sound more musical than others... I guess it's got to do with how the tube handles harmonics, overtones and transients which music is full of. Beyond that... things like silver plated this's and gold plated that's.... oxygen free wire... I think are more like the endless array of fishing lures... they lure more fisherman than fish. I can say we used to have a display set up for Monster Cable speaker wire where there was 50' of what most folks used... something like 14ga zip cord and 50' of the Monster Cable speaker wire with a switch on one channel of nice stereo system and one could tell a MAJOR difference between the two... in level and low frequency audio quality. Sold a lot of wire that way... one could quantify the difference!

Date: Sun, 2 Jan 2005 20:04:57 -0500
From: "Scott Bauer" <odyslim@comcast.net>
Subject: [R-390] manual comparisons

I was reading my 1956 Army R390-A manual and it says not to substitute type 6C4W for a 6C4. It is written that the differences in characteristics are such that the type 6C4W will not operate properly in the receiver. OK... What changed between 1956 and 1970? My Navships 1970 manual lists the 6C4W as the tube to use.

Date: Sun, 2 Jan 2005 20:38:21 -0500
From: "David Humbertson" <w3np@atlanticbb.net>
Subject: RE: [R-390] manual comparisons

I have heard the same thing. Look at this tube list: <http://209.35.120.129/faq->

tubes.htm

Date: Mon, 03 Jan 2005 07:57:06 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] manual comparisons

There's a long story about this. I forget the exact details and am too lazy to look it up. Bottom line is that the 6C4W seems to work just fine.

None of the field changes in the Y2K manual seem to directly impact the 6C4's so they didn't change the radio any to make them work. Since the 6C4's are being used as a mixer the normal things you would do to make a "super tube" version (more gain, higher linearity) probably are not going to make a super mixer. The conversion gain with the 6C4W may be a bit lower than a 6C4. If so it's not enough to significantly impact the sensitivity of the radio. The one thing that would really be an issue would be if the 6C4W has worse overload performance. We check measure sensitivity all the time. We don't seem to do many overload (third order) tests.

Date: Sun, 13 Mar 2005 12:06:08 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Tube Sub Question

>I'm looking for a sub for the 6BJ6. Is there anything out there in a remote or
>semi-remote cutoff tube and 150 ma fil current?? Anyone have an extra dozen
>at less than EBay prices?

The 6BJ6 is base diagram 7cm

Type	Amp.
------	------

Cutoff	
6AS6	

0175	Dual control
6BH6 / 6661	

0.15	sharp
6BJ6 / 6662	

0.15	remote
6BZ6	

0.3	semiremote
6CB6 / 6676	

0.3	sharp
6CF6	

0.3	
-----	--

sharp	
6DC6	

0.3

sharp
6DE6

0.3

sharp
6DK6

0.3

sharp
6EW6

0.4

sharp
6GM6

0.4

sharp
6JH6

0.3

semi remote
6JK6

0.35

sharp
7056

0.15

sharp

If you are running a string of series filaments and need the exact current to fit the string you have a very small range of choices. If you have a parallel filament you can use the .3 or .35 tubes. The extra .15 current draw will not kill the filament transformer. These will all plug in with no problem. The grid bias point may be off and the tube may not work well. You offer no B+ limit but if you are under 300 volts you will be OK. If you inspect the exact wiring on the tube socket, several more tubes may be used. Schematic may give a clue, but you need to look at the circuit. The Grid 3, Internal shield and cathode may be wired such that tubes with other base diagrams may also work in your exact application

Date: Sun, 10 Apr 2005 18:12:03 -0700 (PDT)
From: "Jon L. Turner" <ka0ofp@yahoo.com>
Subject: [R-390] 5814A Tube

I have a question for the group about the 5814A tube used in the R-390A's. What I am wondering, has anyone used the 6189W in place of the 5814A? Will it work as well as the 5814A? I believe it is a 12AU7A. Guess maybe I should just find some spec sheets on the tubes but thought I would run it past the group. I have a large number of the 6189W tubes and a couple R-390A's that I need to keep glowing!!!

Date: Sun, 10 Apr 2005 21:41:42 EDT
From: Radiograveyard@aol.com
Subject: Re: [R-390] 5814A Tube

My "Rider H A Middleton Tube Sub Guide" gives the following;

6189 = 12AU7 Good

6189= 12AU7WA Excellent
5814= 12AU7 Good

5814= 5814WA Excellent
5814= 6067 Excellent

No mention of 5814 = 6189 go figure... Hope this helps it seems it will work.

From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] 5814A Tube
To: "Jon L. Turner" <ka0ofp@yahoo.com>

I've used the 6189* as a sub for the 12AU7* in various things with little problem. They seem to be a good sub for the 5814A/12AU7A in the '390/390A, at least I've had good luck with them. If you've got 'em use 'em.

Date: Mon, 11 Apr 2005 08:14:35 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] 5814A Tube

The 5814 uses more heater current than the 12AU7, 225mA vs 150mA per section. Thus it's not always possible to swap; it depends on the circuit, hence the "good" vs "excellent" rating in the chart below. There's no way to divine the 6189's current, gotta see a data sheet. In the R-390A this is irrelevant since all the 12AU7 heaters are operated in parallel. R-390 owners, I don't have the schematic handy but I bet they're in series; look before you leap.

Date: Mon, 25 Apr 2005 23:15:40 -0700
From: "Dan Merz" <djmerz@3-cities.com>
Subject: RE: [R-390] R390 progress

Hi, I was surfing on Medley's site and see he says getting into the xtal box is quite a job - I'll explore other things before going there. I pulled the two oscillator tubes, 6AJ5's according to the manual and markings on the radio. (What a job to get those little guys out of the cramped box -resorted to tongs with tape to get some traction - I see why I need those missing tube pullers !!) But one of mine was a 6AK5. Both tested ok and the 6AJ5 is apparently the same tube as the 6AK5 designed for low plate voltage. They indicate about the same gm when

tested according to the Hickok settings for 6AJ5, which puts low voltage on with my tester. Does anyone know if the 6AK5 performs reasonably well in place of the 6AJ5 in a 390? I don't think I have extra 6AJ5's but I have enough 6AK5's to sink a very small boat. I think I searched my boxes for most of the 390 tubes when I first got it - may have to go searching again, Dan.

Date: Tue, 26 Apr 2005 07:02:18 -0500
From: "Laird Tom N" <LairdThomasN@JohnDeere.com>
Subject: [R-390] R390 progress

Here is a clip from my archives from Dr. Jerry K0CQ
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I did find full data sheets on the 'J and the 'K. There was a difference in standard characteristics, at least in the GE brand the J's heater cathode voltage was limited to 90 volts but was rated at 120 volts in the K. The other ratings including capacitances were identical. In typical operation the Gm of the J is half that of the K, but with the plate voltage so low the J's curves look more like a triode's curves, because they don't get up to the constant current regions of the normal pentode. There are more curves shown for the J than for the K but they are miles from overlapping so are nearly impossible to compare. Since the input C and the maximum voltage ratings and dissipations are the same, I stick by my prior conclusion. There could be a difference in cathode material maybe to encourage electron emission at the lower plate voltage of the typical operation of the J, but if it was significantly different they couldn't have the same maximum plate voltage, so I stick by my conclusion that the J is a K tested at 28 volts and the K is a J tested at 120 volts on the plate. And the plate test voltage is selected at the end of the production line according to which tube they need at the moment. I suppose these days I should say "was!" There were some Western Electrics, 404 family if I remember correctly that fit the same sockets with higher gain and lower noise that might be interesting for RF stages. I know the Western Electric tubes definitely worked better in old 2m FM radios. Wouldn't be any benefit in oscillators, but might make the higher frequency bands a bit livelier in the RF stage. Probably in a 1938 or 1939 (maybe later) issue of the IRE Proceedings of the Electron Devices group, there's an article about the J and K. Maybe something in the MIT RAD lab books on components since the K was used heavily in WW2 radar IF strips. Maybe something in the IF amp book too.
Jerry, K0CQ

Date: Tue, 26 Apr 2005 16:41:48 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] R390 progress

I sounds like Tom said Jerry said, the whole world knows you need some 6AK5 / 5749 in your R390. Not something you have to do, but you will likely hear more with some 6AK5. Now your looking for tubes, The first thing there is all brands are not equal. Take what you can get today and try them. Do not pass up any swap meet bargains and take those home. Try them. Swapping tubes is the difference between very good receivers and really awesome receivers (my to cents) A tube will not fix a problem that is not the tube. But once you get all the problems fixed, then tubes do make a difference. <snip>

Date: Mon, 2 May 2005 20:14:09 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] R390 progress 6AK5/6AJ5

I tested the 6AJ5's in an R-390 that's on the bench as part of testing all the tubes and they all three tested low...not sure they are really bad since they all tested the same....My sub book does not indicate the 6AK5 to be a substitute for the 6AJ5...they look a lot alike though!

Date: Mon, 2 May 2005 21:59:33 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] R390 progress 6AK5/6AJ5

I do not even find the 6AJ5 in my RCA tube book. There could be enough difference so that in the actual R390 circuit they may not operate as well. Then again they could perform even better. I try not to bank too much on my tube tester. Put one in the R390 measure your signal to noise. Swap the tube and repeat the measurement. Find the best one for signal to noise and put them in the other sockets. Swap the exchanged tubes into the same socket and measure them. Run the best ones you find of any given tube type. Do not bank that some tube number does not work as well as another tube number. Your small set of tubes may come from one manufacture, all be old, all be noisy all be really hot and you will never get some like them again.

Date: Mon, 2 May 2005 23:43:51 -0700
From: "Dan Merz" <djmerz@3-cities.com>
Subject: RE: [R-390] R390 progress 6AK5/6AJ5

<snip> The Engineering Report for the 390/389 says 6AJ5's were used in the oscillators because of their lower power requirements but the biggest discussion of the tube was the justification for using it in the 1st rf, based on other criteria for cross mod, overload and agc characteristics. I suppose there was some thinking that reducing the number of tube types might be important but I didn't see that mentioned. In the 390A, the design went to 6AK5W's for the oscillators so either the low power consideration went out the window with the demise of the 6AJ5 1st rf or the 6AK5 was deemed better for other reasons. I didn't have the heart to change the resistors to match the 6AK5 design of the 390A. I'll probably look for more 6AJ5's down the road. Because I just re-read this stuff, I mention it - I imagine most of you already know it. That's a pretty interesting archived report Dan.

Date: Mon, 06 Jun 2005 18:39:36 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] Megacycle detents, nominal B+, and bad tube brands

<snip> And on bad tube brands: "JJ" (Eastern European manuf) CC82's/ 12AU7's are not too good in the 5814A spots. I've had two develop filament-to-other-element leakage that gave intermittent hum, just in the past week. Luckily I have a good supply of JAN 5814A's.

Date: Tue, 07 Jun 2005 10:05:02 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Megacycle detents, nominal B+, and bad tube brands

<snip> >And on bad tube brands: "JJ" (Eastern European manuf)

Thanks for the experience report on these tubes. If I remember right, the JJ

brand is sold into the hi fi and musician amplifier markets. It's possible that those folks don't fuss as much as we do about tube life and the cost of replacements. Also, it's possible that JJ simply got a bad batch of tubes. (I suggest you send them back to them to see what their response might be. Of course the minimum correct response is a set of replacement tubes by return mail.) The reputation of eastern European tubes of recent manufacture is generally quite good with a few exceptions (e.g. the "7199" tubes that turned out to be another type altogether, enveloped with altered pinout and having remote cutoff in the tetrode instead of the linear one in the real 7199.)

>Luckily I have a good supply of JAN 5814A's.

Shhh! Don't let on. Your security contractor will scold you!

Date: Fri, 08 Jul 2005 21:15:59 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] Ceramic sockets or not?

My yellow striper has several tube sockets in pretty sorry shape. The phenolic (or whatever plastic-like insulating material it's made out of) is crumbling in at least a couple of cases. Naturally, the ones deteriorating the most are those in the least accessible locations (e.g. under the BFO, in-between shielded compartments, etc.)

I have some phenolic sockets with shield bases already. But I also see that ceramic sockets with very similar dimensions are available for a couple bucks a pop. Any opinions on the longevity/durability of these two options? I'm used to seeing ceramic sockets only where there's a lot of heat, but when the next radio's owner comes along in a couple decades I don't want him to find that the 30-year old "new" sockets I put in have turned to dust too. The ceramic sockets with tube bases I've found are the ones in the AES catalog. From the pictures and numbers they appear to fit in the same size holes and have similar dimensions.

Date: Fri, 8 Jul 2005 19:41:10 -0600
From: "Kenneth Arthur Crips" <CRIPS01@MSN.COM>
Subject: Re: [R-390] Ceramic sockets or not?

I prefer the ceramic sockets myself they are very durable, a parts Viking two transmitter I had looked like is had been had detonated like a bomb but the ceramic sockets in it where just fine, once I cleaned all of the carbon off of them.

Date: Sat, 09 Jul 2005 09:56:08 -0400
From: k2cby@aol.com
Subject: [R-390] (no subject)

In general, ceramic tube sockets were considered "top of the line." In addition to being used in high-voltage, high-power and high-heat locations (ie most transmitter final amplifiers), they were also used in oscillators for maximum stability because the capacitance between pins changed very little with temperature. My own 390A has none, and I have not seen any in the odd 390A modules I have picked up over the years.

"Second best" are mica-filled Bakelite. These are the medium-tan colored sockets used throughout the R-390A. They were standard for low-power RF use.

"Third best" are the injection molded black Bakelite sockets. Although these are below "standard" for the R-390 and R-390A, they are certainly suitable for any of the audio stages, the VR tube and the rectifiers. They are not recommended for RF.

Last of all are the flat "wafer sockets" made up of two layers of phenolic sheet material. These were pretty much confined to cheap, mass-produced consumer products, but the military did use this type of construction for vibrator sockets and battery connectors.

Miles Anderson, K2CBY

Date: Sat, 09 Jul 2005 11:31:59 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] (no subject)

That's interesting. Could it be they had another reason for going with the tan, mica-filled Bakelite -- less likelihood of cracking or something? It would seem that at least the sockets for the 6082's would be candidates for ceramic considering the heat factor, and possibly also those for the rectifiers. I don't recall if I've ever seen them there. Odd parallel: I just had some temporary caps (not capacitors) installed at the dentist. I complained that they felt rough, not slick like previous acrylic "temps". The dentist explained that it's quartz-powder-filled -- to provide additional hardness and resistance to wear, not heat resistance, though it probably does that, too. Of course, another material -- used for permanent crowns -- is usually porcelain (ceramic). He's got a lot of stuff that would be handy in repairing small parts, replicating knobs, etc. Unfortunately, the fee would be a tad pricey -- unless, perhaps I can infect him with VRV -- Vintage Radio Virus. (not likely, though)

Date: Sat, 09 Jul 2005 12:31:55 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] (no subject)

>....tan, mica-filled Bakelite -- less likelihood of cracking.....

I've homebrewed several doohickeys using ceramic PCB-mount tube sockets, and despite me dropping them onto the floor a couple of times they've never shown any sign of damage. What I really like about them is that the pin sockets are much less wiggly than a typical Bakelite or phenolic socket. The PCB mount ones I have were made out of two ceramic parts: before riveting the top to the bottom, the individual pin sockets seem to have been inserted. While there's still a little bit of wiggle it's not much at all. The downside would be that it's not possible to replace individual pin sockets. (Well, maybe I could unrivet the two halves... but that seems too much work!) Any recommendations for places to shop for tube sockets? AES <http://www.tubesandmore.com/>) has a very wide range, but I wonder what else is out there. I did once get some from an outfit called "The Triode Store" but I haven't looked at what else they have lately.

Date: Sat, 9 Jul 2005 22:20:16 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Ceramic sockets or not?

I would install the ceramics you have and get on with enjoying your radio. Like

you say they are for high heat locations. But why not use them, they could outlast the rest of the receiver.

Date: Sat, 30 Jul 2005 20:32:25 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] Sub 6AU6 for 6BA6?

In several places (notably VFO and BFO oscillators) in a cow-orkers R-390A, I notice that there's 6AU6's instead of 6BA6's. I know that the 6AU6 is a sharp cutoff pentode, and the 6BA6 is a remote cutoff pentode, and suspect that in an amp (especially AGC-controlled amp) or mixer that there'd be some change in dynamic range/AGC characteristics through such a substitution which may not be good. But in a simple oscillator, does it make much if any difference? (I know that probably the VFO has to have its endpoint adjusted, but that's true even when putting in a different 6BA6 so is "no big deal").

I grew up on Heath Collins Drake etc. gear of the 60's and early 70's (how late did the make the HW-101? Into the 80's?) that used lotsa 6AU6's (sometimes 12AU6's) for just about everything it seemed like :-). Tim.

Date: Thu, 4 Aug 2005 21:17:22 -0700
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: [R-390] Need straight poop on 6C4

I've got a 6C4 going soft in the RF section of my R-390A. The Y2K manual shows to use a JAN-6C4W, another source states to use a 6C4WA, the 6C4W will not work, the 6C4 will work but not quite as well. So, need the straight poop, which 6C4 is the real deal? Got a guy 20 minutes down the road with a house full of tubes to sell.

Date: Fri, 5 Aug 2005 09:15:58 -0600
From: "Kenneth" <crips01@msn.com>
Subject: RE: [R-390] Need straight poop on 6C4

I have milspec 6C4's brand new sealed in their as issued box's these are the one's called for in the original parts list for the R390A. Interestingly the boxes on mine are miss-printed 64C instead of 6C4. The Tube itself is marked 6C4, no W, or WA, just JAN (Joint Army Navy) 6C4.

Date: Sun, 7 Aug 2005 19:47:25 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Need straight poop on 6C4

Any good 6C4 will work in an R390. However, like every thing else all tubes were not created equal. Some are just better than others. JAN marked are OK. RCA Sylvania brands are likely OK. Other brands can also be good. Buy what you can get and then swap them into the same tube socket and compare them for signal strength and noise. Some very strong signal tubes are also very noisy.

Plug them all in, and line them up on the bench from best to poor. Save a few extra. Plug the best ones in to the receiver. A brand new sleeve of five tubes will have each tube perform different. If they are all very close, have high output, low noise you get lucky. Sooner or later you will want some more tubes. Buy 5 for you receiver that needs 3. Some time later (6 months at 24 x 7) the tubes will be different. Do the comparison test again on all the tubes and run the best you

have. While doing 6C4's also do the 5814, 6AK5, 6AK6, and 5759 tubes.

Date: Sat, 17 Sep 2005 11:24:42 -0400
From: "Scott Bauer" <odyslim@comcast.net>
Subject: [R-390] Tubes glow blue

OK, I noticed something interesting. I am sure most of you already know this. If a tube is glowing blue (besides OA2) it should be replaced. Well, I had 2 6AK6's glowing blue. One was V504 and the other V603. No problem, I have a couple hundred of them. I install 2 new ones and they are glowing blue. I try 2 more of another brand and they are doing the same. Crap! I tried 4 or 5 different brands and got the same result. They would also glow blue when pushing the test button on my TV7. Something must be wrong here. These are all NOS, NIB shiny new tubes. I decided to install 2 in a junker and just watch for a while. Well, I came back in an hour and they were no longer glowing blue. So, for the new tubes is this gas burning off? A burn in? I have only noticed this with 6AK6's. No others. Sorry if this seems off topic or an ignorant question. Maybe the tube Guru on the list can fill me in.

Date: Sat, 17 Sep 2005 16:33:44 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Tubes glow blue

Not such an odd observation. The question is the noise level of the tubes. After you let a couple burn in for some hours, how is the signal to noise performance of the receiver? If the tubes loose the blue glow and are not noisy let them be. The blue glow is ionized gas. That gas is being smacked by electrons in transit. Smacked gas makes noise. A couple dead horses on the subject back when. Warming the tubes with a Zippo lighter will take the blue glow out. The reason this works is, you heat the getter stuff and it gets some more of the gas. At least enough of the gas is absorbed so the gas is not visibly glowing blue. In old tubes not heated through use, the getter stuff can let some of the gas loose. Very little gas and very long time (years) to get loose. Your NOS may not be NOS but service pulls and stuffed back in the box. They could be victim's of old age. If the emission is OK and the noise level below your acceptance use them.

Date: Mon, 19 Sep 2005 10:06:56 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Tubes glow blue

Baloney. Beware, beware! There are two (three, actually, or more) kinds of blue or other color of glow in tubes:

1) The thing is normal and operating properly. It is likely a beam power tube and the electrons that don't get glommed by the plate whizz on by and hit the inside of the envelope. The *glass* glows. This condition is recognizable because the glow is ON the INSIDE of the glass envelope. This is not harmful or indicative of any fault or weakness in the tube.

2) The tube has some gas inside (when it should not have much at all). The electrons whizzing toward the plate hit the gas particles and the gas glows. This condition is recognizable because the glow is AMONG the tube elements, NOT on the inside surface of the glass. This IS indicative of a fault or weakness in the tube. However, if you run the tube for a while, the heat *may* make the getter material glomm onto the gas, reducing or eliminating the gas and the glow goes

away. Certain relatively new tubes (such as made by the Viac company for audiophiles) have special getters attached to the plate, which plates run so hot as to heat up the getter device and activate it further to glomm more gas. These unusual getter devices may be washer- or ring- shaped things that are seldom seen in old tubes.

Notes on terminology:

"whizz" to travel at a high rate of speed. In the case of electrons travelling from a cathode to somewhere else, accelerated by the electrostatic potential difference between the electron and the somewhere else. "**glomm**" a special term borrowed from the seller of the engagement ring now in our family, who would sternly caution the Groom while He was examining candidate diamonds, "Don't Glomm the Stone!" -meaning grab onto, cause the brilliant to become dull, or otherwise mess up by attachment of dirt or whatever. Very used tubes such as transmitting tubes, power tubes such as 807's, 6550s, KT-88's and the like can sometimes be identified as being past their useful life because the getter material flashed upon the inside of the glass has turned brown or discolored. The shiny stuff has become glommed by sucking up too much gas. "getter" any material or structure inside a tube intended to glomm the gas. Notes on Good kinds of Glow. (Any of the following tubes are supposed to glow and if they don't, something is wrong):

- any voltage regulator or voltage reference tube. Voltage reference tubes often both have stuff on the inside of the glass (intentionally) and glow very faintly anyway, so you may not see the glow easily

- Rectifiers of the mercury vapor or Xenon gas containing sort. These include 872A, 866, 866A, 816, 3B28, 3B32. (The 0Z4 was an abomination of design and manufacture, was intended to save power in car radios, almost never lasted very long, had metal envelopes anyway, and should be discarded instantly whenever encountered.)

- gas relay tubes such as the 2020, 2D21 and the like.

- Most thyratrons.

(Scott continues...) Something must be wrong here. These are all NOS, NIB shiny new tubes.

Nope, possibly nothing is wrong. If the blue is on the inside of the glass everything is just fine. Enjoy using your excellent new tubes.

>So, for the new tubes is this gas burning off? A burn in? I have only noticed this with 6AK6's. No others.---

The gas may have been glommed by the getter material, or the plate. Roy

Date: Mon, 19 Sep 2005 09:46:56 -0500
From: mikea <mikea@mikea.ath.cx>
Subject: Re: [R-390] Tubes glow blue

Roy's otherwise-excellent post unaccountably omits mention of one particularly-to-be-avoided form of glow in tubes. When a metal 6L6 starts glowing visibly, then you have a serious problem and need to investigate it *IMMEDIATELY*.

That's especially true if it's glowing blue. I've never seen one get past glowing red, and then only for a fairly short time. ;=), with tongue firmly in cheek, in case you hadn't noticed. He's right about beam power tubes, too: a properly-operating beam power tube can show a really pretty blue glow just inside, or even in, the glass. I don't know how fast the e- move in a 6L6, and hadn't thought it would be fast enough to stimulate Cerenkov radiation, but it sure is the right color.

Date: Mon, 19 Sep 2005 11:16:02 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Tubes glow blue

Oh, goodie..something of interest to hear about! Thanks, Mike, for helping with this technical stuff.

>When a metal 6L6 starts glowing visibly, then you have a serious.....

Ah yes. This reminds me of the article (was it in QST?) many years ago of a set of 6 or 8 6AG7's being run to a KILOWATT peak input in a linear by being inverted in oil and run with some 1000 volts on the plates. I think they experienced "reduced tube life". It also reminds me of the 6550's in a Western Electric audio amplifier I have here that ran (briefly!) with one pair of plates quite red. I really must replace those old coupling caps and check the bias supply....

>... stimulate Cerenkov radiation, but.....

"Cerenkov radiation"? Hmmmm.... www.dictionary.com says: "light produced by charged particles (as electrons) traversing a transparent medium at a speed greater than that of light in the same medium called also Cerenkov light "**I* think the electrons whamm the glass which un-glomms some blue photons it's been keeping. Did you know you can buy 6550's with blue glass? They sound much better, some say. AES has 'em from JJ Electronics. Only \$40 each.

Date: Mon, 19 Sep 2005 11:24:33 -0400
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: Re: [R-390] Tubes glow blue

When I killed an 807 in my Viking II (screen resistor failed, B+ spiked and there was a flash from the getter to the metal it deposited on the glass - the spark cracked the glass and left a crater on the inside) the nitrogen glow was pinkish. I've seen the blue when the electrons hit glass and have pushed the glow around with a magnet. The glowing tube got mighty hot too!

Date: Mon, 19 Sep 2005 12:18:58 -0400 (EDT)
From: "William A Kulze" <wak9@cornell.edu>
Subject: Re: [R-390] Tubes glow blue

For what it's worth, I've seen guitar amp output tubes get to glowing a nice blue or purple when they are driven pretty hard, which can be desirable in a guitar amp, probably not so in a communications receiver. These tubes tend to loose their glow when you back off on them a bit.

Date: Mon, 19 Sep 2005 12:32:38 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Tubes glow blue

Yeah, I've seen 6146's in finals do this too especially when they break out into a parasitic oscillation. Not a "nice" glow as usually some capacitors or chokes die shortly afterwards... But the 6AK6 in question isn't a beam power tube, is it, it's just a beefy pentode? IIRC the tube is getting pushed pretty hard (if you've solid-stated the power supply and not put in a dropping resistor you may be pushing right up close to 300V on the B+, which is the max plate voltage speced for the 6AK6. I think typical consumer equipment ran this tube closer to 150V.)

Date: Mon, 19 Sep 2005 20:40:26 -0400
From: "Michael Murphy" <mjmurphy45@comcast.net>
Subject: Re: [R-390] Tubes glow blue

I definitely made the 1625's in my command set sad when I put 800 V on the plates.

Date: Wed, 26 Oct 2005 13:40:16 -0700 (PDT)
From: g kwitka <kc0lwn@yahoo.com>
Subject: [R-390] Foreign tubes 12ax7 (r390/r388)

This is a technical slightly off topic question. I have an r-388 in addition to my r-390a. Does anyone have any experience with Russian or Chinese tubes that will replace the 12ax7. The US made NOS stock tubes are getting to be quite expensive. I believe the r390 uses a 12ax7 so I am hoping someone has experience. (please no political commentary)

Date: Thu, 27 Oct 2005 07:54:50 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Foreign tubes 12ax7 (r390/r388)

Well, my R-390A has no 12AX7's, but my experience with Eastern European 12AU7's (Tesla, now JJ) was less than stellar, with intermittent interelement shorts. Don't get too wrapped up in the astronomical 12AX7 prices... some are highly desired by the audiophile types and others are ignored. I'm sure the ignored kind (even if Chinese or Russian or E. European) will do fine. Even though just looking in the catalogs I'm surprised that used random 12AX7's seem to sell for more than the new imports. And the JAN/industrial number (5751) that's somewhat compatible seems to be pretty expensive too.

Date: Thu, 27 Oct 2005 09:03:15 -0600
From: "Kenneth" <crips01@msn.com>
Subject: RE: [R-390] Foreign tubes 12ax7 (r390/r388)

Simple answer Russian tubes good, Chinese tubes bad. The 12AX7 is a common domestic tube and the supply of this tube is still good.

Date: Fri, 28 Oct 2005 09:57:34 -0400
From: flood@Krohne.com
Subject: [R-390] 12AX7 tubes

I lost the earlier digest but whoever was looking for 12AX7's should contact me off list with how many they need and what they would like to pay or trade. I have a supply of this series that are as best as I can tell NIB mill surplus. If an audiophool wants to trade equal weight in gold they are welcome to but I'd be happier if they went to BA crowd.

Date: Mon, 31 Oct 2005 15:50:16 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Tube microphonics & performance

On a bad day you run what you got. You can use them, HOWEVER. Noise is noise. Try them, they may be better than what you have running right now. Then again they may not be better. Never turn down a tube. You can always use them as part of your test set. If you are not using your line output, you could drop one in that side of the audio deck. The microphonic per say will not hurt the radio. It may add noise to the signal. If it is the difference between radio and no radio, run them. Always run the best tubes you have.

You can compare tubes by hanging a dB meter on the audio output with a 600 ohm 1 watt resistor and comparing tubes with each other when plugged into the same socket. A signal generator is easier to work with than the cal tone and bfo. Most AC meters have a dB scale on them. Hit a few web pages and see how to use your meters AC scale or dB scale. Exact numbers are not required for tube comparison. You are just grading what you have from good to poor. Put the best ones forward in the receiver and use the best of what you have.

Hang an AC volt meter across your audio output. The line level meter works but a volt meter will help you with tubes that are real close together. Set the receiver to cal and BFO off. observe the meter reading. Turn the BFO on. Observe the meter reading. How many dB difference did you get between BFO on and BFO off.

Now change a tube into one socket.
Repeat the test for that tube.
Did the second tube give you more or less dB difference?
Plug all your spare like tubes in the same socket and compare them.
After test put the worst of the bunch into the receiver.
Now retest all of the type you have that is not needed to populate the receiver.
Grade all of these from most dB difference to least dB difference.
Now put the best of these into the receiver.
Save the old poor ones for future testing.

Do this for each tube type. Do the dual triode 5814's twice. Pick a socket where you know which side of the triode is being tested. Use the detector socket for one side. This is a quick post. If its not clear to any one pop me back some mail and I'll try to get some more detail. Roger KC6TRU

Date: Tue, 1 Nov 2005 16:44:34 -0600
From: "Barry" <n4buq@aol.com>
Subject: [R-390] 9-Pin Tube Base Specifications

Can someone point me to the physical characteristics of a 9-pin tube base? I'm interested in the pin diameters and the pin-pattern's diameter. I think this is in the R390A CD, but not sure. I figure the specification is somewhere on the internet but I'm not finding it.

Date: Tue, 01 Nov 2005 19:31:42 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] 9-Pin Tube Base Specifications

I don't know what the official spec is, but the pins of a 9-pin tube fit just perfectly into a 1/2" socket (square or hex). And the pins themselves are the same thickness as 18 gauge wire (0.040" diameter). So the centers of all the pins are on a circle 0.460" diameter.

I have looked for an official spec on the web but never found it, never did find it in a tube handbook either. Note that most PC mount tube sockets have a different pattern diameter (usually on the outside so larger).

Date: Thu, 3 Nov 2005 20:53:28 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] CU-872 Multicoupler

<snip> ...The 6922 are industrial grade E88CC 6DJ8.... <snip>

Date: Fri, 25 Nov 2005 18:10:53 -0800 (PST)
From: g kwitka <kc0lwn@yahoo.com>
Subject: [R-390] Tube longevity

To prolong tube longevity which is better:

- 1) keep the set on with the volume and RF gain turned down
- 2) Install a B+ switch and keep the plate voltage off with the heaters on until the set is used.

Date: Fri, 25 Nov 2005 21:21:37 -0500 (EST)
From: John Lawson <jpl15@panix.com>
Subject: Re: [R-390] Using R-390a in cold weather

A lot (most?) of these radios had heaters in the crystal can - but you could mount the radio in an enclosed rack and then use a 50W lamp - or maybe those heating strips made for melting the snow out of gutters and roof parapets..

I use these on my satellite dishes, and never have problems in the winter...

They were designed to run 24/7/365 in all climates from arctic to tropical, so keeping them on shouldn't be a problem - IIRC there are several ListMembers who haven't turned their 390s off in years.

Date: Fri, 25 Nov 2005 22:28:30 -0500
From: Mark Huss <mhuss1@bellatlantic.net>
Subject: Re: [R-390] Tube longevity

Time for my two cents. (1) is best, though with mil-spec tubes, heater failure from start-up current is rare, or so the old manuals said. (2) the Stand-By position turns off the B+, but is very bad if you have done a solid-state mod to the Power supply rectifiers. If you do not have the 26Z5 tubes in the power supply, turning off the plate voltage by switching to stand-by will cause the plate voltage to raise excessively, and can cause some caps to blow. Never use stand-by. Probably the best thing to do is to add a CL-80 surge suppressor in series with the 2 Amp fuse in back. Personally, I don't think tube life is reduced significantly by turning the receiver on and off. I suppose you will get a few hundred hours more from a tube that is about to lose its heater if you leave it on continuously. The exception is the Ballast Tube. That is rated in cycles (about 2000-5000). On-Off

cycles will definitely affect the life of that tube.

Date: Mon, 28 Nov 2005 20:10:18 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Tube longevity (summary)

So what's a body to do? How many hours are you going to listen to the receiver and how many hours is it going to just sit idle waiting for use? The military run them 24 x 7 for years. They got turned off twice a year for the semi annual maintenance. A technician would likely turn it on and off 4 or five times while doing the maintenance. Once the receiver went back in the rack, it was just left on until some maintenance guy come along again to do service.

If you only use your receiver once or twice a week, you may as well turn it off when not in use. If you are going to listen to it every day, even if only for an hour or so, you should leave it on. If you are going to do a week end event, turn the receiver on several hours early to let it warm up and stabilize. Then leave it on for the duration.

A tube has a working life. The military used them 24 x 7 until beyond acceptable noise performance. At six month intervals, the receiver was tested for signal to noise performance. Tubes were tested for shorts and put back into the receivers. The test set up was performed. Maintenance would try to get a 20:1 signal to noise performance out of the receiver. Noisy tubes would be replaced until the ratio was achieved. The receiver then went back into service for the next six months at 24 hours a day. 4380 hours. Unless the receiver died, it received no additional tube changes for about six months. Over this time the new and old tubes would "age" and get more noisy. Hopefully the signal to noise ratio would stay above the required 10:1 noise level. Most receivers did make the cut of 10:1 after six months use.

>From this we can conclude that tubes will make at least 4380 hours of good quiet life. Hours on a tube with no ears to listen is wasted tube life.

One trade is receiver stability and warm up time. Most R390 receivers will drift some as they warm up. But are you using the receiver in a mode that exact frequency is critical? Even if you have to ride the knob to keep a SSB signal in the band pass, the drift of the receiver is not that much. Most of us have solid stated the rectifiers and the replaced the ballast tube, so the issue is cold filament surge failure against time on a tube until its emissions noise gets excessive. Life cycles on a ballast tube has a high end of 5000 cycles. A tube will likely do as many cycles.

So do not leave the receiver on more than twice as long as you are going to listen to it. Turn it on and off 5000 times and enjoy 5000 hours of low noise reception. If you use it for more than an hour at a time, you will then likely get more than 5000 hours of use with good noise performance, before you have a tube filament fail. If you leave the receiver on for 5000 hours the tubes will start to get noisy and performance will suffer. You age the tubes and get no return. For the casual user, the analysis is to turn the receiver off if it will not be used in the next 6 hours. The exception would be, to leave the receiver on for the duration of an event to avoid a failure at power on and have a temperature stabilized receiver for use during the event.

Date: Mon, 28 Nov 2005 19:03:52 -0800 (PST)

From: Daren Q <greybeard5150@sbcglobal.net>
Subject: [R-390] Re: Tube longevity (summary)

And in conclusion G. Kwitka summarizes: "So what's a body to do?".....

Thanks George! I like your linear-type thinking. I was hoping that someone vastly more qualified than myself would conclude the thread in this manner

Date: Fri, 16 Dec 2005 14:30:32 -0500
From: "Joe Perge" <jmperge@adelphia.net>
Subject: [R-390] Black Marker on Tubes

Is it safe to use a Black Marker to mark the tube number on the glass of a tube? Safe in the sense that it would affect emissions inside the tube. I have found radios where someone used a piece of paper taped to a tube with the shield over it! I don't think that is safe.

Date: Fri, 16 Dec 2005 14:47:09 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] Black Marker on Tubes

For high-power (transmitter, >20W) glass tubes there might be some issues having to do with differential heating that could crack the tube. Hard to see how it could do anything to change emissions.

Most "black marker" inks are actually transparent to infrared and probably won't do much to change cooling, and like I said I cannot see how it could affect emissions at all. The marker ink might not stand up to long-term heat or shield insertion very well. When I've seen people mark their own tubes (often good/bad or ranking for emission/transconductance) it was with paint and they put little dots on the top.

Date: Fri, 16 Dec 2005 15:19:14 -0500
From: "Bruce Hagen" <b_hagen@sbcglobal.net>
Subject: RE: [R-390] Black Marker on Tubes

The cathode & plate will never know.

Date: Wed, 21 Dec 2005 10:05:46 -0500
From: "Scott Bauer" <odyslim@comcast.net>
Subject: [R-390] corroded tube pins

I bought some " NOS " OA2's on ebay. I know, you get what you pay for. Anyway, every pin on every tube is heavily corroded. Usually, I scrape them off but I bought 11 of them and was hoping for an easier solution. I wonder if there is any type of solution one could soak the pins in to remove the corrosion? Baking soda and water ?

Date: Wed, 21 Dec 2005 09:41:10 -0800
From: "Dan Merz" <mdmerz@verizon.net>
Subject: RE: [R-390] corroded tube pins

Scott, I suggest shoving them in and out of a loose tube socket a few times, applying a little deoxit to the tube socket and putting one in the deoxit laden tube socket and taking it out and testing it on a tube tester. If it tests ok, that may be

all that's necessary. If the pins are so badly corroded that the vacuum is compromised, you'll know right away. Good luck, regards, Dan.

Date: Wed, 21 Dec 2005 12:08:50 -0800 (PST)
From: DQ <greybeard5150@sbcglobal.net>
Subject: [R-390] Re: corroded tube pins

This offered as a possible 'wives tale' solution and NOT from a scientific viewpoint. I'm hesitant to offer this, and I hope I'm not making myself appear foolish by posting. You might also try bundling them together with a heavy rubber band and then standing them up in a shallow pan with Coca-Cola in it. My wife has used this trick on various things over the years without harming the base object. I have also seen something on TV about it. As I recall it has to do with a very mild acid contained in the Coke formula.

Date: Wed, 21 Dec 2005 16:20:45 -0500
From: "Bruce Hagen" <b_hagen@sbcglobal.net>
Subject: RE: [R-390] Re: corroded tube pins

And you do not have to waste the Cola. When the tube pins are clean pour into a glass with ice and add enough 180 proof rum to sanitize and flavor. Yes, I agree that coke will probably clean the pins. It's a very mild dose of phosphoric acid.

Date: Wed, 21 Dec 2005 15:25:59 -0600
From: "Bill Hawkins" <bill@iargs.net>
Subject: RE: [R-390] Re: corroded tube pins

The mild acid is carbonic acid, from the CO2 added to the flavored water to make it tickle. Any carbonated beverage will work.

Does it work on corroded tube pins? Depends on what corroded them. Pretty sure the pins could fall off without affecting the vintage vacuum.

Anybody know the base metal and plating of tube pins? It probably varies with the vintage. May the sun rise higher in the sky for the next six months.

Date: Wed, 21 Dec 2005 16:51:41 -0500
From: "Bruce Hagen" <b_hagen@sbcglobal.net>
Subject: RE: [R-390] Re: corroded tube pins

Never thought about carbonic. Maybe it's the combination of the two that makes it work.

Date: Wed, 21 Dec 2005 17:07:23 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Training manual

I have the following mail from the boatanchor pages. "Are 5651 the regulator tubes used in the R390?"

I found the box marked 12AX7's (good news), what was in there was 20 nos mill pkg. RCA JRC 5651's (bad news). Sorry guys, I should have looked first before I sent my first message. Anyone have a use for these? \$2.00 ea plus postage or \$30.00 for all 20 and I'll pay for shipping in the lower 48. Requests for all 20 take first preference. I do not have a listing for testing these on my Hickok 534

so they are as is and appear to be NOS.

Date: Wed, 21 Dec 2005 14:39:12 -0800
From: "ELDIM" <eldim@att.net>
Subject: Re: [R-390] Re: corroded tube pins

The PINS may be of a Tungsten or Tungsten alloy. I've run across the same corrosion or is it severe oxidation. In those cases I have used a fine wire bush (not those cheap brass ones that you find from abroad), but the good high density ones that are small on a wooden handle. It is still difficult to reach the inside area of the tube pins, in which case mild scraping with a X-ACTO Knife blade, Razor Blade, or I use a Medical Scappler which also does the trick. Just scrape gently at an angle as not to gouge or nick the pins. <snip>

Date: Wed, 21 Dec 2005 17:44:59 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Training manual

Regulators in the R-390/URR are 6082's...

Date: Wed, 21 Dec 2005 19:16:05 -0500
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] Training manual

It uses two 5651 tubes (V608 and V609) in series to set the voltage. Then it uses an active series regulator circuit employing a 6BH6 as the error voltage amplifier (V607) followed by two 6082 triodes as cathode followers (V605, V606). The 5651 is sorta like an 0A2 or 0B2 except that the voltage is supposed to be more precise.

Date: Wed, 21 Dec 2005 19:13:20 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Training manual

Sorry about that I thought the 6082's were the regulators...didn't go look it up. I know they are the ones that generate all the heat!

Date: Wed, 21 Dec 2005 20:58:15 -0500
From: "Dave Maples" <dsmaples@comcast.net>
Subject: RE: [R-390] Re: corroded tube pins

All: As I recall it's carbonic acid (NOT carbonic acid, which is terribly powerful). Canada Dry seltzer water has the same stuff in it, without the sugar and caffeine.

Date: Wed, 21 Dec 2005 21:19:38 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Re: corroded tube pins

Phosphoric acid is the stuff used to prep bare steel before applying a primer coat. It micro-etches the surface so the primer will grab. Nowadays, they often use self-etching primer. That's also the ingredient in Coke, Pepsi, and other soft drinks that helps eliminate nausea. In the old days, the soda fountains (and drug stores, etc.) offered "phosphates", quite popular with the ladies. I generally find that DeOxit does a good job on crusty tube pins.

Date: Mon, 2 Jan 2006 22:31:05 -0800 (PST)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Re: TL431 question

>...TL431 and found it to be a 0 to 36 volt regulator. How is that used in a "six - stack" to replace >a 0A2? <snip>

The TL431 is a 3 terminal "buried zener" adjustable CURRENT sink regulator as opposed to a pass type voltage regulator. Using the data sheet formula one can trim them to say 25 volts using just two resistors. Then they can be stacked in series like a two terminal zener. Got the idea from Dr. Jerry. Haven't had the time to do it myself yet.

Date: Sun, 8 Jan 2006 14:37:36 -0500
From: "Scott Bauer" <odyslim@comcast.net>
Subject: [R-390] Follow up/ corroded tube pins

OK, I finally remembered to get to the store for some tonic water to try and get the heavily corroded tube pins cleaned off. I had bought 10 tubes on eBay that I thought were ruined. It worked better than I anticipated. I rubber banded the tubes together and stood them up in a small tupperware and then poured in just enough tonic water to completely soak the pins. I came back in 1 hour to check and the tube pins were perfectly clean. No scrubbing or scraping was needed. I did rinse the tubes off with water to remove the corn syrup though. I used store brand tonic water. Some brands have different ingredients. I just made sure the brand I picked had phosphoric acid listed as an ingredient. Thanks to all for the good ideas, Scott

Date: Sun, 8 Jan 2006 16:02:18 EST
From: Bonddaleena@aol.com
Subject: Re: [R-390] Follow up/ corroded tube pins

Scott, that's a NEW one on me. Thanks fer the idea. What would happen if you used Tarnex? I am unsure what's in it, but it works wonders on old silver plated parts. Another thought, Naval Jelly. It has Phosphoric Acid, if memory serves me.....

Date: Fri, 13 Jan 2006 17:16:22 PST
From: Gary Gitzen <r390a@uwave.com>
Subject: [R-390] 6082 (and other) tubes

Visited a surplus electronics place today and found about a dozen 6082 tubes, mostly NOS/NIB. Are there any folks here on the list with enough interest in them at \$15/ea + shipping for me to travel 75-80 miles to get them? They also had a large number of 6BJ6, 5651, 5749/6BA6, 5814, 5654/6AK5.

I also noticed about 10 silicon 866 replacements. If I go for the 6082s, they can be had for \$20 ea + ship. Also noticed too what appear to be 5U4 silicon replacements. If I go there again, and if you have any special tubes you need, send me a list. They have a large number of "number" tubes, and I also noticed some sweep tubes..From what I've seen so far, cost should be a bit below AES. Packing & shipping will add some to that. Please note: I am not in the tube sales business, and don't want to go there. I saw these 6082s and had heard they were getting scarce, so thought I'd share them with the R-390 list. If I get overwhelmed with replies I'll have to back away from this.

I have no idea what packing will cost these days, but a box + cushioning + gas for running around will probably come close to \$5. Shipping, with insurance, will add more. I've newly rejoined the R-390 list after an absence of a few years because I recently bought another R-390A. But that's a story for another time.

Date: Fri, 13 Jan 2006 18:21:38 -0700
From: Les Locklear <leslocklear@cableone.net>
Subject: Re: [R-390] 6082 (and other) tubes

If you aren't in the tube business and don't want to go there, just post the name, address and phone number of this surplus dealer. Simple huh?

Date: Fri, 13 Jan 2006 18:27:12 PST
From: Gary Gitzen <r390a@uwave.com>
Subject: [R-390] 6082 tubes, a followup

If memory serves, I actually posted it to this list years ago. The reasons I'm not doing it right now are twofold:

1: They don't do mail order. I asked.
1A: I don't think I'd trust their packing.

2: I personally would prefer that members of the list get tubes they need instead of a single person buying them all, or a business buying them up for resale.

After I/we see what happens with this, I'll happily (re)post information on the source.

Date: Sat, 14 Jan 2006 07:32:40 -0500
From: Michael Crestohl <W1RC@Verizon.net>
Subject: [R-390] FS: Set of Three Tube Socket Adapters

I have an extra set of three MIL tube socket adapters consisting of an octal, 7 and 9-pin miniature. For those of you who may not know what these are, they are invaluable for taking meter readings on different tube pins simply and easily. They plug into the tube socket on the chassis and the tube is plugged into the adapter. There is a test point for each pin on the adapter and you get the rest.....They are definitely a safety feature and also save a great deal of time when troubleshooting. These are getting very hard to find especially in sets of three. I am asking \$25.00 plus postage for these. If interested please reply by e-mail.

Date: Sat, 21 Jan 2006 10:59:51 -0600
From: "Paul Staube" <pstaube@qwest.net>
Subject: [R-390] Tubes?

Five years ago I was fortunate enough to get a couple of sets of complete R-390 non-A tube sets from Lowell, K6KC. As several members of this esteemed group will testify, in my 50 year old kid-type wisdom (or is it an obsession?), I have invested in more than a few versions of the non-A, the A and others such as two 389s, a 391 and two 392s. I want to make sure that these radios perform at their peak... (each one has a unique history)... so I'd ask for suggestions as to who you folks would suggest for a good tube source for these radios as spares and/or replacements...

Date: Sat, 21 Jan 2006 15:41:28 -0500
From: "Scott Bauer" <odyslim@comcast.net>
Subject: Re: [R-390] Tubes?

I have had very good luck with "The Tube Center" The prices are better than any other seller I have seen and I have never received a bad tube. I buy directly from their eBay store. Search for "thetubecenter". Phone number is 407-826-9172.

Date: Sat, 21 Jan 2006 23:20:20 -0500
From: "Scott Bauer" <odyslim@comcast.net>
Subject: Re: [R-390] Tubes?

Also " Heavily Tubes " on eBay is good. Fair Price and good service.

From: "Jim M." <jmiller1706@cfl.rr.com>
Saturday, January 21, 2006 9:52 PM
Subject: Re: [R-390] Tubes?

I have bought from www.tubesandmore.com with success.

Date: Fri, 27 Jan 2006 17:31:20 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] CV133 vs 6C4

Is the CV133 the British version of the 6C4? Is it the British mil-spec version? (I'm not all that familiar with British tube numbering, I'm deeply suspicious of any tube that says "ECC" on it too!) Or am I wrong and "CV133" is a Russki marking?

Date: Fri, 27 Jan 2006 17:26:43 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] CV133 vs 6C4

I'm guessing from what little I could find that the CV is Russian or another eastern block designation. I have had good luck with the quality of most ECC marked tubes.....

Date: Fri, 27 Jan 2006 17:02:41 -0800
From: "Dan Merz" <mdmerz@verizon.net>
Subject: RE: [R-390] CV133 vs 6C4

Hi, according to Universal Vade-Mecum, CV133 = 6C4. CV's are British Government types with commercial equivalents. Other listed equivalents are EC90, 6135, CK 6100, CK 6135, L 77, M 8080, QA 2401, and QL 77. Babani's tube encyclopedia also puts CV133 = 6C4.

Date: Fri, 27 Jan 2006 17:40:22 -0500
From: "Bruce Hagen" <b_hagen@sbcglobal.net>
Subject: RE: [R-390] CV133 vs 6C4

FCV133 is a 6C4 but don't know country of origin.

Date: Fri, 27 Jan 2006 23:59:10 -0000
From: "Andy Jackson G8JAC" <g8jac@btinternet.com>

Subject: RE: [R-390] CV133 vs 6C4

Russian? How dare you sir! The CV stands for Common Valve (so not surprising that you guys over there don't recognise it as a "tube")! It is a series of devices approved to a common British specification with, mostly, equivalents in the commercial world. CV133 is indeed, equivalent to a 6C4, A.K.A. in Europe as the EC90. The CV2842 is the equivalent of the 6C4W. CV5183 is the 6C4WA that also meets JAN approval specifications, and CV4058 is a 6C4WA that meets British military secs.

Date: Sun, 29 Jan 2006 11:25:01 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] CV133 vs 6C4

Much much later, I notice that I have a number of JAN-labeled tubes made by Philips in the 80's. Presumably these were made in Europe but I'm guessing they carry only the JAN number because that's the contract they were made under. I wonder whether they made identical tubes but labeled with whatever the CV equivalent is for a 5814A etc. Otherwise most of my mil/industrial numbered tubes seem to be US-made. I think I've got some non-US consumer tubes poking around in my Heathkits and Eicos. Someone once tried to convince me that the euro EC-tube number system (e.g. ECC82) made a lot more sense than our system (filament voltage + letter(s) + number of terminals) but they didn't convince me. Maybe there is a rhyme and reason to the CV numbers but I don't see it.

A website that seems to have a lot of Euro tubes in its index is at
<http://tdsl.duncanamps.com/>

[tubesearch.php](#)

and if I poke around I see CV numbers into the tens of thousands! And I thought our system with "A", "B", "W", "WA" etc suffixes was out of control! In any event they have very good links to hypertext data and often PDF's of the original spec sheet, and when they don't have specs for a specific number they cross-link to sheets for similar tubes.

Date: Sun, 29 Jan 2006 03:28:53 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] CV133 vs 6C4

Well, Cecil, I have to agree with you. The more I look at these CV133's, the more the markings look just a half-step away from Cyrillic. The thick bold lines, the geometric sans-serif typeface, the squares and triangles, all add to the thought. Although to be fair most Euro tubes have those characteristics, and even some US tubes :-). <snip>

Date: Sun, 29 Jan 2006 03:23:14 -0800
From: "ELDIM" <eldim@att.net>
Subject: Re: [R-390] CV133 vs 6C4

That Cecil is sure a funny guy? But true to his convictions! Now on the serious side of an issue close to my heart. ELECTRON TUBES, VACUUM TUBES, VALVES, or what ever name they go by are of interest to me and will always live on. You stirred my interest to dig out some of my custom & specialized manuals to see what they had on the subject. I know they were of UK/Great Britain origin and appear on a lot of my WWII military tube boxes and even later on. I was

surprised that they did not appear in my 1st Edition, August 1950, SECTION 16-820 CATALOG of NAVY MATERIAL, BUREAU of SHIPS SECTION- PART II, titled "ARMED FORCES CROSS INDEX of ELECTRON TUBES" hich was edited & formated by Check Penson WA7ZZE. I also have A GUIDE TO SPECIAL PURPOSE TUBES, published by GRAHAM ELECTRONICS SUPPLY, INC. Copyright 1955, which also has no reference to these designations. My TV-7 Set-Up Booklet, dated OCT 1957 has reference and Settings for a little over two pages of these CV numbers at the end. I'll have to dig into my older manufacturer data books and see what else I can turn up. Lastly, a search of the FEDLOG DATA under "CV" turns up 16 tube types. Till later. KEEP THOSE FILAMENTS LIT! Heading for the the ole homestead soon.

Date: Sun, 29 Jan 2006 17:11:55 -0000
From: "Andy Jackson G8JAC" <g8jac@btinternet.com>
Subject: RE: [R-390] CV133 vs 6C4

5814A = 12AU7 = ECC82 = CV491

5814WA = M8136 = CV4003 = 6189

|>Someone once tried to convince me that the euro EC-tube number system
|>(e.g. ECC82) made a lot more sense than our system (filament voltage +
|>letter(s) + number of terminals) but they didn't convince me. Maybe
|>there is a rhyme and reason to the CV numbers but I don't see it.

E = 6.3v heater

C = Triode

C = second triode

82 Base type (B9A)

There is no logic to CV numbers, and many exceptions to any percieved "rules", but the CV sequence started during WW2 to try and produce a common numbering system for devices used by the Navy, Army, and the RAF, plus other government agencies such as the General Post Office (GPO), all of which used their own numbering systems in addition to those used by US and European manufacturers. CV numbers were also allotted to devices with tighter specifications than normal, ruggedised versions and variations for special purposes. Later, the system expanded to include semiconductors.

<http://www.tubecollector.org/>

will tell you everything you need to know about the CV numbering system and a whole lot more.

Date: Thu, 16 Feb 2006 14:51:33 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] "Fake" 12AX7 tubes on e*pay

I have many "Tesla"/"JJ" (E European) 12AU7A's (actually labeled ECC82, I always thought ECC82 equals 12AU7A's but seeing the subject line maybe you don't think so) and several have already failed with cathode-to-heater shorts in the past couple years. Maybe 30% failure rate. That is not "excellent" in my book,

to me it indicates less-than-stellar manufacturing. It's pretty obvious (from the massive amounts of hum) when the short happens. Maybe I just got a bad batch. And my batch was only 20 tubes. So discount my experience if you wish. I have bought batches of surplus JAN tubes (typically 60's/70's/early 80's) as well and have not experienced this problem with them.

Date: Thu, 16 Feb 2006 18:26:15 -0800 (PST)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Fake 12AX7 tubes- Revised

My train brain got ahead of my thingers on the last post. Here is a listing I saw recently on epay: Tube 12AX7/5751/7025. So here is the problem. They are similar BUT not the same. Here is information I got from the N7JP site, Triode Electronics, and Vacuum Tubes, Inc pages

12AX7 = High-Mu Twin Triode. Amplification Factor 100

5751= High-Mu Dual Triode. Amplification Factor 70

Special-Quality (SQ) Premium Tube. Improved-reliability, trustworthy long-life type.

7025= This type is identical to type 12AX7A except that it has a controlled equivalent noise and hum characteristic. So what tube are you getting? Will the one(s) you get work for your specific application/intent? Since these are at best improperly labeled I stand by my definition of the product.

Date: Fri, 17 Feb 2006 06:06:43 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] "Fake" 12AX7 tubes on e*pay

My personal experience applies only to "small" tubes with close element spacing (e.g. 12AU7's). I've got a few Chinese 6L6 tubes in other equipment and have not yet had a problem.

Date: Fri, 17 Feb 2006 08:59:17 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] "Fake" 12AX7 tubes on e*pay

>...sick to my stomach to think that U.S. made radios would have to revert to
>using SOVIET-SINO tubes.....

I got started in electronics in the 70's and there were a lot of really crappy marginal tubes being sold as "new" at the time through retail drugstores and even TV repair shops too. Rumor at the time was that they came from Japan or South America but many of the brands relabeled everything they sold that it was completely impossible to find out who made them. It's not obvious to me that the Sino-Soviet brands of today are any worse (they're probably better overall). Well, looking through my R-390A's that probably never had anything but mil-spec JAN tubes in them their whole lives I see plenty of heat-damaged plate resistors in them that indicate past possible tube problems. Worst case "cardiac arrest" is probably a short that causes so much current in a transformer or choke and kills it. Resistors and most tubes still seem plentiful enough, and there doesn't seem a lot of dire shortage of most of a 390A's chokes or transformers although I'm certain that there are some that are harder to find than others. Most

(but not all) 390A's have fusing that will prevent the worst many "cardiac arrest - choke fire" cases. (Strangely enough many of the nicer looking ones on E-pay do not have the fusing installed... MARS units that didn't see military use/depot service?)

> p.s. Is Tim trying to give a plug for Triode Electronics?

While I've bought stuff from Triode Electroncis with great success in the past, I am certainly not trying to push them as a source for tubes... I've had pretty good luck getting US/Euro JAN tubes much cheaper at hamfests or even the (I swore I would never talk about it) E-place.

Date: Fri, 17 Feb 2006 09:18:55 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] "Fake" 12AX7 tubes on e*pay

I don't have experience with 6L6 types but I can tell a story about EL34's, or E34L's actually: A friend of mine has a Dynaco Stereo 70 and we retubed it with Tesla E34L's. He had the bottom cover loose and that shorted the bias to one set of tubes. While listening to the thing, he noticed the plates glowing rather strongly red. We don't know how long they's run that way. Immediate shutdown was followed by re-testing of tubes and bias and so on. The tubes tested exactly as they had upon installation and have been running just fine ever since. My suggestion: if you can get any Tesla 6L6GC type tube for affordable prices, do it. Beat the devil out of them and report your experience.

Date: Fri, 17 Feb 2006 07:42:59 -0700
From: "SAM LETZRING" <sletz@msn.com>
Subject: Re: [R-390] "Fake" 12AX7 tubes on e*pay

I needed a couple of 7027's for a couple of old Globe Scout's I'm rebuilding- found some Chinese 6L6GC's cheap and will try them- have some SOvtek also so will do some comparison.

Date: Fri, 17 Feb 2006 10:14:46 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] "Fake" 12AX7 tubes on e*pay

If the plate voltage is high (550 or so) in the Scout, you can expect the Chinese tubes to self destruct. Better get some advice from the guitar guys before you endanger your transmitter. In many guitar amplifier repair shops there is a bucket for burned out transformers and chokes that died from the use of chinese 6L6's and other such tubes. The Chinese 2A3's in audiophile amps that ran near max conditions for genuine UhMurrican tubes were particularly prone to failure. I would trust the Sovtek's more. At least try them first, so that when you fry your power transformer with the Chinese ones you'll at least have had a chance to see how the Sovtek's worked. Your best bet is to use Tesla E34L's (and rewire the socket if needed) if you think the filament supply is up to the increased current draw. Sorry to be pessimistic.

Date: Fri, 17 Feb 2006 10:46:28 EST
From: Radiograveyard@aol.com
Subject: Re: [R-390] "Fake" 12AX7 tubes on e*pay

Hey guys I have a good supply of 6L6's just have to dig them out if there is a

need. Pete

Date: Sat, 18 Feb 2006 11:22:17 -0800 (PST)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Tube plate voltages

>If the plate voltage is high.....expect the Chinese tubes to self destruct.....

The design maximum plate voltage for 6L6's is 375 volts. The design max plate volts for the 12AX7's is 350 volts. If users are at or far above these limits, all bets are off as to country of origin comments. Yeah JAN tubes would take the overload better. I'd like to use JAN 12AX7's if I can find them at a reasonable price. My original post was to point out that on epay auctions, specifically 12AX7's are highly suspect. From reputable dealers it is a whole different story.

Date: Mon, 6 Mar 2006 14:25:36 -0800
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] 6BJ6/6BH6 sub

Affirmative, strong-signal performance will be suboptimal, with increased vulnerability to overload and cross-modulation. If it takes less AGC than normal to achieve a given gain (the case with a 6BH6 sub), then the front end is running hotter than intended, which means it takes less signal to drive them positive.

Your carrier meter will also read low.

The "3D" in your copy of my old post is the tilde character, meaning "approximately". Most of those tubes can't be compared apples-to-apples from the specs, as some are tabulated for a given plate current, others for a given transconductance.

(It would be possible to get closer with many models of transconductance tube tester.) I only meant to list all the ones I could find that would operate, with no implication that they would do well. It seems odd to me that the 6DC6 is less than abundant; it was made for TV's.

Date: Tue, 07 Mar 2006 07:59:06 -0800
From: "Dan Merz" <mdmerz@verizon.net>
Subject: RE: [R-390] 6BJ6/6BH6 sub

Hi all, I'm back with a 6BJ6 in the 390 i.f. in place of the make-do 6BH6 sub that I used for a week or so. Much thanks to the generosity of one of you for sending me what I didn't have on hand.

The radio seemed to operate about the same with either the 6BJ6 or the 6BH6 (i.e. the signal I was listening to sounded the same) but I can't say I explored any extreme situations that might reveal a difference with regard to agc action and front end overload. But I'll accept the conventional wisdom and feel happy that my 390 is now operating more like it was intended to operate, thanks all, Dan.

Date: Tue, 21 Mar 2006 08:13:48 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: [R-390] JAN vs JHS spec tubes, mixer specs, etc.

After buying some 6C4WA's recently, of course I found a huge stash (technically measured as a "metric buttload") of 6C4W's and 6C4WA's in my crawlspace. I probably bought them years ago and forgot about them. That's the nice thing about chronic forgetfulness - every time I look somewhere I don't see everyday,

I'm pleasantly surprised by stuff that I had forgotten it even existed. It's like Christmas year-round, and every day I get a new train set! Anyway, this stash has the traditional mil-spec white boxes, but the tubes (Sylvanias) are labeled twice (once in grey, once in green) and the boxes declare them to be "JHS" instead of "JAN". Can someone remind me what JHS means? If I asked this a few months ago when I last saw these boxes, you can remind me again, it'll be like I never heard the answer first time around! <snip>...

Date: Thu, 23 Mar 2006 07:50:50 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] Random tube sub of the day: 6AU6 for 6BA6

One tube sub I tested: 6AU6 for 6BA6. They are both 7BK base pentodes but the 6BA6 is remote cutoff (more appropriate for AGC action) and the 6AU6 is sharp cutoff. Sticking the 6AU6 into various places in the IF strip resulted in changes in AGC action and carrier level meter. The changes were noticeable but not horrendously bad. I did not tweak the GAIN ADJ for each sub. I only subbed one tube at a time.

What was more surprising was action in the PTO and BFO sockets: no oscillation at all! I had expected the cutoff details to be unimportant there, but I suppose it's possible that the 6AU6 is biased deep into cutoff where the 6BA6 isn't. I have to find a tube equivalent of SPICE or something and start modeling some of the 390A's circuitry. Of course it's probably more fun to stick tubes into sockets and see what happens! I get to stare at computer screens all day at work, why should I think about doing that instead of playing with tubes and solder? I think it's time to break out the tube handbooks and some graph paper. As a boss of mine once told me : "If you don't know how to do it, you don't know how to do it on a computer." I know how to do graphical analysis of operating point and gain vs bias for single stages, but have never really tried it for a huge RF/mixer/mixer/mixer/IF/IF/IF/IF+AGC chain. Is there a tube receiver with more stages than a 390A?

Date: Thu, 23 Mar 2006 08:52:35 -0500
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: Re: [R-390] Random tube sub of the day: 6AU6 for 6BA6

More stages than a 390A?
Yes, the 390 and the 392 have more in the IF.
Cheers de Gord, VE3EOS.

Date: Thu, 23 Mar 2006 14:28:42 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] Random tube sub of the day: 6AU6 for 6BA6

More stages in general?? I have a WRR-2A, it has about 50% more circuitry and tubes than the 390A, more or less. It weighs about 3x as much as a 390 as well.

Date: Mon, 27 Mar 2006 00:43:15 -0500
From: "Drew Papanek" <drewmaster813@hotmail.com>

Subject: RE: [R-390] Random tube sub of the day: 6AU6 for 6BA6

>Sticking the 6AU6 into various places in the IF strip resulted in changes in AGC
>action.... <snip>

Since there are a multiplicity of gain-controlled stages, losing control in just one stage (as by substituting a sharp cutoff tube for the original variable mu tube) would have mostly minor effect. AGC is applied to the R-390A's mixer stages; some have written on the topic of the receiver's oscillator frequencies being pulled by reflected capacitance changes at the mixer cathodes induced by AGC. If such be the case, less pulling could be had by removing AGC from the mixers. Makes me wonder if less pulling combined with less AGC control would be a worthwhile tradeoff. The Final Engineering Report (Cost Reduction version) mentions that AGC was added to the R-390A's mixer stages to compensate for AGC control lost by having one less RF stage and a couple less IF stages (as part of transforming the R-390 into the R-390A). Is all that AGC control range necessary in our applications? 'Tis interesting that a few folks have found R-390A's with the third mixer stage modified to use a 6BE6. The 6BE6 pentagrid mixer would offer superior isolation from AGC-induced capacitance changes as compared to the original 6C4 triode mixer. The 6BE6 would also be vastly inferior to the 6C4 in terms of resistance to overload, and would be far, far noisier. (The accounts I have read all mentioned reversing the modification).

>.....action in the PTO and BFO sockets: no oscillation at all! <snip>

Interesting. One SSB conversion I read about recommends swapping the 6BA6 BFO tube with a 6AU6 to obtain increased BFO signal amplitude. Maybe your 6AU6 has low transconductance?

Date: Mon, 3 Apr 2006 10:25:22 -0700 (PDT)
From: "KC8OPP Roger S." <kc8opp@yahoo.com>
Subject: Re: [R-390] power tube removal

> Hello all, I am working on some amplifiers that use 4CX250B
> style Eimac tubes, they are in a socket at the bottom of a deep chimney and are almost impossible to remove without grabbing the top with pliers which chews it up. my question is does anyone know of a good way to get them out or is there a tool maybe something like snap ring pliers with flat tongs that slide down between the fins??? and if so where in the world can I get a pair??

I have a tool here made with the Eimac logo on one leg, that is called a "Tube Extractor". Built like reverse tweezers with notches on outside of each leg that fits the outer ring of the tubes. Overall it is about 5 inches tall, made with 3/16 inch wide strap of SS. Squeeze it together and work it through the fins until the notches snap in place then "Extract" the tube. Works great! but only have the one. Good Luck
Roger KC8OPP

Date: Tue, 18 Apr 2006 23:29:18 -0400
From: David Drew <k3dxlab@comcast.net>
Subject: [R-390] 6C4? 6C4W? 6C4WA?

I could use guidance from the group regarding which version of the 6C4 is best to use in the R-390A. The R390A FAQ says, "Three 6C4WA tubes are used in the R-390A. The 6C4WA designation is for the ruggedized version of the 6C4, a medium-mu triode. The 6C4W tube WILL NOT work as a replacement for the

6C4WA in the R-390A. The 6C4 will work as a replacement, but sometimes not quite as well as the 6C4WA."

Now, in the Y2K R-390A Technical Reference, there are many references to the 6C4. There is one reference to the JAN-6C4W in the parts list. And there are NO references to the 6C4WA. The 6C4 is commonly available for \$3 NOS. The 6C4WA seems to bring \$5 NOS/NIB.

Even more surprising, my 1964 edition of the RCA Receiving Tube Manual lists the 6C4 as a power triode, used as a LO and a class-C power amplifier. I wonder what the designers were thinking when they chose the 6C4 for mixer service in the R390A? Immunity to overload? Low noise?

I also looked in Bud Tomer's 1960 "Getting the Most Out of Vacuum Tubes." He mentions the "W" suffix for ruggedization, but doesn't say that a W-type would be better in other ways. There isn't much vibration in my shack! The Army's "Basic Theory and Application of Electron Tubes" wasn't any help, either.

In the end, I believe in the collective wisdom and experience of the FAQ. Still, for me, part of the fun of using these wonderful old receivers is learning more about them. Why is the WA the best, and the W, the worst?

Date: Wed, 19 Apr 2006 07:56:41 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] 6C4? 6C4W? 6C4WA?

My personal experience: I've got bunches of 6C4's, 6C4W's, and 6C4WA's. I believe the technical quantification is "metric buttload". Modulo small changes in IF/RF gain balance, I see zero functional difference between them. I'm not going to claim they all have the same noise figure etc. but the "WILL NOT WORK" quote is entirely off-target.

The CV133 and EC90's are equivalent to 6C4's too.

> The 6C4 is commonly available for \$3 NOS. The 6C4WA seems to bring \$5 NOS/NIB.

Those are "asking prices". I often see large lots of all three varieties going for less than \$1 a tube. The military surplused large lots of JAN 6C4 varieties in the past couple decades and I don't think we're in any shortage of them.

> Even more surprising, my 1964 edition of the RCA Receiving Tube Manual
> lists the 6C4 as a power triode, used as a LO and a class-C power amplifier.
> I wonder what the designers were thinking when they chose the 6C4 for mixer
> service in the R390A? Immunity to overload? Low noise?

The 6C4 is simply a very common "jellybean" triode. If you think of it as half of a 12AU7A, you are exactly on target. "Power triode" is a bit of an exaggeration, it's no 3-500Z, but it has plenty of plate dissipation for receiver and driver use. I have noted that all the mixer circuits in a 390A use identical DC operation points. The repetition is almost enchanting. I still want to analyze the circuit in terms of conversion efficiency vs AGC voltage, but I don't think that any single mixer stage has a whole lot of gain in typical use. It is vaguely possible that in some RF uses parasitics might affect a 6C4W differently than a WA. Someone here was kind enough to point out the degeneration resistor in the 390A's mixer

stages, and I think that this will swamp all such differences.

Like any technical data source, even the "FAQ" and "Y2K" manuals are full of statements that are simply wrong. Don't get too worked up about any single one.

Date: Wed, 19 Apr 2006 08:22:29 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] 6C4? 6C4W? 6C4WA?

As long as we're talking about 6C4 types, I see in the mailing list archives a note from many years ago about the 6C4A being "Bad". As far as I can figure out, the 6C4A is a transliteration from a Russian tube type that is also a general purpose triode, but with a rather different pinout. The tube itself is not marked 6C4A but the Cyrillic letters are sometimes transliterated that way (I can't type Cyrillic but what is supposedly a C looks more like a greek mu, and the A is more like a greek pi, sometimes this is transliterated into a "P"). These have shown up on Ebay from the well-known Ukrainian sellers and there they note that they are not the same base as 6C4's! It's vaguely possible that the FAQ has applied yet another layer of indirection on this.

Date: 19 Apr 2006 13:24:54 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: Re: [R-390] Low sensitivity on 7-8 Mhz band

I think that was Mr. Chuck Rippel.

<http://www.r390a.com/Commonfail.htm#I%20was%20finishing>

Date: Wed, 19 Apr 2006 08:42:13 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] 6C4? 6C4W? 6C4WA?

I just Googled around and found lots of references to "6C4P" (6S4P was more common however) but no 6C4A. I'm not ruling out that transliteration, but I didn't see anyone using it. In any case, if someone plugs one in in place of an American-numbered 6C4, they will be disappointed. The numbering systems have nothing to do with each other and any resemblance is a coincidence.

Date: Wed, 19 Apr 2006 17:47:29 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] 6C4? 6C4W? 6C4WA?

Another numbering gotcha: 6CW4 might conceivably be confused with 6C4W. But it won't even come close to fitting in the socket!!! But rather than guess what typos somebody else may have made, this afternoon when I got home I put in three 6C4W's and the radio works just fine (even bumping up against some of my local AM BCB intermod sources) with nearly identical S-meter reading (1 to 2 db higher) than the few-months-installed (and 50 year old) 6C4's I had in there. So my uneducated but empirical conclusion: whoever wrote that 6C4W's won't work was obviously mistaken.

Date: Wed, 19 Apr 2006 18:03:22 -0400
From: "WF2U" <wf2u@starband.net>
Subject: RE: [R-390] 6C4? 6C4W? 6C4WA?

The Russian 6C4P is equivalent to European EZ80 and US 6V4 dual rectifier.

Date: Wed, 19 Apr 2006 22:11:33 +0000
From: odyslim@comcast.net
Subject: Re: [R-390] 6C4? 6C4W? 6C4WA?

I have a few different manuals. The oldest states "no substitutions". W WA or whatever. the newer manual which is dated April 1970 does not mention the tube substitution and has the correct tube listed as 6C4W.

Date: Fri, 21 Apr 2006 12:29:39 -0400
From: David Drew <k3dxlab@comcast.net>
Subject: [R-390] Re: 6C4? 6C4W? 6C4WA?

Thanks for the advice on the 6C4 mixers. Now I can stop losing sleep over it! :-) I only have 6C4's - no W's or WA's. Tim's quick test was very interesting. I have not yet seen 6C4WA's for under \$5 in small quantities.

Date: Fri, 21 Apr 2006 12:45:32 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Re: 6C4? 6C4W? 6C4WA?

Most of the 6C4's, 6C4W's, 6C4WA's that I have bought in the past couple years, I'm sure I paid less than \$1 each for. Most all in JAN packaging (I do have a few sleeves of consumer, mostly RCA, 6C4's that aren't JAN.)

I do occasionally forget about what I already have and "accidentally" buy some more. My wife isn't so sure it's accidental, but... Street price from EXPENSIVE tube distributors (e.g. Antique Electronic Supply) has 6C4's for \$3.50, 6C4WA's for \$4.50, etc. There are a number of individuals that sell NOS tubes for even lower prices but largely they are not on the web.

Mostly E-bay prices for tubes are a factor of 30%-200% above the EXPENSIVE tube distributors and are even higher compared to hamfest prices, unless you happen across a large lot etc. It boggles the mind that people will competitively bid up prices to a factor of several beyond what you can buy them off the shelf for elsewhere.

Date: Fri, 21 Apr 2006 13:52:44 -0400
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] Re: 6C4? 6C4W? 6C4WA?

I wish we had hamfests in Florida like you seem to have. Tube prices at local hamfests are astronomical. I have had very good success by selective bidding on eBay.

On the other hand I have had good success in selling audiophile type tubes on eBay at what I consider prices so high as to be completely unimaginable.

Date: Fri, 21 Apr 2006 14:30:48 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: RE: [R-390] Re: 6C4? 6C4W? 6C4WA?

For better or worse my memories are a mix of the best of what I've seen, the worst of what I've seen, and what I wanted to see but didn't actually see :-). A

couple of times I've convinced myself that my stockpiling of tubes/parts/etc. in advance of need is economically nonsense. It would make far more sense to have say one spare of each tube, and then replenish as I actually use them. But that's not what I do! Perhaps I was stung too bad in the late 70's and early 80's as the list prices for pretty crappy tubes at the drugstore and local TV repair shops soared to stratospheric heights. (I remember paying \$12 for a 6AU6 and \$15 for a 6CL6, for example, because I needed them for my rig and otherwise I was simply off the air. And that was serious money for a cash-strapped kid back then.). By comparison today I can get good JAN tubes most of the time for less than a tenth the price I had to pay back then on my "buy only as needed" philosophy. Probably induces hoarding behavior.

Date: Sat, 22 Apr 2006 10:27:12 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] Test: 6DK6 sub for 6DC6

I got a bunch of 6DK6's for my Tek scopes, and thought as long as I was bringing them up to speed that I'd drop one in to the 6DC6 socket of my 390A and see what happens. Note: this is a quick 5-minute test. No other part subs, not even zeroing the S-Meter or setting IF/RF gain balance.

Two obvious things: S-Meter reading approximately doubled on fairly strong BC and SW stations. e.g. 60 DB readings before the sub resulted in pegging the meter after the sub, 20 DB readings before became 40 DB readings after, etc. AND the zero-point setting of the meter went way off to the left. Without seeing the actual tube curves, I'm guessing this means that for the same "strong signal" AGC voltage, the 6DK6 has a lot more gain. And that maybe at "weak signal" AGC voltage, the 6DK6 has less gain? (Not so sure about the second conclusion.) This seems inconsistent with what a sharper-cutoff pentode should do but I never claimed to have a deep understanding of AGC system balance and design! In any event there was no rebalancing of gain so making heads or tails of S-meter readings is probably impossible. Two more obvious things: Intermod of the local blowtorch AM station in my backyard was now EVERYWHERE, when it never occurred with the 6DC6. And AGC action seemed to mostly work, at least on AM modulation. On CW the AGC action seemed oddly out of kilter, like it wasn't kicking in fast enough even on the SLOW setting. I did not have enough time with the tube in to evaluate anything resembling weak-signal performance. With that intermod it would've been hard anyway. OK, that's enough with messing with Art's tube choices for the day :-).

Date: Sat, 22 Apr 2006 10:44:46 -0400
From: "WA0HQQ" <r390@al.tirevold.name>
Subject: [R-390] 6C4 versus "W" and "WA"

Since I needed to pull my R-390A for some other work, I decided to duplicate Tim Shoppa's findings on the performance of 6C4 versus W and WA. After 3-4 hours of tube swapping, hot fingers and careful measurements, I see similar results to Tim's. The "will not work" reference will come off of the FAQ web site. I checked back to the source and it had been around for a while - traced to a 1950's R-390A manual reference. As far as the 'the "FAQ" and "Y2K" manuals are full of statements that are simply wrong' accusation in a previous posting - I say 'put up or shut up' - if you have knowledge of factual errors in either, please share them with the group and me, so they can get corrected. They will not get fixed unless you provide data instead of rhetoric.

Date: Sat, 22 Apr 2006 17:39:59 -0500

From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] Re: 6C4? 6C4W? 6C4WA?

I'm like Tim, I don't think I've seen any difference between the different flavors of 6C4 in any of my radios. All seem to work just fine.

Date: Sun, 23 Apr 2006 08:32:27 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] Re: 6C4? 6C4W? 6C4WA?

All the 6C4's are used as mixers. Triode mixer performance is strongly dependent on:

1. Local oscillator injection strength
2. Gain of the triode
3. The way the gain changes depending on LO strength
- 4: noise figure

Most of these come in a non-linear way - for example for marginal LO injection a small 20% change in LO strength can correspond to a 40% (or sometimes more) change in conversion efficiency. For weak-signal work, also important is number 4: noise figure. So potentially 3 of the factors depend on the tube. One of the factors depends on LO strength.

Also: In both my RF decks, many of the carbon comp resistors had drifted way off in value in many stages, including the mixer. The 2.2K 1/2W units were the worst, and note that each and every mixer stage has TWO of these. These being off directly ties into factors (2) and (3) above. I did not do any before/after measurements but after replacing the resistors and realigning I know the deck was way way way more "peppy" in performance.

And one obvious difference I've noticed between 6C4's: Their height! Sylvania 6C4W's are the shortest, almost as small as the 6AK5W's elsewhere in the radio. Non-JAN 6C4's are the largest, in my stash I have both GE and RCA's that are tall.

I also have some Brit CV-133's that are tall too. I have not noticed any obvious difference in performance in real on-the-air listening with the different sizes/brands. Someone who lived in a low QRN/QRM environment might have a different conclusion though. Even though I claim no detailed measurements, if I pull the RF Amp tube and go through different 6C4 varieties in different sockets, I can hear differences in noise. For somebody who lived on a remote Pacific island I could see these differences being important and obvious in daily use. Difference between tall and short tubes:

The short 6C4W's are Sylvania's, and have the same basic construction on the bottom of the tube as the taller 6C4WA's from Sylvania, but on top the tall 6C4WA's are much more elaborate, with an extra insulator and a substantially more elaborate getter structure. The consumer 6C4's and the CV-133's have their base triode structure much more elongated. As for date codes: Most of my JAN 6C4's are July 1945 National Unions.

Most of my 6C4W's are Sylvania's with 6-62 date codes, and my 6C4WA's are 7-62 Sylvania's. Note that I am NOT CLAIMING that I have two months worth of Sylvania's tube plant production in my basement. No sir! I will deny any claims

that I have all those tubes, and I am STICKING TO MY STORY! OK, I think I set
the record for most attention to triode brands
Tim. EVER.

Date: Sun, 23 Apr 2006 13:27:41 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Re: 6C4? 6C4W? 6C4WA?

I have found any and all 6C4 of any variety that would test OK in a tube tester would work in and R390 or R390/A. But as you say "Of course, there are other factors to take into consideration besides the tubes suffix. Such as Manufacturer and Date of Manufacture, etc."

Once you get past the tube works and you go on to signal to noise and receiver sensitive all bets from the tube tester results are off. I have tubes with good high tube tester reading that are very noisy in the circuits of the receivers. Likewise a low reading is no clue to tube noise either. First find tubes that test good in the tube tester as there is no reason to burn out R390 resistors as a means of checking tubes for shorts. Then as higher reading tubes in the tube tester are thought to be better tubes, start subbing them into a circuit and measure the signal to noise. Start comparing the tubes you own in the same circuit. Consider the signal to noise ratio. You can adjust the final receiver gain in several stages. Pick from the tubes you have in hand the best one as rated on signal to noise ratio. Put the best one forward in the circuit. Different tubes from the same manufacture have whole ranges of signal to noise. I have new tubes with very bad signal to noise. I have brought known pulls and used tubes at swap meets and found some to be better than new tubes. Not all and not everyone. But I cannot tell a good tube by looking at the item.

6C4 are not the only tube in this class. Every tube in the R390's come in the full range of noise flavors. Every tube circuit in the receiver will benefit from tube selection on the signal to noise test. Some circuits in the receiver (forward circuits) provide a better place to test tubes than other circuits (back end) but always rank all the tubes. Install the bet you have and place the best ones forward.

If you do not own enough tubes to do signal to noise testing and own enough good tubes so that you do not need to think about which circuit to place the tubes into you do not own enough tubes. You will just have to listen to what you own until you find some more good tubes. Real life is that you will likely buy more bad tubes before you find more good tubes.

I have purchased brand new tubes that had more noise than the tubes I already had. Going off to the store is no sure bet that you will come home with a better tube. So a good many folks not knowing the variation of tubes from manufactures, dates and batches have found a good tube marked as and a bad tube marked as and just declared all tube marked as are not as good as the other flavor. In fact it was just two random of 12 random tubes compared and a declaration made. Another run from the same manufactures may have completely different results.

Back in the 68 - 75 era I would get new JAN tubes out of supply and find bad tubes. Likely if we found a new tube to be noisy, every thing we had in stock would also be from the same production run and also bad. Life was hell then.

You just could not toss 20 tubes in the trash and ask for more. There was no way to send them back. We had to find a circuit to use them in where we could get enough good tubes around then to make the receiver pass minimum acceptable tests. Other than 6DC6's you can like with a noisy tube type some where in the receiver.
Roger.

Date: Sun, 23 Apr 2006 13:52:42 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Re: 6C4? 6C4W? 6C4WA?

I like Tim's following points: All the 6C4's are used as mixers. <snip>

Once you down to differences you cannot hear you can still measure smaller differences with test equipment and meters. Just look at all the factors Tim listed. There is no substitution for placing a tube in a circuit and measuring the output. Who knows exactly where the resistor values in your receiver circuit will bias a tube.

Who knows where a tube will fall on its performance curve. No substitution for lots of tube substitution in the circuit to find the one tube that best fits the circuit from a signal to noise perspective. Does Tim have a batch of tubes from one source that behave a lot better than other tubes? I can believe he sure does. What do we know from all of this. Tim has found some good tubes and some not so good tubes. What can we take away from this? Our mileage may vary. Our choice is to keep buying and testing what we find.

Date: Sun, 23 Apr 2006 15:22:02 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Re: 6C4? 6C4W? 6C4WA?

I seem to remember a thread some years ago about the 6C4 and it being best if the tube is not too "hot" -- as if a mediocre-reading (middling, not weak) tube was the better choice -- or one that had been worn in elsewhere. I don't recall if it got into s/n ratio or whatever. Anybody else remember that one?

Date: Sun, 23 Apr 2006 15:44:09 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] Re: 6C4? 6C4W? 6C4WA?

I believe that argument is most often invoked for the 6BA6W/5749 in the PTO. There the argument is that constant emission/mu there is most relevant for long term stability, with some hints that "hot" high emission/high gain tubes may actually be more likely to have their gain depend on other voltages/circuit elements/have their gain change more rapidly over time as the tube breaks in.

Contrast this with classical oscillator theory where high gain is used as a Q-multiplier. That works well for Meecham bridges but for better or worse the 390A oscillators are not so idealized! Me, I use 12BA6's that probably saw many years of use in AA5 sets :-). One of my summertime projects may be measurements of PTO and the three crystal oscillators for frequency changes as a function of AC line voltage/AGC voltage/PTO filament currents etc. After a burst of Cosmos PTO activities a few months ago I am a little burnt out with frequency measurements at the moment, though :-).

Date: Sun, 23 Apr 2006 16:11:53 -0400

From: "Joel Richey" <richey2@mindspring.com>
Subject: [R-390] 6CW4

Gentleman Its a triode, it aint nothing more or less, on and on you go, I don't care what letters follow the number, its still a triode, good grief, stop the nonsense. A 6w4 is a simple triode and all the letteres after it makes it more "rugged" .. BS"

Date: Sun, 23 Apr 2006 15:50:26 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] 6C4-The Final Horse Beating?

Roger nailed it on tube peculiarities and selection. More could be added about tube production and lot swapping among manufactures but let's get this vampire horse wooden staked in the heart, garlands of garlic placed around its neck, and buried in a mirrored coffin. Then we can wind down our pacemakers until the next knicker-twister issue or sheep arrives. (If we don't, this could go n as long as the ballast tube comments. HiHi) The following note is being added to Chapter 7 Parts List Revision.

Note 10: There is a severe error in the 1956 Army R390-A manual. It says not to substitute type 6C4W for a 6C4. It stated that the differences in characteristics are such that the type 6C4W will not operate properly in the receiver. This is wrong. Navships 1970 manual lists the 6C4W as the tube to use. The "W" and "WA" postscript designations refer to mechanical ruggedization specifications. Cross-checking of tube reference data bases confirm that the electrical specifications of all types are identical. A 'ruggedized' or "Industrial" equivalent are types 6100 and 6135 among others. All versions will work properly. Some may be quieter or last longer. See Chapter 9 supplement for additional tube information.

Date: Sun, 23 Apr 2006 19:40:08 -0700
From: "Ed Zeranski" <ezeran@ezeran.cnc.net>
Subject: RE: [R-390] 6C4-The Final Horse Beating?

<snip>.... I've had several 'sticks' of new RCA 6C4s that developed fil-cathode type leakage where the noise got worse as signal strength increased. It wasn't the whole stick but 2 or 3 tubes out of 5, still a high count. The first time it popped up was the OSC in an HQ-170-VHF. The 6C4s were boxed-NOS given to me from a friends pile as thanks for re-working a Valiant.

Date: Mon, 24 Apr 2006 12:53:54 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Re: 6C4? 6C4W? 6C4WA?

Yes, A lot of tubes get better with use. Or not as noisy. I do not know why but it was that way when I was doing it 8 hours plus a day.

Date: Mon, 24 Apr 2006 14:21:59 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] 6C4

> > I have a National RAO-2 that turned up with a slightly broken
> 6C8G -- where the "G" is probably for "glass", but could be "George", who
> knows. Anyhow, the thing is broken at the cap - small hole let that elusive

> vacuum escape. I see on that tube substitution web site that the 6F8G is a
> possible sub.

It definitely won't smoke, but while the 6F8 and 6C8 are both dual triodes, with identical pinouts, they are different mu and so on. ISTR that the limiter side is used as a diode; that's hard to do wrong. The other side (2nd detector) might give you insensitivity or distortion. It's wired in a so-called "infinite impedance" circuit, a cathode follower biased near cutoff. The positive half-cycles bring it out. High mu is important here, and the 6F8 is a medium. But it will probably run well enough to keep you entertained while you dig up a 6C8.

Date: Thu, 27 Apr 2006 05:32:41 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] Russki 6AK5W equivs on E-bay

I bought a bunch of Russki "6AK5W/5749"s on E-bay for twelve cents each. The tube number in quotes because the tubes don't even have Cyrillic markings that I can decipher. They certainly aren't "real" 6AK5W's - way too tall (like 2", even taller than a 6BA6 and at least half an inch taller than real 6AK5's) to the point where if I stick one in my 390A's crystal oscillator, I can no longer put the lid on the 390A!

The seller is British but the tubes actually ship from Ukraine. No indication on the auction that these aren't real tubes or that they're Russki tubes, but hey, I guess I should've known better than to buy from an auction that states repeatedly in the title and body that these are 6AK5W's/5749's. They do seem to mostly work when I stick them in and in fact the S-meter readings go up very slightly. My guess is that the operating point of these Russki pentodes is different than a real 6AK5W. Casting about on the websites I have not seen any details about Russki 6AK5 equivalents. Physically what I can see inside looks more like a 6AU6 with the 7BD (instead of 7BK) base. (Not that those bases are very different anyway.) Oh, well, I've no shortage of real JAN 5749's, so it's just a (monetarily cheap) lesson learned. I've had a lot of fun reliving my childhood and getting tubes on E-bay that seem to be in every way identical to the ones stacked up at hamfests from when I was a kid but I could barely afford at the time, and I'm not going to stop because of one rotten apple :-).

Date: Fri, 28 Apr 2006 17:58:33 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: [R-390] More senseless tube subs

More randomly senseless pentode subs: 6AK5W's work in many places where 6BA6's are supposed to be. AGC action a bit messed up in some spots. S-meter mostly reads higher. A 6BA6 in the crystal oscillator chassis mostly works. Output seems low, oscillator sort-of works on most but not all bands.

A 6BA6 in the 17Mc oscillator's 6AK5W socket didn't work at all.

6AK6's work in many places where 6BA6's are supposed to be. AGC action a bit messed up. 6AK6's work in the crystal oscillator 6AK5W but not the 17MC osc 6AK5W socket.

6BA6's in the 6AK6 sockets sort-of work, in the IF output the result is soft and mushy, and the audio amp it sounds pretty crappy (probably not in class A anymore!)

Tomorrow's senseless sub: 6C4 in a 3-500Z socket. Where DO I keep that adapter?

Date: Sun, 28 May 2006 12:55:26 -0400
From: "Dave Maples" <dsmuples@comcast.net>
Subject: [R-390] Cleaning tube sockets

All: As is always the case, this group is absolutely invaluable in their insight. I've got another question. I am repairing another R-390A for another fellow, and have run into TWO tube sockets in the IF deck that seem to have "intermittent" pins. Everything is soldered; the receiver has sat for so long unattended, though, that the pins themselves seem to have oxidized. Suggestions? Is there something I can use to gently clean the contacts in the tube sockets?

Date: Sun, 28 May 2006 14:21:55 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Cleaning tube sockets

If you haven't done so already -- freshen up the solder joints on all the pins on that socket. The solder can look good on the outside, but the joint may have impurities on the inside -- which I learned on this list can result in very long term degradation. (i.e. was not a cold solder joint to start with)

If it's the pins themselves, good ol' Deoxit is the thing to try first. Put a few drops of D5 in the socket terminals and coat the tube pins -- then insert/remove a few times and see if that cures it.

The terminals may have lost their grip - - often due to from pluggin in tubes with bent pins. (Never use a socket as a pin straightener.) You can try either using something like a dental pick to coax the terminal closed a bit -- or an old TV-tube jockey's trick -- bend the two pins on the tube a bit to establish contact. All that fails -- it's socket replacement time.

Date: Thu, 8 Jun 2006 22:28:06 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Tube questions

Has anyone used the 7788 tube in a front end of a R390 or SP600 or other HF receiver? (Yeah, I know it's a nine pin.) If so, how did it work out?? Does anyone want to sell some at less than ebay prices? I know they are good tubes as Tek used them in their scopes. Has anyone subbed the 6BY6 for the 6BE6 mixer? If so, how did it work out?

Date: Fri, 09 Jun 2006 08:06:02 -0700
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] Tube questions

The 7788 is a SHARP cutoff pentode. I can see why you like it - the transconductance is quite high. In fact, I don't think I have seen transconductance so high. But, that notwithstanding, it shuts off at a grid voltage of -2 to -5 volts.

The 6BA6 shuts off at -40 volts. The 6DC6 shuts off at somewhere in between. If you substitute the 7788 for either of those, it will mess up the entire AGC system.

Every time I have ever tried this kind of thing, I have regretted it - it generally results in distortion on strong signals (because the tube is running very close to shutoff, and with a strong signal, it will go into shutoff for the negative-going part of the input waveform, resulting in audio distortion).

As for the 6BY6, it looks similar enough to the 6BE6 that I don't think you will notice any difference. Again, they have somewhat different grid 1 voltage ranges which could produce some saturation problems on the SP-600 receivers that inject the AGC voltage into the first grids of the second mixer tubes - some models do this, such as the JX21 and JX26.

The tubes are similar enough so that I don't know that there will actually be any audible difference one way or the other. I don't see that it could do anything particularly good (unless you happen to be out of 6BE6 tubes).

Date: Fri, 09 Jun 2006 09:25:07 -0700
From: "Kenneth G. Gordon" <kgordon2006@verizon.net>
Subject: Re: [R-390] Tube questions

Although I have not tried this, I HAVE subbed a 6SB7Y for a 12SA7 in an S-41G. The 6SB7Y has about the same conversion transconductance as the 6BY6, as I remember it. In the S-41G it made a tremendous difference in sensitivity, since that receiver is essentially the predecessor to the S-38 and the circuits are essentially identical. There is no RF stage.

In the R-390 I would suspect that substitution of the 6BY6 for a 6BE6 would make very little difference since Collins designed the R-390 so that any noise or lack of sensitivity due to the mixer stage was compensated for in other ways. I would suppose that there would be a marginally lower noise figure, since the RF amp stage(s) is what mostly sets that parameter. YMMV.

Oh. I might mention that in order to sub the 6SB7Y for the 12SA7 in my S-41G, I had to :

- 1) install a small filament transformer, and
- 2) substitute tubes with different filament voltages for a couple of the remaining tubes to make the filament string come out to 120 VAC.

Date: Fri, 16 Jun 2006 14:47:25 -0500
From: "K3PID" <k3pid@sbcglobal.net>
Subject: Re: [R-390] Need 26A7GT tube for R-392

tubesandmore.com has it listed for \$7.10

Date: Fri, 23 Jun 2006 23:56:50 -0400
From: Scott Bauer <odyslim@comcast.net>
Subject: [R-390] Interesting tube manufacture

Im sitting here listening to a little military chit-chat and going through some tubes. Just when you thought you have seen them all, something new comes along. A JAN 6AL5 packed in 1953 made by AC Spark Plug in Flint MI. To bad the original tube was not inside. I would have liked to see it.

Date: Sat, 08 Jul 2006 00:06:21 -0400
From: Scott Bauer <odyslim@comcast.net>

Subject: [R-390] 5814A/ 6C4 tube placement

I wonder if there is any particular circuit in the 390 or 390-A that would benefit from using a triple mica / dual support rod version of the 5814A? I have read that 6C4's can be very micro-phonetic and a triple mica type would be very helpful in the R390 and 390-A. Also, has anybody noticed any difference using 6189's rather than 5814a's or 12AU7's?

Date: Fri, 7 Jul 2006 22:28:29 -0700
From: "Ed Zeranski" <ezeran@ezeran.cnc.net>
Subject: RE: [R-390] 5814A/ 6C4 tube placement

I have read that 6C4's can be very micro-phonetic Not sure how it relates to R390s but I had several brand new (NIB) 6C4s used in osc ckts that had cathode/fil leakage causing noise under strong sig conditions in Hammarlund communications receivers. Not mixer but osc circuits in my HQ-170AVHF and the 6C4s were from new sticks of tubes.

Date: Sat, 08 Jul 2006 21:37:00 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] 5814A/ 6C4 tube placement

The one place where tube quality can make the radio be lousy in these tubes is if there is excessive grid leakage current, which can mess up AGC action in really mystifying ways. Several 6C4's and 5814A's in the 390A fall into this category. While I have destroyed many leaky tubes with a vengeance I cannot say that I have seen a pattern among 6C4's/5814A-alikes. It is possible that supports/mica/etc. details can contribute to gassy tubes in some circumstances I suppose.

My preference is to use sturdier examples rather than flimsier examples and I suppose that more supports inside the tube make them on the sturdier side. I have shared my experience with E European 12AU7-alikes being much much less than sturdy in the past here. Nor have I noticed microphonics being bothersome. Usually it's the 390A causing microphonics by being dropped, rather than it being a victim :-).

Date: Sat, 08 Jul 2006 21:47:05 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] 5814A/ 6C4 tube placement

> Not sure how it relates to R390s but I had several brand new (NIB) 6C4s used
> in osc ckts that had cathode/fil leakage causing noise under strong sig <snip>

Was there something odd about the Hammarlund oscillators using a high cathode-to-filament potential? In simple oscillator implementations it's just a few volts difference for grid bias BUT sometimes they do funny tricks like putting cathode followers in there or putting a very large resistor (same size as the plate resistor) in the cathode to pick off a signal of opposite phase without using a transformer, and in those cases you can end up with 70 or 100V real easy (and that is pushing the limits of the spec.)

Speaking of which the 390A has a remarkable lack of buffer stages between oscillators and mixers. I have not yet tracked down which oscillator seems to pull under CW reception strong AGC action.

Date: Fri, 21 Jul 2006 10:27:38 -0400
From: Scott Bauer <odyslim@comcast.net>
Subject: [R-390] microphonic 5749W

FYI, I have been using 5749W's made by Phillips on a 1986 contract. I have 100+ and am having micro-phonic problems with them in the PTO and a couple spots on the R-390A IF strip. They work fine for the first 20 or 30 hours then go micro-phonic. These are the tubes with Phillips written in blue ink. If you should see these at a hamfest, don't buy them.

Date: Fri, 21 Jul 2006 09:48:26 -0700 (MST)
From: Richard Loken <richardlo@admin.athabascau.ca>
Subject: Re: [R-390] microphonic 5749W
To: Scott Bauer <odyslim@comcast.net>

Is that what the say on them? "Phillips"? I ask because Philips AG of Holland has one 'L' in the name.

Date: Sat, 22 Jul 2006 14:17:36 -0400
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] microphonic 5749W

I have many of these (along with lots of other JAN 6BA6's/5749W's) I think and I have never really noticed microphonic problems. I'm starting to think that you're much more picky than me :-).

Mine say "JAN 5749W Philips ECG 34167 USA" with stamps like "8726 ADE for date and ?plant?" etc, blue lettering. They often show up at hamfests etc.

Date: Fri, 25 Aug 2006 13:34:31 -0500
From: "Dave Merrill" <r390a.urr@gmail.com>
Subject: [R-390] Re: [Boatanchors] WANTED: 26C6 Tubes for R392

Contact Lowell Thomas <k6kc@lightspeed.net>
Earlier this year he had some NOS 26C6s at reasonable prices.

Date: Sun, 10 Sep 2006 10:53:26 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Tube Substitutes

<snip> >.....has anyone tried using 6BH6 tubes in the 390 in place of the 6BJ6? .

The 6BH6 will operate. They will change the noise floor. Use them if you have them they are better than not having a working receiver. There are a lot of tubes that can be substituted into the receivers. Most of the other stages have so much filtering and signal gain over noise that a tube here or there will not degrade performance. If you do not get too many odd tubes into the receiver it will operate well. I have not found a wonder tube that just gives a better performance than the stock tubes. Back in 1973 in Okinawa we tried just about every tube we could get. We found a lot of tubes would work. Nothing popped up that we wanted to submit the paper work on for a suggestion award. We had about 60 technicians and several hundred receivers. We were keeping logs and doing

serious alignment and signal to noise test for comparisons. There was prize money at stake. Most of our operators run with manual AGC so sharp and remote cut off pentodes did not cause grief. Mostly it was over all signal to noise ratio. Lots of things worked well at single signal on the bench with a generator but had lots of noise with a real antenna from mixing of many signals in the band pass.

There are a lot of tubes that will work well. I have never plugged a tube in with the correct base match and had the smoke come out. You need to look under the deck at the actual solder connections. You will find that tubes with the screen and cathode tied together may or may not work depending on how the tie is made either in the tube or under the deck. You find only one pin soldered on the socket and the tube makes up the connection. If you get under the deck and make up the other pin, a bunch more tubes can be used in the socket.

Fellows have found tubes really very in performance. You may do a signal to noise and swap in a different tube type and do a signal to noise and go wonderful I found a super new substitute. It turns out you are just comparing a poor tube with a different good tube. Once you get two good tubes the difference is not there. We find whole batches of good and bad tubes of every type. Get out the tube manual to look at base diagrams and use what you have where you can. The quest for the best set of tubes in any receiver never ends. That is part of Amateur and Boatanchor Radio. Roger AI4NI

Date: Sun, 10 Sep 2006 15:10:04 -0400
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] Tube Substitutes

You can't make that substitution. The 6BH6 is a SHARP cutoff pentode. At about -4.5 volts on the control grid, it stops conducting entirely. The 6BJ6 is a REMOTE cutoff (or semi-remote cutoff according to some manuals). It doesn't stop conducting until at least -20 volts. Substituting one for the other will screw up the AGC behavior of the receiver.

Curiously enough, you could possibly replace the 6BJ6 tubes with the 6BA6. The pinouts differ in that the cathode and suppressor grids are exchanged. All uses of the 6BJ6 have the cathode and the suppressor grid connected together except for V509, so 6BA6 could be substituted everywhere except in V509. I've never tried this. The cutoff of the 6BA6 is "more remote" than that of the 6BJ6, so there will be some difference in behavior. Who knows if it would be significant?

Date: Sun, 10 Sep 2006 14:26:24 -0500
From: Rick Brashear <rickbras@airmail.net>
Subject: Re: [R-390] Tube Substitutes

Thanks Andy. You're right, it's not a direct sub and doesn't work well, but it did get me up and running until my tubes come in. I found the 6BJ6 is a preferred sub for the 6BH6, but due to the characteristics you mentioned the opposite is not true. Even though it does mess with the AGC, it works better than the almost dead 6BJ6 I pulled. :-)

Thanks for the insight. I seem to learn something new everyday when I am playing with this 390. I really appreciate you and the entire list for the patience and assistance.

Date: Tue, 21 Nov 2006 06:39:02 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] 12AX7's and Subs
>

>I need about 20 12AX7's for my R-388's and other equipment. Epay is
>Is the Russian Double Triode Tube 6N2P-EV a legitimate viable substitute?
>What about the Svetlana 12AX7's sold by Triode Electronics?

The 6N2P will only work if you can rewire the filament connections in your radio to support tubes with 6.3V heaters. IMHO the E european 12AX7's are much more likely to suffer interelemnt shorts than the best JAN USA tubes. But they probably aren't any worse than what the TV repair shops sold in the 70's and 80's.

> Some NOS 6N2P tubes on epay are cheap.....

I believe that Allied now has 12AX7's in their latest catalog (2007) again, for \$12.75 each. Probably branded National, probably Russian.

Date: Tue, 21 Nov 2006 07:52:39 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] 12AX7's and Subs

I was working on the fact that many of the Allied tubes are National brand labels of imports, but didn't actually know about their 12AX7's. Sometimes National branded tubes are really NOS made in the USA from the 60's or 70's or 80's. I'm not so sure now: the picture in their catalog of a 12AX7 is late 70's GE production, which almost certainly would've been made in the US. May be irrelevant because their stock is currently zero!

Date: Tue, 21 Nov 2006 09:56:49 EST
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] 12AX7's and Subs

Keep in mind the 6N2P tubes have a 6 volt filament. You will have to rewire the filament line going to the 6N2P to 6.3 volts to get it to work. May cause problems down the line if the mod is not clearly documented on the chassis or near the tube socket and someone tries to plug in a 12AX7. May be more trouble than it's worth to modify a radio to use them. 73 Todd WD4NGG

Date: Wed, 20 Dec 2006 23:34:23 -0500
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] Dial lights, 6082 tubes

I have as many 6082 tubes as you like for \$12 each (tested). I have a lifetime stash of them. (I am out of town until 12/28, so don't expect a reply until then)

Date: Thu, 4 Jan 2007 15:08:29 EST
From: R390rcvr@aol.com
Subject: [R-390] Tube organizing help

A common problem, but I could use some advice. I have several thousand tubes for my various beasts, and don't have a good organizing system. I have tried shelves, boxes, etc. The main problem has to do with adding and deleting tubes, changing the sequence, having room for additions, without taking up the entire

basement. I certainly would appreciate the groups wisdom! Randy

Date: Thu, 04 Jan 2007 15:51:52 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Tube organizing help

Here's how it works at my place, at least so far as I have actually organized the tubes: I use reclaimed office copy machine paper boxes. Inside them, I use the flat trays that soda cans come in. (Both I acquire at the coffee/copier room at work.) Any tubes I have in individual cartons can be stood up in the trays. Two or three trays fit into each paper box. In many cases, I have a lot of one type of tube, e.g. 6AU6 or 6V6, and they go into plastic freezer-quality baggies clearly marked with the type number. Paper notes may go into the bag: "All test good" or "Not tested" or whatever. Premium tubes such as 7788, Bugle Boy anything, or the like get new tube boxes and are marked in red. Larger tubes in boxes can similarly be stacked into either the trays or in the paper box itself. I generally separate mini tubes from octals, and larger tubes get their own boxes. Here are examples of categories:

Minis:

Bulk Minis

Octals

S-line tubes

Large TV tubes (compactrons)

Small TV tubes (4-, 5- volt ones)

Low voltage Rectifiers (5U4, 5R4, 5Z3's and the like)

High voltage Rectifiers (872A, 866's ...)

Delay tubes

VR tubes

Transmitting tubes

(A pair of 4-400's gets its own box)

Dud tubes (for scrounging the bases to use as connectors or coil plugs)

I have made no effort to account for every tube, or to set in order all the tubes I

have. Maybe one day.

Date: 4 Jan 2007 21:07:05 -0000
From: "n4buq@knology.net" <n4buq@knology.net>
Subject: Re: [R-390] Tube organizing help

Wow. That sure beats my "dump 'em in the little place in the back of the tube tester where the leads are stored" method...

Date: Thu, 4 Jan 2007 14:26:01 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Tube organizing help

Filing cabinets work well, Index card files work better, I have a two-door cabinet six feet tall for many of mine. I have my R-390A/URR in a three foot tall Bud cabinet, the space behind the speaker hides a big cardboard box that has all the tubes related to that radio and its test equipment. There are three tube caddies that hold related spares in the shack. Beyond that there are piles and bags of tubes slightly related to each other pile hither and yon. They come in too fast to find places for them,... not that they come in all that fast, but the spaces for them just don't open up! Avalanches here are dangerous!

Date: Fri, 05 Jan 2007 00:13:20 +0000
From: odyslim@comcast.net
Subject: Re: [R-390] Tube organizing help

I have a whole room in my basement devoted for tube storage. I have metal shelving surrounding the room. I buy the sterolite containers from Walmart and fill them by tube numbers. One tube number per container. I stack the containers on the shelving putting the less used numbers on the bottom of the stack. Last count was a little over 10,000. Every one NOS. My problem is I should stop buying certain numbers. I have way too many but I still buy them if the price is good.

Scott

Date: Thu, 4 Jan 2007 20:04:36 -0500
From: <don@thedjbrothers.com>
Subject: RE: [R-390] Tube organizing help

I've been back and forth over this ground a number of times. I keep something like 2000-4000 tubes here to serve as spares. 80% of these are used pulls that have been re-boxed. Space is at an EXTREME premium here so that is a key factor in my thinking. I started out setting aside a separate box for each radio with the spares for that radio in it. This turned out to be grossly inefficient--space-wise, so I abandoned that approach. What I do now is keep the tubes in boxes, sorted by filament voltage and, if necessary, base type. So my receiving tube boxes go like this (each new line is one or more boxes):

0--VR Tubes

1,2,3 Volt Types, all
5 Volt Rectifiers

5U4 have their own box
6 Volt Glass Octal

6 Volt Metal Octal
6A-6B Miniature

6C-6L Miniature
6M-6Z Miniature

(Most commonly used 6V Miniatures: 6AU6, 6BH6, 6BZ6, 6BE6, etc.)
6L6 have their own box

6SN7 have their own box
7 Volt and All Loktals

12 Volt Glass Octal
12 Volt Metal Octal

12A-12L Miniature
12M-12Z Miniature

(Most commonly used 12 volt miniatures: 12AU7, 12AX7, 12AT7, etc.)
Oldest: (01A, UV200, UV201, 199-299, 10, up through 27)
2A3's have their own box

30's and 40's
45's have their own box

50's thru 79
80, 81, 82, 83, 84, 85 Rectifiers

High-value Tubes,
Nuvistors & Wire Lead: CK-xxxx, 7788, 7360, etc.

CRTs have their own boxes and I don't keep too many of them

Eye Tubes have their own boxes just marked EYE TUBES

I have found this arrangement to be space-efficient and easy to find what I'm

looking for. If a box is not full, I add padding to keep the tube boxes upright so I can see their ends. I already have way more tubes than I will ever use in my lifetime. So I don't keep randomly-acquired tubes. I go through them and see if any of them are an upgrade for me or fill gaps. If they are duplicates, I just sell them off ASAP--remember, space is a problem. I don't keep an inventory of receiving tubes because it is too much work to keep up with as it changes. The tube boxes are all on easily-accessible metal shelves and it is simple to pull down a box, pop it open and look for the tube you need. Unless the tubes are high-value types, I don't test them until I need one. If I need a 12AU7, I pull out 3 or 4 and test them. I set aside a good one to use, discard any weak ones, mark and date the other good ones and put them back in the box. If I'm dealing with a sensitive circuit, I may test several tubes in the circuit just to look for differences that the tube tester didn't bother telling me about...

And that's about it. Once you get rolling, probably in this or any other system, it's automatic and easy to maintain. It's getting started that is really a pain.

Good luck. 73, Don Merz, N3RHT

Date: Thu, 04 Jan 2007 17:38:58 -0800
From: Renée Deeter_k6fsb <rjdeeter_k6fsb@sbcglobal.net>
Subject: Re: [R-390] Tube organizing help

Don- you saved me a lot of time typing as this is the method I've been using with a small variation and has served me well for for over 40 years. it was set up by my father (WB6TBK), it is efficient, saves space and time. (I can hear him now-"If you're gonna keep this junk it must be organized and stored neatly at this house!!" gee some of this got away from me when I left home....). I have a log of what is in each box in a separated binder. Large transmitting tubes (3-500,4-1000 etc...) have their own cardboard (printing paper) boxes....no searching through boxes till ya needs something, then it is not too bad. I've tried to keep the unboxed same type in labeled paper bags(so they will breathe) within the appropriate box.all tubes are tested prior storage...no sense keeping the really bad'uns. then again this takes time and i'm back-logged here.....

Date: Thu, 4 Jan 2007 20:52:23 EST
From: R390rcvr@aol.com
Subject: [R-390] Thanks for all the tube organizing help!!

A hearty thank you to everyone who responded on the tube organizing question. I have tried variations on some of the ideas, but will use your input to refine my technique. What has always been hard has been the ability to change the storage as time goes on, with different needs/tubes. Rather than reorganizing an entire rack or tube caddy, I think breaking them into many smaller boxes will work. If I get a completely new type, I will add an extra box if they won't fit elsewhere in the scheme, and if I get too many of one type, just add a second box for the same. Now if I just get my USM-118B refurbished so I can do lighting fast check as I sort my tubes, I would be in great shape! Thanks again! Randy

Date: Thu, 04 Jan 2007 16:55:42 -1000
From: "pete wokoun, sr." <pwokoun@hotmail.com>
Subject: Re: [R-390] Tube organizing help

Amazing, I almost have exactly what Roy does. My variations: duct tape folded

back on itself makes nice flat handles for the inside trays which makes taking them out easier. Use the same size boxes on any given tray. It takes a LOT of time the first time but try and keep same types together. I tested them when I organized mine and used stick-on colored dots on the box tops to indicate quality: green=good, yellow=? and red=bad on the meter but kept if not gassy or no shorts. Really dead ones, or ones with gas and shorts are immediately trashed. For those without boxes buy a bunch of the blank white ones and put 'em all into a box. For your inventory it's relatively easy to do in Excel and you end up with everything in order with quantities and which box it's in. I only have about 1200 and they fill up 6 of those copy paper boxes. A seventh has all the big xmitting types in it.

Date: Fri, 5 Jan 2007 08:25:06 -0600
From: "keller family" <kellerfamily01@charter.net>
Subject: [R-390] Tube Organizing Help

In addition to some way to store the tubes, I keep an equipment list in an Accountants Work Sheet Pad. In there, I list the tubes for each piece of equipment and record how many I have in inventory. I record the numbers in pencil so all I have to do is erase it and write in a new number as the inventory changes. This way, I always know at a glance exactly how many spare tubes I have for each piece of equipment without having to go to the boxes.

Date: Fri, 5 Jan 2007 10:09:43 -0500
From: flood@Krohne.com
Subject: [R-390] Re Tube storage

Thanks for this question. I too was running out of space. That prompted me to start on a serious testing run. I had the tester at work and tested loads while eating lunch every day! It was a good way to thin out the herd and I threw away hundreds of bad ones I especially like Roy's system and with his permission will use it here. However I have a better system for you. Send them all to me and let me worry about it! Actually I was thinking about a new fad. You all remember the Pet Rock of the '70s? Well if people are willing to spend money on a rock that does nothing, I want to RTV good for nothing tubes on a small box and light up the fil. with cheap wall warts! Yes, you guessed it "Pet Tube". I'm sure that we could get loads of money from this, (especially from the audiophools as we could convince them that putting one of these on top of your computer will make the computer audio sound better), put old wall warts back into service, and finally, find a use for all the lonely tubes that have no practical use these days or even useful tubes that are bad but at least light up! I'm willing to licence this product to someone in the UK for the "Pet Valve" project. Enough rambling, this must be a side effect of the codeine from the cough meds the Dr. just gave me. Happy New Year All! John Flood

Date: Fri, 5 Jan 2007 10:20:10 -0500
From: <b_hagen@sbcglobal.net>
Subject: RE: [R-390] Re Tube storage

I simply do not understand this problem. Why stock tubes? I simply go down to my distributor, Main TV Supply, in Akron and buy what I need. Oh, I forgot, this isn't 1950. I use the product box method, i.e., one box is labeled 390, another 1F5, etc.

Date: Fri, 05 Jan 2007 19:36:18 -0500

From: "Steve Hobensack" <stevehobensack@hotmail.com>
Subject: [R-390] Tube organizing help

I use cardboard sixpack beer/soda boxes.
I stuff small paper Lunch bags in the holes.
I staple a 3X5 notcard to the outside showing inventory.

Date: Fri, 05 Jan 2007 19:47:50 -0500
From: Scott Bauer <odyslim@comcast.net>
Subject: Re: [R-390] Tube organizing help

I also have a supply of used tubes. For those, I used ziplock bags. I just bought 2000 bags. 1000 2x3 and 1000 3x4 bags. These help me separate by brand, number etc. For me, it's an easy way to keep organized. The bags are cheap on eBay. The 2x3's were 8.00 per thousand and the 3x3 were 12.00 per thousand. That is a lot cheaper than buying the nice white boxes for used, common tubes. The white boxes are for the good stuff.

Date: Fri, 5 Jan 2007 21:32:34 EST
From: R390rcvr@aol.com
Subject: [R-390] Tube sleeve source?

Thanks again for all the sorting help. I went to Staples today and bought a bunch of flat 15x11x4 boxes, which I think will be a nice size and shape for storing the smaller tubes. What would help keep them organized within these boxes are the 5 tube sleeves, that you sometimes get on tubes. Does anyone still sell those?

From: Carole White-Connor <carolew@bellatlantic.net>
Subject: Re: [R-390] New Project (More Questions)

Today, I redid the filter caps, replaced the "exploding" cap and adjusted the IF gain. The set is performing nicely, but I have a few more questions:

1. The AF deck had two 3223 tubes in place of the 5814As. Is that an acceptable substitute? I replaced them with NOS 5814s. <snip>

Date: Sat, 24 Feb 2007 23:26:30 -0500
From: Scott Bauer <odyslim@comcast.net>
Subject: Re: [R-390] New Project (More Questions)

I believe Tung Sol prints 3223 on some of their 5814A's. The White paint marking the tube with 5814 or 12AU7 rubs off but the permanently marked 3223 remains.

Date: Mon, 26 Feb 2007 08:42:32 -0500
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] New Project (More Questions)

Scott's experience matches mine. (His stock of tubes must be far larger, though!) 12AU7WA's and 5814A's from Tung-Sol are highly regarded.

Date: Wed, 02 May 2007 00:26:29 -0400
From: Scott Bauer <odyslim@comcast.net>
Subject: [R-390] triple mica tubes

Is there a certain place in the R-390A or R-390 that would benefit from the use of a triple mica 5814A or 6189? Or will any old garden variety work. I have always saved them over the years for some reason. Its time to use them or sell them to the audio guys. This question also pertains to the 6C4 as well.

Date: Wed, 02 May 2007 07:48:05 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] triple mica tubes

I think that "triple mica" is related to "low leakage", and low leakage is always a good thing around the AGC caps, ... BUT in every single case where a bad tube caused me some AGC heartache, it was not just leakage but a gassy tube. So I can't see any obvious advantage. Just as a side point: I recently found out that the 5814A at one point a half century ago was specced for some folks down the road from you - ARINC. (ARINC has a nice little museum sponsored by their radio club near the lobby of one of their Annapolis buildings, too.)

Date: Thu, 3 May 2007 11:01:38 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] triple mica tubes

Some believe the triple mica tubes are better. If your receiver is just setting on the bench and not mobile or subject to more than normal vibration, the mechanical benefits of the extra mica are lost in your application. The Navy and mobile Signal Corp. ask for the extra mica.

Tube noise does make a difference. Try all of your 5814's into the first FR section of the audio deck. Use a signal generator and power meter (AC volt meter an 600 ohm resistor on the local output.

Compare Modulation on and modulation off meter readings. At modulation off the lower meter reading is less tube noise. As tubes are used, the noise goes up and the power goes down. With the signal generator modulation on the output will be lower. With the signal generator modulation off the noise level will be higher. Run the 6C4 in the second mixer and use some Rf above 8Mhz.

Rank all the tubes you have as spare. Put the low noise tubes to the front end, starting with the best 6C4 in the first mixer.

With your pulls and spares run all of these tubes again in you receiver that now has better tubes in it than you had in the first pass. (assume some of the spares were better than what was in the receiver and you now have the best tubes forward in the circuit.

Now you know which of the tubes are really better from a signal to noise prespective.

You can do this with all the tube in the receiver.

Do the 6AK6 in the last IF
Do the 5749's in the First IF.

Put the best 5814's in the audio chain you use (local line). Then put good ones in the AGC. The IF follower is not used by most of us so put a poor tube in that socket. If you do not use the limiter, then a noisy tube can go in there. If you use

your limiter, then put your best 5814 into that circuit.

Hope this provides you some insight to getting the most use out of the tubes you have in hand.

Date: Wed, 20 Jun 2007 19:36:58 -0400
From: Scott Bauer <odyslim@comcast.net>
Subject: [R-390] maintenance

I rotate my radios in order to keep the maintenance up on them, In the winter, I run the R390's and summer I run the 390A's. As I was testing the R390 tubes, I noticed one radio that needed an incredible 22 tubes.

These were all fine last year. The radio ran fine with all the bad (really bad) installed. Thats amazing. I decided I had better get out my spare tester, a Heath TT1-A to verify the condition of the tubes and my TV7 All 22 tubes were just totally dead.

My thought is last year the tubes still passed but were weak Then I ran them non-stop all this winter. I think from now on, I will keep better notes. I do put a sticker on the back of each radio to keep track of when the tubes were tested. I just thought I would mention this to anybody that wondered how often to check tubes.

My radios are most always on unless it is stormy and the tubes did not last as long as others claim. Could it be the tubes are slowly dying even if not in use? 40 years of sitting on a shelf before use. Could all the magic ether be leaking out?

Date: Wed, 20 Jun 2007 19:58:38 EDT
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] maintenance

Running the R-390 24/7 puts a lot of hours on the tubes. Do you run any forced-air cooling into the radio? Do the tubes have the black IERC-type tube shields? Reducing the heat of the tubes should dramatically increase their life especially when running them 24/7.

Date: Wed, 20 Jun 2007 20:33:45 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] maintenance

Might be a case of high line voltage...or at least higher than the radio was expecting... Years ago 126 to 132 would have been considered high...but is fairly common place today. The radio is probably more comfortable at 110Vac. A variac would take care of that. Some radio's have various input taps on the power transformer and one can set it for the highest voltage available. (but not 220) Just a thought...

Date: Wed, 20 Jun 2007 22:42:11 -0400
From: Scott Bauer <odyslim@comcast.net>
Subject: Re: [R-390] maintenance

That is my reason for writing. To get the opinion of others. I have read of people running radios 10 years on a set of tubes. Some do make good common sense.

For example, 1/2 of some of the 12AU7's are gone. Measuring 20 on 1 side and 90 on the other I am using the black IERC shields. I just had a guy here in Frederick, Bill Waters go through the testers. I have a 3rd that was done by Chris Haedt. Thanks for your input Don. Have a good day!

Date: Thu, 21 Jun 2007 00:57:58 -0500
From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] maintenance

Didn't Nolan Lee keep his on 24/7 and only took one down when it had a problem? Seems I remember some of his were online for years, only taken down for periodic mechanical maintenance/lubrication.

Date: Thu, 21 Jun 2007 02:51:20 -0400
From: "Joel Richey" <richey2@mindspring.com>
Subject: [R-390] Bad Tubes???

I read a lot of funny things on this list, this is one of the better ones, 22 bad (really bad) tubes but the radio still works good, did I miss something??

Date: Thu, 21 Jun 2007 02:16:00 -0500
From: "Don Reaves" <don@reatek.com>
Subject: RE: [R-390] maintenance

Scott, having 22 tubes go out at once seems highly unlikely unless some catastrophic event occurred, like a sustained over time over voltage on the filaments of the tubes. You would have likely noticed that - bright lights inside the radio! If the radio is still playing OK, then the tubes aren't dead.

Date: Thu, 21 Jun 2007 07:30:43 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Bad Tubes???

One possible explanation - the tube tester you used a year ago was broken. I certainly have seen radios with a lot of "tests bad" tubes in them. If the radio is working fine, why replace them?

Date: Thu, 21 Jun 2007 09:35:07 -0400
From: Charles A Taylor <WD4INP@isp.com>
Subject: [R-390] Maintenance: mains voltage

I was on this reflector back in the early 90s, and had a loooong debate with Gerald Johnson K0CQ about running an R-390A at less than 110 VAC mains voltage. I postulated running one at as low as 85 VAC, since I found that my own Motorola would operate down that low.

He pointed out "thorium stripping" of the 26Z5 heaters and of the other tube cathodes as a reason why this should not be done..I have part of the debate still in my e-mail archives. I believe that K0CQ acquiesced on running an R-390A at 100 VAC: it would not be deleterious to the tube heaters.

Having settled that, I have operated my own set at 100 VAC, set via a Variac.

I do NOT hit the set with a full 100 VAC at turn-on, but "ramp up" the mains voltage over a period of about 60 seconds. I acquired this set in 1984, and only

last week replaced 1 of the two 26Z5s. Unless you are down to the point of changing the air in your tires and ACTUALLY cleaning out your attic, I would suggest not fretting over the condition of the tubes. Leave 'em alone, sez Ah. Jest mah too sints.

Date: Thu, 21 Jun 2007 08:48:11 -0500
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Bad Tubes???

Lessee, the radio worked 'good' or 'fine'. Sounds like a hamfest description. The tubes are all 'bad'. Can we get quantitative? Does the sensitivity meet specs? How about IF gain? What about audio gain and distortion? How bad is bad? What percentage of rated transconductance do you get on the TV-7? Does a new tube test good? Are the pins corroded? Does the heapkit test a new tube as good? If you've got a 120 volt wattmeter, like the Kill-A-Watt unit, is the power high for a 390? If you don't have a wattmeter, measure the B+ voltages. Maybe the regulator failed high. IIRC, there are at least 25 tubes in a 390. What tube functions were OK? Just the facts, sir.

Date: Thu, 21 Jun 2007 11:41:00 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] maintenance

My experience with much simpler (fewer tubes, less "excess gain") radio is that I often get the radio with the original factory (e.g. Hallicrafters-branded tubes in a Hallicrafters or Daystrom-branded tubes in a Heathkit) tubes. The radio works fine with the tubes. I pull the tubes and run them through the transconductance tester and every single tube is below the acceptable number, often two or three times low. I put new tubes in and the radio works fine too. Maybe the AGC action is a little different with the new tubes. Now a 390 or 390A has so so many gain stages (if not labeled gain then the mixers still provide gain). There is no shortage of raw gain available from the tubes. Many of the stages are operated with considerable degeneration and you will simply not notice if the tube is considerably low in transconductance.

Date: Thu, 21 Jun 2007 08:42:58 -0700 (PDT)
From: "W. Li" <wli98122@yahoo.com>
Subject: [R-390] re: maintenance

I think that you must be a victim of a *surge*. Vacuum tubes do not tolerate overvoltage or mechanical trauma well. Operating them at design voltages in a stable environment is the best way for a reasonably long life of 10,000 hours (1.14 years if left on 24 hours a day). Adding a cooling fan in hot environments is a very good suggestion. Bill Kleronomos wrote a real good article in ER in 1994 (vol 66 page 10) entitled *Electron Tube Survival Primer*. Perkins Electro Acoustic Research lab in Canada ran some tests in which they found that running a 6AK5W at an envelope temperature of 100_C resulted in a 50% tube survival at 5000 hours, but 80% failed by 2000 hours if run at 253_C.

In the same article, they found running heaters at 5.04VAC gave the longest life (albeit at lower emmissions); running at 6.30VAC had a 85% 5000 hour survival, but running them at 7.56VAC led to a 20% 5000 hour survival. Hope this helps.

Date: Thu, 21 Jun 2007 12:19:01 -0400
From: "David C. Hallam" <dhallam@rapidsys.com>

Subject: RE: [R-390] re: maintenance

I live in Florida and have a R-390 with a Johnson Invader 200 and a HB4CX1500A amplifier. I don't leave any of them on any longer than absolutely necessary. With the heat from fans on the 6082 series regulators in the R-390, the 6146 finals in the Invader, and the 200 watt filament dissipation of the 4CX1500A, even the stand-by load is too much for my AC system in the shack. Maybe in mid January in up state New York the heat would be appreciated. In Tampa it's too much any time.

Date: Fri, 22 Jun 2007 08:16:14 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] maintenance

>Age of New Old Stock does not appear to effect the life of tubes.....

But, of course, manufacturing defects can show up long after manufacture.

>I'm not sure what happened with a couple of sticks of 6C4s I had once.
>All 10 were NIB RCA but developed grid-cath probs after a few hours use.

I bought four unused in the box Western Electric tubes at a fest. They were modest in price, unlike some of WE's products. My tube tester (gasp!) showed they all were kaput. Extra warmth on the envelope with filament power only led me to suspect that "all the vacuum had leaked out". Close inspection showed shorter than normal tip pinch-offs (these were 9-pin miniatures), and a little line of "bubbles" through the tip. I suspect they all had leaked slowly after manufacture and testing - most unusual for Western Electric tubes!

Date: Sun, 24 Jun 2007 21:30:45 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Maintenance: mains voltage

>Indirectly heated cathodes can also suffer "cathode poisoning" if they spend a
>lot of time cut off (drawing zero current).

This is why ops left the receivers with the gain set off zero and the head sets unplugged. They never set a receiver to standby. Roger AI4NI

Date: Wed, 27 Jun 2007 19:47:31 -0400
From: "Steve Hobensack" <stevehobensack@hotmail.com>
Subject: [R-390] 12BE6

My SP-600 JX-17 is finicky about the 6BE6 mixer. Some seemingly good 6BE6 will not work. I wonder what passive component in the associated circuit might be getting out of spec ?

Date: Wed, 27 Jun 2007 21:06:23 -0400
From: "Al Parker" <anchor@ec.rr.com>
Subject: Re: [R-390] 12BE6

Your subject says 12BE6, the body says 6BE6. I hope you're using 6BE6's in your SP-600, 12's sure would have to be "specially selected" to work. Get your manual out (if you don't have one, go to The Hammarlund Historian website and download one for free), and do some voltage and resistance checks at the mixer

(you don't say which one, 1st or 2nd). The SP-600's are notorious for 2 things, bad, leaky, BBOD's, and resulting resistor value shifts. If your SP-600-JX-17 has a ser. no. above about 17,500, then it probably has disc ceramics, and much less problems. If it's the 2nd mixer that's your problem, directly check the resistors around that tube, particularly the screen dropping resistor, R40 20k 1 watt, and the subsequent bypass cap, C106. If it's the 1st mixer, you'll have to use the resistance chart in the manual as a guide, as you can't get to that tube socket without removing the RF deck, but can get creative. If you have BBOD's rather than discs, you'll want to remove the RF deck and replace all 20+ of them, and check all resistors in there. Not a trivial job, but one that can be done. There's a great article by Ray Vasec, W2EC, in the Service section that'll give you some good pointers on how to do the complete job.

Date: Thu, 28 Jun 2007 14:38:06 -0700
From: "Dan Merz" <mdmerz@verizon.net>
Subject: RE: [R-390] 12BE6

Hi, I did a study of 6BE6 blocking characteristics because that tube as a converter is prone to grid blocking (acquiring a large positive voltage on the grid) in some old radio circuits where the grid return resistor is too high or the screen voltage drops too low. Generally speaking if the grid return resistor becomes large the tube will self block and must be "reset" by turning it off and then back on again.

This tendency is enhanced when the screen G2/G4 grid voltage is low, for instance if the the resistor to the screen becomes larger than it should be for normal operation. Pulses to the grid can cause blocking to occur and then the tube must be reset when these conditions exist. I haven't checked any of these observations in my SP-600 and haven't observed it happening in that radio but if the grid resistor or screen grid resistor have drifted higher, this may be one possible reason for the finicky behavior in your case. When I was exploring this phenomenon, I tested 5 different 6BE6's and all but one were susceptible to blocking. All tested as new tubes on a tube tester. The one tube that didn't block was a NIB GE tube that had about 25% higher gm than the other tubes. Another NIB tube exhibited blocking. If anyone is interested in more details, I'd be glad to send a copy of the manuscript that was printed in the AWA/OTB, but I think the summary here includes the information that might be relevant to what is happening in your SP 600 and showed that seemingly good tubes can behave quite differently in this circuit. The 6BE6's in the SP 600 are mixers with separate tubes for the oscillator whereas I was looking at the 6BE6 as a converter. However pin 7 is G3 (the grid that is responsible for blocking) has the same function in the converter and mixer.

Date: Tue, 10 Jul 2007 14:03:15 -0400
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: [R-390] OT: What's a 2J1626 tube?

I have a 2J1626 tube from an estate sale up on you-know-where. I can't find this tube in any of my references. Is it a tube at all? The box is sealed, so I am reluctant to open it. Anybody know what this is? Any help would be appreciated.

Date: Tue, 10 Jul 2007 13:22:49 -0500
From: "Rick Brashear" <rickbras@airmail.net>
Subject: RE: [R-390] OT: What's a 2J1626 tube?

Do you think maybe the "2J" is some kind of military identifier and the tube inside

is a 1625 triode? Would the box accommodate a tube that size?

Date: Tue, 10 Jul 2007 16:26:09 -0400
From: "Kim Herron" <kherron@voyager.net>
Subject: Re: [R-390] OT: What's a 2J1626 tube?

Yup, see this alot with mil surplus tubes. This is a 1626 tube. I've had lots of Mil surplus tubes that have the 2J designator in front of the tube number. Why?--I don't know the answer. It's not rare, just numbered different. Maybe somebody else out there has an explanation for the extra numbers

Date: Tue, 10 Jul 2007 16:53:37 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] OT: What's a 2J1626 tube?

In the RMA system of 1942-1944 era, a "2" means heater power less than 10 watts, and "J" usually means magnetron. Certainly a lot of magnetrons start with 2J. But a 1626 is not a magnetron! "C" is triode, "D" is tetrode, "E" is pentode, "N" is crystal.

Date: Wed, 26 Sep 2007 13:37:18 +0200
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] 5749W's on eBay

Those look like the Philips 1985 run of those tubes. I have several boxes of these if anybody wants them. They are NOS JAN spec. I will sell them for \$10 for sleeves of 5 tubes, plus some shipping. Unfortunately, the shipping will probably be \$3.85 for US. Sorry. I also have several boxes of the 5750/6BE6 for \$15 for sleeves of 5 tubes.

Date: Wed, 26 Sep 2007 07:56:32 -0400
From: Bob Camp <ham@cq.nu>
Subject: [R-390] Tubes

There have been "big gulp" sales of R-390A tubes on eBay for quite a while now. I suspect that a number of us have more than a couple of spare tubes. What do people need? Is there enough interest for somebody to start doing tube sets again, or do one type at a time sales make sense? I'm *not* trying to get in the tube business, just to see if there's a reasonable way to get around the shipping costs.

Date: Wed, 26 Sep 2007 09:11:05 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Tubes

Many of the "big gulps" are JAN-surplus tubes and are either the result of:

- 1: A new liquidation of military surplus.
- 2: The buyer of a previous liquidation of mil surplus tubes realizes that they've been sitting on the lot for a decade now (the 90's military liquidations were incredible - guys would come to the hamfests with truckfulls of tubes and get ignored because of everybody wanting to sell their latest 386-clone PC) and they aren't selling.

I do note that AES seems to have hiked their prices in the past month (possibly correlated with the release of their 2007 catalog).

> I'm *not* trying to get in the tube business

I suspect the tube business requires a certain kind of mindset that is not common among most business people. When the stock of tubes has been sitting around for decades without buyers, why should anyone think they can turn a buck when the previous owners didn't either? There may be appreciating prices for some subset of audiophile tubes but I don't see it rubbing off on the radio tubes. I'm interested from a user/collector point of view at what brands and constructions of radio tubes are available and occasionally have some deep epiphany as a result, (like, "wow, some 6CH8's are really chirpy in this Heathkit HG-10 VFO and others aren't, boy am I glad I've got bunches of these old TV tubes!") but overall view them as fun and not a business :-). I'd like it if NOS 5814A's and 12AX7's and 6L6GC's and other tubes common in my radios were as cheap as ten or fifteen years ago but do not know how to turn back the clock myself. When I've found the price of NOS tubes to be truly objectionable I often find there are Russian or Chinese equivalents that seem to work just fine. (Just put some Russki 6L6GC's into my old Heath 250V regulated bench supplies and they work great!)

Date: Tue, 02 Oct 2007 15:50:40 +0200
From: Wim Penders <wpenders@home.nl>
Subject: [R-390] gold-plated tubes

Philips Holland and their subsidiary Mullard in England made tubes with gold-plated pins. They were Special Quality tubes with a guaranteed life time of 20.000 hours, much more than the standard tube. The other advantage was their very close specs. I for one prefer them much over the "normal" tubes, because they are almost undestructable. They were used in all special measurement instruments of the time overthere.

Date: Tue, 04 Dec 2007 20:39:07 -0600
From: Barry Williams <ba.williams@charter.net>
Subject: [R-390] Found something interesting about tubes

Anybody remember Nolan Lee's R-390As that ran 24/7?

TUBE ROTATION AND REPLACEMENT

Date: Fri., 15 Jan 1999 22:34:22 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: Re: [R-390] MTBF (was tubes and 3TF7 ...)

Every six months, I pull the tubes out of the R-1051B's and install new ones. They'll last longer than that but I've got plenty of them. I think that I paid .25 a piece for the 6AN5WA's when I bought them and only about .70 each or so for the 6BZ6's. At the current rate of consumption I think that I have enough for 30 years or so. :-) It costs me about 4 dollars a year to retube both receivers. Cheap, huh? And, yes I can notice a difference in sensitivity before and after retubing. The performance difference and the low cost of the tubes is the reason that I don't even bother to test them.

The antenna couplers, have a switchable meter on the front panel that monitors

the ten pairs of 6922's in each one. When I see the numbers drop to a level a little below the recommended reading, for one pair, I replace that pair. I used to just replace all of them but my supply of good quality Amperex 6922's is getting low and they now cost more than the coupler is worth thanks to the golden eared audio crowd. When they're finally gone, I'll have to start using the Jan 6922's but in the mean time, I'll cook Bugle Boy's in the couplers.

I've make little cards up that I keep on each of the receivers. On the card is the testing date, the location (V#) in the receiver, the SN of the tube tester, and the tested value of the tube expressed as xx/yy, where xx is the tester reading and yy is the minimum value of the tube. I try to test the tubes about every six months. After a couple of decades, you see trends. It's been my experience that for the R390A's the tubes that seem to have to be replaced the most often are the 26Z5W's, and the 0A2WA's. I typically let them run 24/7. I don't trust the regulator tubes as far as I can throw them. I hate the damn things.

Anytime I install new rectifier tubes in an R390A, I select and install a new regulator tube. Amazing how many are a couple of volts or so "off". I've also had "noise" problems in the receiver that I've traced to them. It's amazing the difference in sensitivity the tubes in the RF section make as they start to deteriorate. Since it's a gradual thing and you don't notice.

About the least trouble that I've had is the 6 or 7 dozen or so tubes in the old Tektronix scope and the CA plugin that's usually in it. Over the last twelve years or so, I've changed a set of 5 of the 5642 HV rectifiers, the 0G3 regulator and a pair of 6CW5's that come to mind. Very well engineered piece of equipment. As long as the tubes aren't noisy or shorted, they'll usually work fine in it even when their test values are well below the normal "worn out" numbers that the tester manuals list. I've had MORE transistors fail in the 547 than I have tubes fail. Finding matched pairs of those old early 1960's transistors can be a real pain, too. No BA collection is complete without a hundred plus pound tube type Tektronix scope setting on the bench sucking up a thousand watts or so. They're magnificent pieces of gear that are first class examples what American industry was capable of producing at one time. Quality engineering, craftsmanship, and best quality materials available, but mainly, when people took pride in their work.

Tubes, as a whole, are a hell of a lot more reliable than a lot of people believe. There were some really suck designed tubes/applications in the 1970's, such as those damn compactrons used in televisions and used in applications like RF amplifiers that they really weren't really up to. Ditto to the tubes in the power supply for the IP-173 series panoramic adapters. I've not real impressed with the life of the 6AK6's used in the R390A's either. They don't seem to last as long as they should. For what it's worth, the RCA's seem to last longer then the other brands. The 6DC6's on the RF deck are another one that should be replaced every 6 months of 24/7 in the R390A's if you're interested in peak performance.

On a side note, try to never install a new 5749 in the PTO module of an R390A. Always use a good strong used one. The alignment will hold longer.

Just for kicks, measure the sensitivity of your receiver, remove and label the tubes on the RF deck and replace them with new tubes. Then retest the sensitivity. I'd almost bet money that you'll leave the new ones in there. :-)

Oh, about the only piece of gear that I have that gives a time frame for tube

replacement is my AN/PRM-10 Grid Dip Osc. The 955 acorn tube in the head is supposed to be replaced every 300 hours. I was curious about this a while back, so I tested the tube then let it run for a couple of weeks and sure enough, the tube was flatter than hell. ;-) Which reminds me, I need to pickup a few more spares, I only have a couple of them left. ;-(Thinking of the GDO, 6X4 rectifier tubes don't impress me much either. I've went thru a lot of them in the GDO, the RC and RCL bridgers, the old CV-116 when I used it (it has five of them in it), and the pair of them in the TV-2 tube tester. The 6X4 is one of my least favorite tubes.

One factor on "tube life" that's over looked is the application that the tube is used in. As an example, lets look at the 6AK6 used in the R390A as an example. There's three of them in there if I remember right. Two on the audio deck and one on the IF deck. The one used as the 4th IF amplifier on the IF deck seems to last the longest, followed by the line output amplifier and then the local audio amplifier on the AF deck. Same tube, way different "life". When I have to replace a 6AK6 used for local audio, I always install the new tube on the IF deck, and take that tube and install it in the line audio position, and then place the line audio tube in the local audio position. Hmmm, maybe we need a tube rotation schedule. <grin> Nolan

Date: Sun, 16 Dec 2007 22:09:59 +0000
From: eldim@att.net
Subject: Re: [R-390] Collins tubes

Hello FELLOW BOATANCHOR COLLECTORS & ENTHUSIASTS, The military had many of their electronic components from resistors, capacitors, chokes transformers, synchro's , vacuum tubes, etc packed in metal cans of all size and shapes. I have many cans from WWII, Korean era, and even Vietnam. All I can say is that they are truly preserved, and pretty well protected. Unless the can rusts through, the item is pretty much preserved. Some of those items that would rust easily were coated with cosmoline which was a pain to clean off to prepare the part for use. Always, had to keep some kerosine on hand, or use other toxic chemicals. Others were wrapped in all sorts of material from ole newspaper to elaborate waxed and corrugated butcher paper, horsehair and other products. I once opened some wall toggle switches that were wrapped in a ammonia impregnated paper. The Bakelite switch bats were crumbling like sand stone. Needless to say, I threw them all away. Eimac, RCA and other tubes manufacturers packages there metal, cerami c, & g lass tubes in soup sized cans with pull-tab tops. I still have many cans with mostly ceramics such as the 4CX150/250 TYPES, 2C39'S, ETC.

Date: Sat, 19 Jan 2008 18:48:20 -0500
From: Scott Bauer <odyslim@comcast.net>
Subject: [R-390] Hytron tubes?

Does anybody know the history of Hytron tubes? Were they actually manufactured by some other company? Are they cheapo drug store tubes? Somebody else's seconds? My reason for asking is I am thinning out my inventory and am trying to figure out which to get rid of.

Date: Sat, 19 Jan 2008 19:30:52 -0500
From: <kim.herron@sbcglobal.net>
Subject: Re: [R-390] Hytron tubes?

Hytron built transmitting and the other name associated with them was CBS. You will find lots of receiving tubes with the name CBS/Hytron on them. I do not know when they were sold or to who but they definitely were not cheapo drugstore tubes.

Date: Sat, 19 Jan 2008 19:38:10 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Hytron tubes?

CBS's tube operation was out of business by about 1970. Their tube making equipment is still being used to this day making various interesting things ...

Date: Thu, 21 Feb 2008 15:01:49 -0500
From: "James A. (Andy) Moor" <jamminpower@earthlink.net>
Subject: [R-390] NOS 26A6 tubes for R-392

Folks, a big box of NOS 26A6 tubes followed me home a few weeks ago. They are RCA, date-coded 1974, and are unused. They come in the cool, white military boxes. The R-392 uses 11 of these. \$12.50 for a sleeve of 5 tubes. Count \$5.00 for postage for the first 5. Add \$1 for each additional 5. PayPal preferred to jamminpower@earthlink.net. Just about anything else accepted as well.

James A. (Andy) Moor www.jamminpower.com

Date: Sat, 27 Dec 2008 22:17:50 -0600
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] re: Chuck Rippel's parts kits

I need a cross ref. on a EF806A tube for my R&S USVH freq. meter.

Date: Sat, 27 Dec 2008 23:46:16 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] re: Chuck Rippel's parts kits

(I like to sleuth odd tube types): At: <http://www.tubedepot.com/ts-ef806.html> you can buy one for \$37.00+ It's like the 6267 and I find data on that one at: <http://tdsl.duncanamps.com/tubearch.php> It's like these: 6F22, CV10098, CV2901, CV8068, EF86, Z729. It's a low-noise pentode with base pinout B9A

At: <http://www.vacuumtubes.com/6267.html> you can pay over a hundred bucks for one or a similar tube A cross reference list I have shows the tube base to be 9CV and shows these other tube with the same base:

6BQ5/EL84 (miniature pentode with pinout 9CV)
6267 7189 EF86
6BQ5 7189A EL84
6BQ5WA 7320 N709
6P15 E84L Z729

Of course some of these are not the same sort of tube at all, they just have the same pinout as the 6267.

Date: Sun, 28 Dec 2008 01:47:46 -0600
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] re: Chuck Rippel's parts kits

Thanks for the tube info. I need to run it through one of tube testers or ck the pinout for the filament, which I think is NG.

Date: Fri, 20 Mar 2009 22:25:50 -0500 (CDT)
From: Jim Haynes <jhhaynes@earthlink.net>
Subject: [R-390] Current direction

When I was an E.E. student in the late 1950s the texts all showed "conventional" current flow, positive to negative. At the time we had a lot of veterans and particularly the Navy ones were vociferous that the texts were all wrong and that current went with the electrons, negative to positive. It was hard to get them to realize that it doesn't really matter so long as you are consistent; the answers will be the same either way. (It's not the same as believing that Niagara Falls will flow uphill!)

Date: Sat, 21 Mar 2009 15:40:20 -0400
From: jcoward5452@aol.com
Subject: Re: [R-390] Current direction

If electron flow in a vacuum tube did not flow from cathode (negative potential) to anode (positive potential) then the suppressor grid would be placed at the cathode and not the plate. IIRC the suppressor grid was to attract electrons that actually bounced off the plate and then impacted again causing noise. This grid would draw off those errant electrons and thus improving the noise figure of the tube. In semiconductor material, there is electron flow and what some call "hole" flow. There are atoms with excess electrons and atoms that are lacking electrons. As current flows, electrons move to an atom lacking electrons. The atom losing electrons is now a "hole" and thus there is a "flow" of holes positive to negative and a "flow" of electrons negative to positive. Of course this is an oversimplification. One must understand atomic physics to get a grasp of semiconductor theory. And atomic physics is always in a state of flux. I stick with vacuum tubes because I find them more understandable from a layman's point of view and with my R-390A operating I do not have to heat my workroom!

Jay KE6PPF

Date: Sun, 22 Mar 2009 11:38:20 -0500
From: "Bill Breeden" <breedewb@cableone.net>
Subject: Re: [R-390] Current Direction

Purdue University taught "conventional" (positive to negative) current flow while I attended between 1968 and 1973. The Air Force taught "electron" (negative to positive) current flow when I attended their basic electronics training at Keesler AFB in 1973.

Date: Sat, 04 Apr 2009 21:46:22 -0400
From: frankshughes@aim.com
Subject: [R-390] TV-10 tube testing questions

I received my updated, calibrated TV-10 from Roger (alltubetester), and started learning how to use it on the pile'o spare tubes I have collected for my R-390A. As I understand it, the TV-10 is very similar to the TV-7, but the TV-10 displays Mutual Conductance in Micromhos values directly. I have read that no two testers will provide the same value for the same tube, so I understand that this is

not an exact science. But as I have no idea what to expect, I am asking for advice as to if the values that I found from some preliminary testing are reasonable or not. For all I know Roger may have put a small ravenous Hamster inside the TV-10, and somehow attached it to the meter movement. I set up the TV-10 as per the manual, and also followed Rogers "how to test" instructions.

I tested four 6DC6 NOS JAN 12/86.
The TV-10 chart says the minimum value is 2840.
The tubes tested 5000, 5000, 5500, 5800.

Tested six JAN 5749,? minimum=2070,
Test values = 3300, 3900, 3900, 3900, 4050, 4200

So if these are reasonable, I guess the lesson for me is that there is quite a difference between new tubes and aged tubes. I also noted that there are some tube types that the TV-10 does not have on the roll chart; (these have the "W" and/or "A" suffix). I would like to understand the technical difference (if any) for these tubes, there must be a good reason that their number differs, but I don't know if it makes any difference as far as the testing.

Here is what I think is in my R-390A:

OA2WA

(Not on the TV-10 chart)
5654W

(The TV-10 chart shows a 5654)
5749

matches TV-10 chart exactly
5814A

(The TV-10 chart shows a 5814)
5963

matches TV-10 chart exactly
6AK5W

The TV-10 chart shows a 6AK5
6AK6

matches TV-10 chart exactly
6CB6A

The TV-10 chart shows a 6CB6
6C4

matches TV-10 chart exactly
6DC6

matches TV-10 chart exactly

12BA6

matches TV-10 chart exactly
26Z5W

matches TV-10 chart exactly

Date: Sat, 4 Apr 2009 21:49:25 -0700
From: "Greg Werstiuk" <greg_werstiuk@msn.com>
Subject: Re: [R-390] TV-10 tube testing questions

The tube callouts with the "W" suffix are the ruggedized versions often used in both military and industrial applications. Some have dual assigned nomenclatures such as 5654 / 6AK5W. Test setup for the regular and ruggedized versions are the same.

Date: Mon, 6 Apr 2009 08:44:33 -0700 (PDT)
From: wli <wli98122@yahoo.com>
Subject: Re: [R-390] TV-10 tube testing questions

Not unusual to see JAN tubes show a higher micromho's than commercial grade tubes. What you will find that JAN tubes are more uniform than the others. JAN tubes are said to have thicker supports and thus are less prone to vibration damage.

IMHO, tube testers are best for detecting dead heaters and internal shorts. The functional tests have variable value, depending on who you speak to. Perhaps the best functional test is to see its actual performance in a circuit where it is destined to be used.

Recently, I went thru the drill of running my spares thru the R390A; rank ordering them in S+N/N as outlined in past posts. Took a while, but now I have a listing of all of my spares for the future.

Date: Mon, 6 Apr 2009 16:42:52 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] TV-10 tube testing questions

Most tube testers just set the tube up as a triode.
All the extra grids get tied to cathode or plate as needed.

The set up grid bias is then selected to get the tube to give a mid scale meter reading about the go-no go line.

A small change in the grid bias setting will let you have a pass or fail on any tube that is not shorted or near dead.

Tube testers give you no clue to gas or noise conditions.

JAN mil tubes mostly have less noise than the commercial tubes of the same type.

JAN tubes are more rugged and thus mostly produce less mechanical noise.

I have been told that JAN tubes have a better vacuum and inert gas fill thus less

noise.

Do not loose your tube tester. It does what it does very well. You need it when you need it. It just is not the begin all and end all of every thing. It is just one more test instrument on your bench.

Date: Wed, 29 Apr 2009 12:55:22 -0400
From: Jon Schlegel <ews265@rochester.rr.com>
Subject: [R-390] Heater Dropping Resistor R536

I'm working on the IF module from my R-390A and just noticed that V507 (Limiter, 5814A) has a 4 ohm resistor (R536) in series with the heater. For the moment assuming that the heater's resistance doesn't change over temp, this means that V507's heater draw is about 250 mA @ 5.3 VAC instead of the nominal 300 mA @ 6.3 VAC. Heater power is about 70% of nominal. Anybody know what's going on here? Isolation from the rest of the heater string? Does the Limiter depend on soft emission? Don't think we're at a frequency where cathode back heating is an issue <G>. Also R536 looks to be about a 5 watt WW and it's dissipating a cool 1/4 watt. Guess they wanted the stability of a WW.

Date: Wed, 29 Apr 2009 10:19:46 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] Heater Dropping Resistor R536

The limiter is running dim to reduce noise and hum. Those cathodes are at the input of the audio chain, and they're floating around at high impedance; the slightest H-K leakage would cause hum. In some positions in old tube-type Tektronix oscilloscopes, a tube might be selected for low leakage. The other day I noticed hum in my R-390A when the limiter was on. I replaced the limiter tube and the hum stopped. The original tube did not register any leakage on my Hickok 600A. Tube audio preamps run dim to reduce noise. If the cathode emits enough electrons to satisfy the maximum requirement of the circuit, then it's bright enough. The requirement here is very small.

Date: Wed, 29 Apr 2009 13:51:56 -0400
From: Jon Schlegel <ews265@rochester.rr.com>
Subject: Re: [R-390] Heater Dropping Resistor R536

Interesting. I now see the 470k resistor feeding the cathodes of the Limiter tube. That's pretty daunting. I've just started to bring this radio up to speed. I've recapped, re-tubed and re-mech-filtered the IF module. I powered the unit last night and with no IF input signal (coaxes disconnected), I was hearing hum controllable with the Local Gain control. I'm now building an extender cable so I can work on the module easily. You can bet that I'll head for the limiter as a possible source of the hum. Thanks for the info, Dave. Never expected this to fall out of a casual question about the heater resistor.

Date: Wed, 29 Apr 2009 16:14:33 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] Heater Dropping Resistor R536

When I've had hum from the IF module, it in fact was caused by heater-to-cathode leakage in the V507 limiter tube. This happened to me I was using an Eastern European 12AU7 there. I blamed the tube, but the limiter design is certainly unusual compared to most tube usages, because the cathode is at

such a high impedance (470K) to the limiter level control, and it may be more susceptible to heater-to-cathode leakage as a result. Maybe there are places where hi-spec 5814A's are desirable and leakage in lesser grade tubes are more noticeable.

Date: Wed, 29 Apr 2009 16:35:17 -0400
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: [R-390] Limiter hum

I've had that problem too. The fault doesn't show up on a tube tester!

Date: Wed, 29 Apr 2009 13:47:32 -0700 (PDT)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] ?A? Tube Filament Voltage

There has been considerable discussion on the list regarding tube shield efficacy and filament voltage. There has been mention of running the tubes filament voltages at 95% of the nominal rating of 6.3 volts. Thus 6.3 times .95 equals 5.995 volts. On all six of my R390A power transformers the filament voltage is stated as 6.1 volts not the 6.3 that at least I had assumed. This contradicts the Y3K manual chapter 5 values which are given as 6.3 volts. I am TDY for several months so I haven't been able to make any measurements. Now comes the question: Is this the actual voltage or a typo? If 6.1 volts is the actual value then I guess that the Collins engineers realized that there would be heat issues affecting tube life and used this value to help prolong tube life.. Could some one enlighten the list on the true value?

Date: Wed, 29 Apr 2009 16:55:28 -0400
From: Jon Schlegel <ews265@rochester.rr.com>
Subject: Re: [R-390] Limiter hum

Here's a thought that came to mind. Even if H-K leakage were excellently low, I could see that some sort of imbalance in the heater wire geometry could capacitively couple an AC component onto the cathode.

Date: Thu, 6 Aug 2009 09:41:48 -0700 (PDT)
From: John Flood <kb1fqg@yahoo.com>
Subject: [R-390] Line audio output problem and 6C4 RF tubes

<snip> Also when powered up, this one, on local audio, it made noise but was deaf. Looking into the RF deck first I found all three of the 6C4's bad(only slight deflection on the TV7. This worried me a bit so then each tube was removed and tested. A couple of hours later (that is the time you wish that heaters warmed up quicker!) all other tubes tested strong and with new 6C4's in place it was working. I jokingly asked if it had taken a lightning hit! All of the 6C4's looked to be of the same lot number and one could guess that lot had quality problems but I still thought it strange. Any thoughts on this or is it one of those unsolved mysteries that I should forget about now that it is working?

Date: Thu, 6 Aug 2009 12:53:17 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] Line audio output problem and 6C4 RF tubes

A lot can have problems. I bought four Western Electric mini tubes at a fest one time and found all four gassy. Close examination of the pinch off tip at the top

showed a possible gas leak. The manufacturing process was so consistent (the ultimate goal of tube manufacturing) that they must have tested ok at production, but all had a very slow leak.

Date: Thu, 6 Aug 2009 12:58:36 -0500
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] Line audio output problem and 6C4 RF tubes

Many years ago, I had over two dozen 6AK5/5654 JAN General Electric tubes. Every single one was shorted or gassy. They all had the same batch numbers.

Date: Thu, 6 Aug 2009 22:21:18 +0000 (UTC)
From: odyslim@comcast.net
Subject: Re: [R-390] Line audio output problem and 6C4 RF tubes

I bought from eBay 100 JAN 6AK6. Date code 1986. Every one gassy. I have a friend that once quoted eBay as one big toilet bowl. Remember when buying tubes or any other great deal, there is no such thing as a free lunch.

Date: Fri, 7 Aug 2009 04:54:51 -0700 (PDT)
From: John Flood <kb1fqg@yahoo.com>
Subject: Re: [R-390] Line audio output problem and 6C4 RF tubes

>...two dozen 6AK5/5654 JAN General Electric tubes. Every single one was shorted or gassy.....

These were GE tubes made in the last week of Nov. 1965.

Date: Tue, 11 Aug 2009 18:18:11 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] 12BA6

The 12BA6 is not a JAN tube. It is just a commercial tube. 6BA6 stuff with a 12 volt heater running at 1/2 the 6 volt current. The couple Europe numbers are the only matches. Lots of pentodes that come close in pin configuration and performance. Most vary at close to cutoff and total power.

In an AGC controlled circuit this is a problem. If you are not operating variable gain or at cut off, lots of other tubes will work in the circuit very well. Tube manuals must cover every Bevis and Butthead use. So lots of possibilities will never make the cut. Start with tubes in the same base diagram. Then look at close relatives that may work as the actual tube socket is wired to see what will plug in. 12BA6's are still available so no reason not to just go hunting to find what you need.

Date: Wed, 12 Aug 2009 09:01:58 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] 12BA6

I once specifically looked to see if there was a mobile or ruggedized 12BA6 for vehicular use. After all GE etc had a line of industrial/vehicular rated tubes and they also sold mobile radios. I was a little surprised to see no ruggedized 12BA6.

> Lots of pentodes that come close in pin configuration and performance.

I once tried randomly swapping 6BA6's with 6AK5's and 6AU6's and some other similar pinout pentodes. In the R-390A I observed very little difference in usability from doing this with just a single tube, even in IF and RF stages. Changing one IF or RF pentode for a different kind would result in the carrier level meter working a little differently but AGC mostly seeming to work OK. Changing the cutoff characteristics of multiple IF tubes did impact AGC usability.

Date: Mon, 17 Aug 2009 16:06:25 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Alternative to IERC tube shields

Other than say 3TF7's and 26Z5W's and 6082's, I don't see any shortage of 390/390A tubes. And 3TF7's and 26Z5W's are still readily available (meaning hand over the bucks) if you really want them. Most of the 390 and 390A tubes are in such easy supply because of vast quantities of JAN tubes liquidated from military stocks.

After I got my 390A's, I went out on tube buying sprees snapping up cartons at hamfests and online; I carried around a "going price" list in my pocket and made tally marks as I acquired them at lower and lower and lower prices. I got a lot of tubes for not too many bucks.

I compare the price of tubes today from any of the online distributors to prices I paid in my hometown 30 years ago, and my conclusion is that I paid way way too much for tubes back then :-(. I mean, I remember needing 0A2's and 6CL6's and 6AU6's and 6146A's for my Heath radios, and paying an hour or two's worth of my puny wages for each. I compare it to today where a couple minutes of my wages will buy any of them.

Date: Mon, 17 Aug 2009 16:22:05 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Alternative to IERC tube shields

I procured at least a couple complete sets of replacements, including 3TF7s and 26Z5Ws around 2002. The seller was asking around \$40 a set back then. He threw in some #47 bulbs and some 12VDC auto bulbs that fit the dash of about 1997 vintage American automobiles. I have one of the Western Electric, (Made by Hickok - Mdl 6XXX series), tube testers. It performs the conductance testing along with checks for gassy and shorts. It was an item I obtained from a former AT&T employee. He really had no use for it any longer.

Date: Fri, 11 Sep 2009 19:35:19 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Restoring my '390

I think 24 x 7 x 52 x 5 is a bit long. Tubes will last almost forever but 43,680 hours is mostly over the line. I think Rick Mish got miss quoted. Or lets not take that exact statement to literal.

Think about 10,000 operating hours on a good tube. For the first 720 -1,000 hours you hope the thing will quite down and get stable. From 1,000 to 2,000 hours you hope it will quite down and get stable, because it did not do it in the first 1,000 hours. Then you get about 7,000 hours of good tube life. Then the tube starts to get noisy from what ever its mellow point was.

If you are going to do a PM and change some tubes. Go whole hog and get all the 6DC6, 6C4's, 5654's and 5759's in the IF string. Swap the in line 5749's off to the VFO and BFO. Move out any 6AK6's and 5814's that will help get some noise out of the signal to noise ratio.

Save the old tubes. If you have a couple that go noisy early, you swap and old less noisy tube back in and put off doing a full refresh. If you are mixing your best used stash into a receiver for best signal to noise with what you have on hand, then a one pass alignment will get it. The used tubes have been burned in. By the time you get to the alignment part, the receiver has warmed up and likely stable.

After installing new tubes, do an electrical alignment twice. Leave the receiver on for a week and repeat the alignment if you can.

720 hours (24 x 30 days) after you do some tube changes, do another electrical alignment. The tubes will burn in and change. An alignment will bring improvements. At month 2 (another 720 hours) do it again. Then you should be good for out to about 9,000 operating hours.

Once you start doing tubes one at a time you need to do that alignment with the tube change, and again after it ages a month or so. So if you start swapping tubes one by one as they die, you are for every doing alignment or just listening to a less than optimum receiver.

In the past years, several of the Fellows who have been there done that, have compared tube life and power off on cycles until the filaments break. The ratio is to leave the receiver on for at least 2 hours when you turn it on. If you turn the receiver on for 2 hours and then turn it off, the filaments will break just about the time you reach the end of the tubes useful life.

Back when (68 - 75) we did a PM on a receiver each month. It got a minimum eyeball for blue tubes and we ask the operator if it was missing any thing (like a megahertz of signals). Twice a year (semi) the receiver went to the shop for about 4 hours of face wash, dusting, tube checking, mechanical inspection and electrical alignment. We used a signal generator, AC volt meter across 600 ohms (power meter) on the Local Audio output and a DC volt meter across the diode load. On a good day we may have counted the VFO and BFO with a counter.

Good 20:1 signal to noise from tubes was a solid year. $24 \times 256 = 8760$ hours. Tubes would go another year. If you were happy with 10:1 signal to noise you can have 20,000 hours and more. Tubes will go almost forever. If the goal is grid voltage varies plate current and things do not smoke.

But if you are trying to eak the weak one out of the noise, do try to keep tube life under 10,000 hours. Always your mileage will vary. Turn the receiver off when not in use. Let it warm up a 10-20 minutes before you get into a contest.

The R390/A's are mostly over 50 years old. Any thing that is going to age and burn in has done so. BBOD's are a problem. But again, rather than poke at them one at a time just do them all. Get it over with and start aging a whole new set of replacements.

One of the Fellows asked about doing this himself last week. Your time as a radio repairman is easily worth \$25.00 an hour. On top of that you would like some return on the assets of the shop equipment and mark up on parts inventory. A good semi PM can easily go out 8 plus hours and never get to a wash and lube. <snip>

Date: Sun, 18 Oct 2009 22:19:59 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] QSK; standby reduced fil. voltage; separate B+ on/off

<snip> There is a phenomenon called "cathode interface" that occurs in tubes that stay in cutoff condition for long periods of time. "Computer rated" tubes such as the 5963 (like the 12AU7) were developed with special cathode coating composition to reduce this effect. I am not sure if low filament voltage would cause this difficulty or not <snip>

Date: Mon, 19 Oct 2009 09:40:56 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] QSK; standby reduced fil. voltage; separate B+ on/off

<snip> >.....and prolonged tube life.....

<snip> I honestly don't think you have to do anything to protect any of the tubes. These are not fragile tubes, they are mostly ARINC-rated tubes with robust filaments and support structures designed for aircraft or mobile operation. Perhaps the most fragile would be the 12AU7A, but you will note that the ARINC 5814A was used by the military instead. It is possible to measure VFO drift on warmup but I don't think that reduced standby filament voltage is any kind of solution to that. As Roy pointed out, cathode poisoning could be possible if you had HV applied but no or low filament voltage. <snip>

Date: Wed, 27 Jan 2010 21:53:44 -0600
From: "Barry" <n4buq@knology.net>
Subject: [R-390] Microphonic tubes

Since we have discussed the effects of microphonic tubes before, I thought you guys would enjoy this one: <http://broduke2000.livejournal.com/87950.html> I hope no one has a tube that bad in their radio...

Date: Wed, 27 Jan 2010 23:28:33 -0500
From: jcoward5452@aol.com
Subject: Re: [R-390] Microphonic tubes

That was a great video! My microphonic radio is a very nice example of the Zenith "Bomber" 7G605 TransOceanic portable. When operating it will, on occasion, let out a very ethereal moan which I find quite endearing as it tells me that this radio bemoans its lost past and the history that was told through its tubes and speaker to those souls who once gathered 'round to listen in. Now if my R-390A did that it would have to report behind the wood shed after chores were done!

Date: Thu, 28 Jan 2010 00:59:27 -0500
From: jrfke5ri@aol.com
Subject: Re: [R-390] Microphonic tubes

Chances are, if your R-390A could play from its past, it would be classified.

Date: Thu, 28 Jan 2010 12:01:39 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Microphonic tubes

That is a cute video. What disturbed me was the person who said the guy on the video was "hot". As a female, of a more "mature" age, I do not find him hot... I guess I hope it was another woman who said he was hot... hmm, it could be one of those Navy guys.. you never know.

Date: Mon, 22 Feb 2010 18:30:11 -0600
From: "Gary Harmon - K5JWK" <k5jwkgary@gmail.com>
Subject: [R-390] 6AJ5 Substitute

Both my 6AJ5s are weak. Looks like a hard tube to find. Any close more common subs that work?

Date: Mon, 22 Feb 2010 20:44:19 -0500
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] 6AJ5 Substitute

6AK5's are same base and in my experience work just fine. In a pinch most of the pentodes can be swapped around and you'll still have a working radio. I once just randomly started swapping the pentodes around between oscillators, IF deck, and RF deck, and while the AGC characteristics were messed up if I played around with multiple tubes in the IF deck, the radio still worked. Most of the 7-pin RF-type pentodes have identical or similar pinouts. 6AJ5's are in stock at all the major suppliers (Antique Electronics Supply, ESRC, etc) and cheaper than

E-bay. I don't think the military had zillions of mil-spec 6AJ5's stockpiled like they did the 6AK5. I'm not sure I've ever seen a JAN 6AJ5.

Date: Mon, 22 Feb 2010 19:25:14 -0600
From: <wb5uom@hughes.net>
Subject: Re: [R-390] 6AJ5 Substitute

http://shop.ebay.com/?_from=R40&_trksid=m38&_nkw=6aj5&_sacat=See-All

Date: Mon, 22 Feb 2010 21:55:55 -0700
From: Transmaster <22hornet@gmail.com>
Subject: Re: [R-390] 6AJ5 Substitute

6AJ5's are available from Antique Electronic Supply for \$2.50 cents each. When you can get them this cheap there is no point in modifying your rig for another tube. Go to the following link <http://www.tubesandmore.com/>

Date: Tue, 07 Sep 2010 13:08:20 -0400
From: Jon Schlegel <ews265@rochester.rr.com>
Subject: Re: [R-390] Fake Caps

Speaking of Tube Washers... our purchasing dept was scrambling to find some sort of replacement for the RCA 3N200 RF signal MOSFET in a receiver. This was at a time when the industry was really shutting down the production those kinds of discrete RF parts. I had been charged with evaluating samples from

these lower tier fab houses and distributors that purchasing was finding. One set of samples caught my eye when as I handled them, the part number stamped on cases would easily rub off. The response on these parts as I tested them was just as horrifying. The curve tracer display was unidentifiable as anything. What did the "supplier" think? That "maybe they just won't notice"???

Date: Tue, 7 Sep 2010 13:12:49 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Fake Caps

Are there any websites that talk about the history of Tube Washing? I tried to use Google but it finds almost nothing that's relevant. There are plenty of examples of counterfeit semiconductors that show up with a google search! I know that Ludwell Sibley has talked about it - confirming the heresy circling around in my youth - and I think it's even mentioned in Tube Lore.

Date: Thu, 24 Feb 2011 23:49:01 -0500
From: Robert Young <youngbob53@msn.com>
Subject: [R-390] V509 runs hot

I'm on a quest to find the intermittent volume jumps in my R390A and finally got around to getting some of my stuff from my storage space and pulling the radio out of it's cabinet. A list member suggested it may be a cathode to filament short in one of the 5814A's. I find that V509 runs MUCH hotter than the other 5814A's in the IF deck, I subbed another tube for the one that was there and it too got very hot quickly, is this normal? The intermittent is quite difficult to isolate, at first it was constant after warm up, it is now very sporadic and only lasts a few seconds, for ex. it has only occurred twice tonight in about 4 hours. If this question from a beginner at trouble shooting an R390A is beneath you or you think I am wasting band space please ignore it. (I had to add that after my last controversy generating post).

Date: Fri, 25 Feb 2011 00:14:51 -0500
From: k2cby <k2cby@optonline.net>
Subject: [R-390] V509 runs hot

The only thing that will make a triode run hot is excessive grid voltage.

There are three suspects:

The most likely is a short or leak in the capacitor leading to the grid from the plate of the prior stage causing the plate voltage to drive the grid of the following stage positive.

The less likely (but possible) is a short in the capacitor that bypasses the cathode resistor, causing the tube to become zero-biased.

The least likely is a plate resistor or a cathode resistor that has vastly decreased in value (although the plate resistor may well have changed value due to excessive current).

Date: Fri, 25 Feb 2011 09:14:23 -0800
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] V509 runs hot

I had intermittent jumps on mine too, which I traced to a bad mica cap.

V509 section B (pins 6-7-8) is the IF Cathode Follower. According to the voltage charts, it has 185V on the plate and 4.3V on the cathode. $4.3V/390\text{ohms}$ is 11mA, giving a plate power dissipation of 181×0.011 or 2W.

The other triodes have essentially no plate power dissipation.

Now factor in the heater power. Each 5814 receives $6.3V \times 0.45A$ or 2.8W. Therefore V509 is dissipating 4.8W while V506 and V507 are dissipating 2.8W, so it is perfectly normal for V509 to be significantly hotter than the other two.

Date: Fri, 25 Feb 2011 12:18:40 -0500
From: Robert Young <youngbob53@msn.com>
Subject: Re: [R-390] V509 runs hot

I'd like to thank everyone for their help, the radio ran fine all night with the new 5814A subbed in for V509, no volume changes. Now to check the caps and resistors around that stage,

Date: Tue, 1 Mar 2011 21:51:33 -0500
From: Barry <n4buq@knology.net>
Subject: [R-390] OT: HP-410B Tubes

I have an HP-410B that I have cleaned, recapped and trying to get working properly again. The problem is with the tubes.

It came with 5814's in place of the 12AU7's. These work great, but they draw extra heater current and I would like to get 12AU7's in there again. I ordered a set of 12AU7A's but the meter will not work well at all with them. It won't stabilize, zero, or do anything else correctly (well, the ON lamp does work, but...) with them in place.

The pair of 12AU7A's check quite strong on my Hickok 752A (they check about the same μMho values as the 5814's). Is this just a case of finding a pair of well-matched 12AU7's (non-A, whatever...) that work? I'd rather not continue throwing money into tubes that don't work but at the same time, I don't like the extra stress the heaters in the 5814's put on the old transformer.

Date: Tue, 01 Mar 2011 22:44:05 -0500
From: Jon Schlegel <ews265@rochester.rr.com>
Subject: Re: [R-390] OT: HP-410B Tubes

I observed somewhat the same behavior on my 410B although not as pronounced. I had enough 12AU7's to swap around until I got the meter to zero with the zero pot pretty much in the center. Not much else I can offer here.

Another thought. The 410B I have had numerous bad solder joints especially on the printed circuit card(s), believe it or not. It took many hours of elbow grease to ferret out all of these problems. They certainly didn't make working inside the unit very easy.

Date: Tue, 1 Mar 2011 22:50:29 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] OT: HP-410B Tubes

This is one of the early models that does not have printed circuit boards. I had one of the PC-board models a few years ago and I know what you mean about them. This one has some very sturdy, old-fashioned solder "posts" (for lack of a better word) to which the parts are soldered. Very nice, solid joints. I found the DC calibration pot is quite bad. Once I get that replaced, perhaps things will settle down a bit with the new tubes.

I didn't check the 12AU7A's for gas. That also might be a problem.

Date: Wed, 2 Mar 2011 01:19:57 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] OT: HP-410B Tubes

> This is one of the early models. I found the DC calibration pot is quite bad.

One trouble reported with the HP meters is that they used a wire wound (200 ohm, I think) pot for some of the cal or settings pots. These develop intermittent or high resistance at the ends where the winding is crimped by the solder tabs. Treatment with De-Oxit might help. you may have to re-crimp the crimps if you can get to them. Or replacement pots would be a good idea. if you find this is the case, let us know where you found the pots.

> I didn't check the 12AU7A's for gas. That also might be a problem.

You might also simply let them run for a week, then try calibrating/zeroing again. There are many tubes similar to the 12AU7 that might work in it's place. The 5963 is a "computer rated" tube built to avoid "cathode interface" from long periods in the Off mode. The 6211 is another similar tube meant for long periods of cutoff conditions and may be useful. Sometimes the A suffix on a tube number indicates that it is selected for balance between units. Often the military version of a dual tube has tighter specs for inter-unit balance. Note that the 12AU7 filament is 150 mA on 12.6 volts and the 5814 is 175 ma. I doubt that this difference is going to matter anywhere near as much as the likely higher than used-to-be line voltage. I suggest you measure the filament voltage and your line voltage to see what is really happening there.

Date: Wed, 2 Mar 2011 08:15:59 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] OT: HP-410B Tubes

> Sounds like you got some lousy 12AU7s.

I don't think the tubes are exactly "junk", but just not quite good enough for this circuit. The manual is quite detailed about matching, gas, etc., for these tubes so it appears these problems were there from the start. I figured, though, I'd be able to find a pair of 12AU7[A]'s that would work.

> I have run 5814s in everything I own that calls for 12AU7s

Transformer specs for this model are something I haven't been able to find. I was just trying to err on the safe(er) side.

>the tubes available today are mostly cr@p.

I well remember some of the discussions that Nolan Lee had about using a lighter to de-gass tubes. I never tried it but I think others did and it apparently works in some cases. I need to test these 12AU7A's for gas (although it probably won't be conclusive as I've never found a gassy tube with the Hickok 752A).

>ones that are already in it -- even if they register "weak"

Already found the "worry" point. DC calibration pot is bad. It's been replaced once in its lifetime so the pot may not be quite the grade it had originally.

Date: Wed, 2 Mar 2011 08:22:40 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] OT: HP-410B Tubes

>.....One trouble reported with the HP meters is that they used a wire wound (200 ohm.....

The pot acts rather weird. It's a 500-ohm WW. Checking the "unused" side, it shows about 1000 to 1200 ohms as I turn the wiper. There's a company (KISS Electronics) that services these (and other model) VTVMs and they seem to have replacements for a lot of the parts. I've asked Ashley (the owner?) about some replacements. There are also some good candidates from West Florida Components on eBay right now (in case KISS doesn't have any).

>The 5963 is a "computer rated" tube built to avoid "cathode interface" f
>.....The 6211 is another similar tube meant for long periods of cutoff conditions

On the VARIAC at 115, filament voltage is right on 6.3VAC; however, one of the tubes is operated at a reduced filament voltage and that may account for some of the problem with a marginal tube.

Date: Wed, 2 Mar 2011 08:37:43 -0500
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] OT: HP-410B Tubes

5814's (or more often 5814A's) were widely used in lots of instrumentation as preferred tubes and usually swapped out at regular predefined maintenance intervals. I'm sure there were good brands/batches of 12AU7's too but the 5814A's were often put in there by shops who used them everywhere else already, mostly based knowledge learned from the school of hard knocks. This is backed up by my largest users of this base tube, my 390A's, where consumer-type 12AU7's in there, I have found to be noticeably less reliable than the industrial-rated 5814A's. In other words I'd go for the 5814A's every time, never mind the slightly higher heater current. The 410B manual makes it clear that balanced sections in the dual triodes are desirable, and there was probably some industrial-numbered (4 digit) 12AU7 variant that was graded for balance between sections.

Date: Wed, 2 Mar 2011 09:46:58 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Gettering old tubes

I do not even want to approach the discussions on how to get a 3-500 by

heating the anode until it is cherry red (follow that on eHam under amplifiers if that is your baby). But I recall seeing in some of those 1960's vintage tube videos (someone posted a link to them a year or so ago) that they would getter a tube after manufacturing by heating it via an induction furnace.

There really is not that much to an induction heating device. Maybe someone wants to try to make one and see if they can make the getter to reactivate on old tubes. There is a limited amount of barium/ zirconium/ sodium (name your own metallic gettering materials here). As long as the metal has not entirely turned into an oxide it still has some gettering potential and may be able to scavenge some gas molecules out of the tube.

This is sort of like asking at a Mexican restaurant "how many times have you refried the refried beans this week?" Sooner or later the getter "ain't gonna do anything else" or with refried beans, you get salmonella.

This may be at least another choice rather than crapping out the cathode with poisons.

Remember the old B&K Precision picture tube rejuvenator? It would run the filament at a higher voltage and do some other things. Sometimes it would give at least a few more months of life to a tired old color television set. It was an easy way to make extra money during high school that did not involve getting nekkid <joke>.

Date: Wed, 02 Mar 2011 09:47:45 -0600
From: Barry Williams <ba.williams@charter.net>
Subject: Re: [R-390] OT: HP-410B Tubes

> I well remember some of the discussions that Nolan Lee had about using a lighter to de-gass tubes. I never tried it but I think others did and it apparently works in some cases. I need to test these 12AU7A's for gas (although it probably won't be conclusive as I've never found a gassy tube with the Hickok 752A).

Yes, the Zippo lighter method. Zippo'ed, not butaned according to Nolan. He took that to an almost exact science. I had almost forgotten this.

Date: Wed, 2 Mar 2011 08:27:37 -0800
From: "Scott" <scott@becklawfirm.com>
Subject: Re: [R-390] OT: HP-410B Tubes

I brought a couple of HP-410B's back into service a few years ago. When doing so, an old HP friend who "engineered" in the HP Palo Alto factory in the old days recounted the 12AU7 burn-in and balance test rack in the "410" end of the factory. HP apparently had problems with 12AU7 section balance and drift too.

Date: Wed, 2 Mar 2011 11:38:06 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] OT: HP-410B Tubes

As I mentioned before, the first amplifier's (V2) filament runs at a reduced voltage. According to the schematic I have, there are two resistors (R51, a 10-ohm, and R51A, an 18-ohm) in parallel that are in series with that filament.

Apparently R51A was an change to get just a little more heater voltage. Mine is an early model and does not have R51A so V2 is running with quite low filament voltage - something on the order of 3.7 to 3.9 (don't remember the exact value).

I jumpered in a 15-ohm (what I had on hand) and, with the line voltage set to 115, V2 was seeing right at 4.5 which is what is shown on the schematic; however, with that in place, the 12AU7A's still won't work in the circuit.

I'm still going to run some more tests (gas, etc.) on the 12AU7A's. Maybe I'll find something.

Date: Wed, 2 Mar 2011 13:24:52 -0500
From: "Todd, KA1KAQ" <ka1kaq@gmail.com>
Subject: Re: [R-390] OT: HP-410B Tubes

And let's not forget the special edition Zippo lighters that a certain beehive kicker whose name I won't mention (but his initials are Joe Foley) was working on getting made for those who wanted to pursue this approach. The hang up came in getting the R-390A front panel drawing transferred into an etching on the lighter body, as I recall.

"No no, doctor - he's fine, really. You don't have any bees around here, do you?"

I've had about the as much luck with the Zippo method as with jacking up the heater voltage on the tube tester for a period of time. Sometimes the gas goes away, emission increases, and other times nothing happens. Always figured, what's to lose, if the tube is gonna to be tossed anyhow? We learn by doing, as crazy as some of these ideas may sound at first.

Date: Wed, 2 Mar 2011 12:43:47 -0700
From: "Lloyd Godsey" <kk7iz@cox.net>
Subject: Re: [R-390] Gettering old tubes

Ever tried putting one in a microwave? (GRINNNNNN)

Date: Wed, 2 Mar 2011 13:46:11 -0600
From: Ben Loper <brloper@gmail.com>
Subject: Re: [R-390] Gettering old tubes

This is probably getting out of hand but maybe put together a chassis with multiple sockets and a filament supply to keep your tubes warm

Date: Wed, 2 Mar 2011 15:05:28 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Gettering old tubes

I was searching for tube rejuvenating methods and found a site with some postings from around 2006 where some guys were trying just that. Some had limited success. The trick was to leave the oven on for just long enough for the getter to flash. Results ranged from "the tube was much better" to "it ruined the filament" to "the tube burst". They had a pretty low success rate, but it was interesting to see it did work for a few tubes.

Date: Wed, 2 Mar 2011 15:11:21 EST
From: MillerKE6F@aol.com

Subject: Re: [R-390] Gettering old tubes

The Tooooob audio folks put a lot of value on the "Condition" of the getter flash on the old premium audio tubes like the 6550 etc. I know that the getter is flashed at some point in the assembly process by induction heating (assuming it's already been rough pumped by mechanical means) and that flash consumes most of the trace gasses inside the envelope. My question is how much "Gettering" action takes place after the initial flash? I realize that hard glass transmitting tubes use alloyed (coated?) getter material on their anode structures that provide ongoing gettering provided the anode is heated to a very high temperature (red plates orange plates white plates..... take your pick)

Date: Wed, 2 Mar 2011 17:39:12 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] Gettering old tubes

It is just an idea. I recall dissecting some of the tubes with the little metal halo and found the metal that was left in the groove to be highly reactive (still). This is the only reason I mention it. If we could inductively heat the getter halo then some gas scavenging might still remain.

Date: Wed, 2 Mar 2011 20:05:32 -0500
From: "Jerry O. Stern" <jsternmd@att.net>
Subject: Re: [R-390] Gettering old tubes

Those strange audio geeks love NOS tubes but they cook the tubes for several days on filament only without grid or B+. They swear the getter(s) do the job 90+ % of the time on 50-70 year old tubes.

Date: Wed, 2 Mar 2011 19:22:10 -0600
From: "KA9EGW" <ka9egw@britewerkz.com>
Subject: Re: [R-390] Gettering old tubes

I wonder what the grids look like after a couple days of filament-only?

Date: Wed, 2 Mar 2011 20:31:21 -0600
From: "KA9EGW" <ka9egw@britewerkz.com>
Subject: Re: [R-390] Gettering old tubes

Come to think of it, Bill Kleronomos did an article in Electric Radio years ago on how to go about reclaiming gassy NOS tubes...I'm really sorry I don't remember the specifics, but it had to do with applying plate voltage with some sort of current limiting to prevent runaway...

Date: Wed, 2 Mar 2011 20:43:49 -0600
From: "KA9EGW" <ka9egw@britewerkz.com>
Subject: Re: [R-390] Gettering old tubes

There's a pretty good article at w8jj dot com about gettering and tube failures

Date: Wed, 2 Mar 2011 22:10:50 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Gettering old tubes

http://www.w8ji.com/vacuum_tubes_and_vacuum_tube_failures.htm

Date: Wed, 2 Mar 2011 23:06:30 -0500
From: Barry <n4buq@knology.net>
Subject: [R-390] OT: HP-410B Tubes - The Saga Continues...

I did a little more testing on the 12AU7A's tonight. In the tube tester, I ran the filament voltage down to approximately where the first amplifier is running them. They're running about 3.8V in parallel so I set the filament switch on the tester to the nearest value - 7.5V. In that position, the 12AU7A's really went off the deep end transconductance-wise. Both tubes showed a significant reduction in transconductance on triode "1" and on triode "2", both tubes showed extreme reduction in transconductance.

The same experiment with the 5814's showed some reduction in performance but not much and the reduction in both triodes (at least on the one tube I tested) tracked together.

I then tried running one 5814 in V2 (first amp where the filament voltage is reduced) and a 12AU7A in V3 (second amp). This actually worked okay. It took just a little while longer for the meter to stabilize, but once the zero point stayed very close when switching between ranges and modes.

I tried running the 12AU7A's in both positions and jumpering out filament dropping resistor just to see what would happen and the results weren't pretty. I know they reduced the filament voltage for reasons I don't quite understand and apparently it is quite necessary (although I did not try this with the 5814's).

Oh, and, neither 12AU7A showed any significant signs of gas on the tester (no surprise there).

Anyway, I thought some of you might find this interesting...

Date: Thu, 3 Mar 2011 11:20:08 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Tube Gettering

If we ran our tubes at absolute zero the gases would all just condense out and we could draw them off with a sippy straw.

I think that for the immediate future (10-15 years) we can all make do with the supplies that we have all squirreled away, waiting for the big EMP event so we can be the only ones listening to static.

It was surprisingly easy to (re) collect almost 200 tubes. I even have an old Easter basket sitting under the coffee table filled with 1625's and 1626 tubes.

All I am waiting on now is a spare B-29 to land in my yard and I can bring the radios back to pristine condition. <g>.

Date: Thu, 03 Mar 2011 12:51:34 -0600
From: Barry Williams <ba.williams@charter.net>
Subject: Re: [R-390] Tube Gettering

That's what Nolan Lee always said. He had enough tubes and parts to last through the duration.

Date: Thu, 3 Mar 2011 13:52:42 -0500
From: "Jerry O. Stern" <jsternmd@att.net>
Subject: Re: [R-390] Gettering old tubes

I thought the original thread began about how reliable/good were NOS (really old) tubes. I have a neighbor who does estate and storage auctions looking for NOS audio/amplifier tubes mainly 6L6 (metal), 6L6GC (glass) and EL34's. He built different fixtures for these as well as for NOS 12AU7/AX7/AT7's. He plugs in 10 at a time and he "cooks" them for about a week at rated filament voltage and reduced plate voltage. These tubes span from the 1940- 1970's. His Sencor tester, which is supposedly very sensitive to gas, has found fewer than 1 in 100 to have shorts or gas. A grossly gassy tube can never be re-gettered. I do him a favor and run a batch of 20 or so of the power tubes every few weeks through my Hickock 539C where I match them for current draw. He sells them to the guitar tube amp folks and them love them. I found this link where you can buy a very pricey version of his fixture. Does this really improve the tubes?? YMMV.
<http://www.maximatcher.com/maxiburn.html>

Date: Thu, 3 Mar 2011 15:42:54 -0500
From: "Todd, KA1KAQ" <ka1kaq@gmail.com>
Subject: Re: [R-390] Tube Gettering

When you consider that pretty much everything electronic from the 30s up to and through the 70s used tubes (including all the government stuff), it's no surprise that there are literally millions of NOS tubes still out there. It wasn't until the 60s that sand state really took off. Aside from some of the really old tubes that were never made in large quantities or similar specialized tubes, we'll never see the end of them in our lifetimes. Even those high priced audio tubes still seem to surface with regularity. And the Chinese are making more, too. The 3TF7 is a perfect example. Prices rose along with internet demand and activity, mainly driven by the R-390 folks. Some paid \$50 or more to get one before they were 'gone forever'. Yet they still keep surfacing, NIB. Seen several back down in the \$20 range over the last year or so. With the government purchasing the R-390 family, FRC-93 and so many other tube-based systems in the tens of thousands (and spares in the hundreds of thousands or higher), it all makes sense. The 6000 used in the T-368 exciter seems to be the one exception, though they do still show up. Haven't found anything else that used that tube, putting it in the 'specialized' category.

Date: Sat, 05 Mar 2011 18:25:54 -0700
From: Robert Moses <rhmoses@earthlink.net>
Subject: Re: [R-390] Gettering old tubes

I have this gut feeling that this is not something that you would likely do more than once! <wink> The high current surges that would be produced would tend to melt the screens / grids of the tubes unless the tube had a metal envelope. If the envelope was glass then the spot of getter on the inside of the tube would tend to get very hot and create thermal stresses in the glass envelope that could cause cracking.

Date: Wed, 9 Nov 2011 20:01:50 -0600
From: "Ray" <bluegrassdakine@hotmail.com>
Subject: [R-390] 4PR65A

I HAVE HAD THIS TUBE FOR A LONG TIME. Oops. What is it use in? I have not seen it on any parts lists or price lists of the usual sellers so don't know what it is it's use.

Date: Thu, 10 Nov 2011 00:31:36 -0500
From: Glenn Little WB4UIV <glennmaillist@bellsouth.net>
Subject: Re: [R-390] [Milsurplus] 4PR65A

This is a pulse rated 4-65A.
IIRC 4-65s were used in the AN/ARC-21.

Date: Thu, 10 Nov 2011 00:39:49 -0500
From: Jeff Adams <physicist@cox.net>
Subject: [R-390] 4PR65A

EIMAC 8187 REPLACEMENT NSN 5960-01-005-119265W
Tetrode transmitter tube
I don't know where its used.

Date: Thu, 10 Nov 2011 01:20:35 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] [GreenKeys] 4PR65A
To: "Ray" <bluegrassdakine@hotmail.com>

The PR means "Pulse Rated". it's a version of the 4-65, a moderately small transmitting tube, in fact the smallest of the RCA glas tubes in its family. The normal tube is meant for RF or audio modulator service. The 4PR65 is meant for pulse service such as in large radar video displays or radar transmitters.

Date: Thu, 01 Dec 2011 09:03:22 -0500
From: k2cby <k2cby@optonline.net>
Subject: [R-390] OT Strange 5R4

I recently acquired a Viking 1-1/2 transmitter (that's a Viking I with the TVI suppression and audio mods from the Viking II).

Before I fired it up - and before I re-fastened the umpteen 6-32 screws that hold the top shield in place - I thought I ought to check the tubes on my trusty TV-7.

The power supply uses two 5R4 rectifiers.
The first one I popped in tested fine.
The second one didn't move the needle at all - not a flicker.

I said to myself "Well, that's obvious: open filament." As I reached over to pluck the tube out of the TV-7 and throw it in the trash I got a surprise - it was hot and glowing. I then figured maybe there was a solder fault in one of the base pins, so I sweated all of them and applied additional solder - no cure. I never heard of a rectifier with a good filament that wouldn't conduct at all. Did 5R4s have an internal fuse?

Date: Fri, 2 Dec 2011 09:31:50 -0500
From: Steve Hobensack <stevhobensack@hotmail.com>
Subject: Re: [R-390] Strange 5R4

Apply a megger across the filament pins. If it is open, try sparking a T model Ford coil across the pins. Sometimes you might get lucky and burn in a poor connection. I have had success with rare old tubes doing this, but since 5R4s are still cheap and plentiful, it probably isn't worth messing with. There could cause some grief in the future.

Date: Fri, 2 Dec 2011 12:04:16 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] OT Strange 5R4

Perhaps you need go to get one of these:
<http://www.myvintagetv.com/testers/r404.jpg>

Date: Sun, 1 Jan 2012 20:04:40 -0800
From: "Chris Kepus" <ckepus@comcast.net>
Subject: [R-390] OT (sorta) - long - Vacuum tubes were the 4th largest US export in 2011!??

Happy New Year to all. First, I apologize in advance to others who subscribe to the same multiple lists I belong and wonder, "Why in the *^%U&I* does this guy splatter all the lists with his OT QRM?" If you feel this way, please just hit the "Delete" key now. The reason I am posting this far and wide is because there are many very knowledgeable experts in the business of electronics who only post on one of the lists to which I subscribe and I want to hear back from you, wherever you are, if you know the answer to a question about the subject.

One of my non-ham friends called me asking, "...you're a ham who told me you use vacuum tubes and that new vacuum tubes came from China, Russia, and other countries...I thought USA manufacturers of vacuum tubes were all dead.... did you know an AP article on top US Exports appearing in The Salt Lake Tribune named Vacuum Tubes as the 4th largest US export at \$37.1 Billion!!!how is this possible?"

Astonished (and very suspicious of a misunderstanding), I Googled and found a couple of references to this report as well as the AP article here:
<http://www.sltrib.com/csp/cms/sites/sltrib/pages/printerfriendly.csp?id=53206814>

All the vintage boatanchor lists I monitor have been quiet on this subject. Maybe, I thought, I'm the only ham who doesn't know this "secret". God, I hate being ignorant! Another reference to supplement this information is this report: "Best Export Markets for U.S. Electronic Components, 2010". On this website:
<http://static.globaltrade.net/files/pdf/20101216032232.pdf>

This report appears to be a partial source of export information for the "vacuum tube" category named: HS 8540: This category is defined as including: Thermionic, Cold Cathode or Photocathode Tubes (Vacuum, Vapor 3 or Gas Filled Tubes, Cathode-Ray Tubes, Television Camera Tubes, etc.). "Vacuum Tubes" were also in the top five exports in 2010, 2009, 2008, 2007 and 2006! To those of you who know something about current vacuum tube manufacturing, could you please enlighten me as to what it is, exactly, that we are exporting that are called "Vacuum Tubes"?

Date: Sun, 01 Jan 2012 22:45:50 -0600

From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] OT (sorta) - long - Vacuum tubes were the 4th
largest US export in 2011!??

Sure the old "major" manufacturers are gone (RCA, Sylvania, Tung-Sol, GE, etc.) but that doesn't put the US "out of the business" making "common" tubes... but think Industrial, broadcast and other communications. Look up companies like CPI (Communications & Power Industries) - the largest manufacturer and rebuilder of electron tubes in the U.S. CPI owns Eimac, Econo and Beverly Microwave systems. Look up companies like Richardson Electronics and/or Westrex. These smaller companies specialize in high value tubes (such as WE 330Bs and such) but still contribute to the US's output of tubes. Then there are places like Antique Electronics in Tempe, AZ - with a inventory of hundreds of thousands of tubes (at one time more than a million!). They sell all over the world... which also "counts"...

Date: Mon, 02 Jan 2012 09:58:16 -0600
From: Robert Nickels <ranickel@comcast.net>
Subject: Re: [R-390] OT (sorta) - long - Vacuum tubes were the 4th
largest US export in 2011!??

Hi Chris - good catch! I agree that number doesn't seem to make sense. After 10 minutes of research, I think it is incorrect, or perhaps a product of over-zealous copy editing. I'd certainly be interested in know if I'm missing something, or if further clarification as to the claimed export numbers turns up. All US production is reported in the Economic Census, the last of which was completed in 2007, and the new one should be released in about 3 weeks. The GNP is broken down into categories according to NAICS - the North American Industry Classification System - and the NAICS category that seems to be relevant here is 334411 "Electron Tube Manufacturing", which is described here: <http://www.census.gov/econ/industry/def/d334411.htm>

But even if this includes specialty tubes that carry a high unit price tag, is there any data to support the claimed export number? I say no, based on the 2007 Economic Census. You can learn more than you probably ever wanted to know about electron tube manufacturing from the detailed information that can be found at: <http://www.census.gov/econ/industry/ec07/a334411.htm>
Or to save time - here's a one-page snapshot: *<http://tinyurl.com/7ocjbey>*

But the bottom line is that total production for NAICS 334411 totalled \$1.2 billion in 2007. It's inconceivable therefore that exports could now be more than 30 times this amount. As can be seen in the summary, sales of electron tubes and employment in this industry dropped by over 50% between 2002 and 2007. In 2007 the US-based tube industry consisted of about 70 firms employing roughly 5,000 people. That smells about right to me.

I've found that in business analysis as well as in radio troubleshooting, a good nose is your best tool!

Date: Mon, 2 Jan 2012 17:08:19 -0500 (EST)
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] OT (sorta) - long - Vacuum tubes were the 4th
largest US export i...

Once you get over a 100 watts or so of transmitter power you are back into

vacuum tubes. Every big (more than 200 watt) AM, FM, Short-wave, Radar, Xray machine, plastic melting bonding machine has vacuum tubes. And these are made in America. The process plants are old machines. For China to break into the business is a large up front expense and working against the many years of traditional customer relations.

So until the manufactures screw up big time they have a captive customer base. The real big kilowatt tubes are very big bucks. It may be a billion dollars in sales but it is smallish volume and not real profit. If the plant was not paid for long ago when small tube volume was high it has long since bit the dust to other companies that had better financial bases. Consider that every AM, FM, short-wave station butts a full set of transmitter tubes every year. Maybe \$50,000 per station per year.

A lot of the export is radar parts for stuff sold to other governments. Air traffic control, navy ships, other ships, military aircraft guidance systems.

There are a lot of RF industrial applications. A bunch of it is micro wave oven tubes.

There is a lot more kilowatts of RF in the air than you consider every day.
Roger AI4NI</HTML>

Date: Mon, 09 Jan 2012 19:28:26 -0800
From: Renee K6FSB <k6fsb.1@gmail.com>
Subject: Re: [R-390] AF Deck recap

I thought a 5814A was a 12AU7A only matched with sections and reliability.... maybe I am in error?

Date: Tue, 10 Jan 2012 09:15:09 -0800
From: David Wise <David_Wise@Phoenix.com>

The 5814A also has a higher heater current. It doesn't matter here, but in series-string applications you can't interchange them.

Date: Fri, 4 May 2012 18:57:43 -0700 (PDT)
From: Mike Jones <dustoff4@sbcglobal.net>
Subject: [R-390] Tube question

I've been looking at the tube kit for the R390 on ebay. I noticed that he gives 6AJ5 tubes instead of the 6AJ6 that the manual calls out. Does anyone have the datasheets for these tubes? I can't find anything on the 6AJ6, so I have no idea if the 6AJ5's are the same or not. Anyone know?

Date: Fri, 4 May 2012 20:15:29 -0700 (PDT)
From: David <davidbr549@yahoo.com>
Subject: Re: [R-390] Tube question

Look here for tube manuals. <http://www.tubebooks.org/index.html>

Date: Sun, 6 May 2012 20:48:44 -0400 (EDT)
From: Roger Ruskowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] Tube question

The R390 has two RF tubes. The front end of a R390 is a 6AJ5 type tube. 6AJ5's are also used in the first and second oscillator of the R390. The R390/A uses 5654/6AK5's for the first and second oscillator. I do not have a 6AJ6 in my tube manuals so you might e-mail to see if that's a typo for the 6AK6's Try antique radio tubes if you need tubes. You likely do not need a whole set of tubes Shop around for your tubes. Prices are all over the place and you can pay way too much.

Date: Sat, 22 Sep 2012 00:34:59 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] Pomona model 1447 and 1449 test socket adapters

Their web site is: <http://www.pomonaelectronics.com>

The "Contact US" link asks you to register to get information. But give it a try. They don't list them in the search for products listings, but there MIGHT be some on the shelf. You'll need to sit down when you find out the price, though.

Date: Mon, 15 Oct 2012 20:20:38 -0700
From: Greg Rainwater <w7acm@comcast.net>
Subject: Re: [R-390] Ballast for R-390A

I get all my tubes from Roger KE7NTD including the 3TF7. His Tube business web site is <http://www.vacuumtubes.biz/index.html> He is very reasonable on prices and a great guy! Having said that, I converted my R-390A to eliminate it. There is lots of info on how to do that.

From: "Todd, KA1KAQ" <ka1kaq@gmail.com>
Subject: Re: [R-390] IERC 6020-B cans

> I've been putting together a set of Tube Shields for an R390A and have
> managed to find them all but the 6920-B's.

Also used in a lot of other gear. Some years back, I'd guess a decade or more now, several of us on this list put together the Great IERC Tube Shield Swap which allowed folks to swap sizes they didn't have for what they needed. A few members even sold them outright, but most of us guard them jealously and only trade for other sizes we need. In my case, I'm always looking for the tall 7 & 9 pin versions, the 5025 and 6025. If you've got others to trade, I'd suggest going that route. List what you have and go from there. In a pinch, the later, open-top 6015 types will help. This is the style where you can actually look down the sides of the heat sink that contacts the tube envelope. The older types with the rolled lip/edge around the top will not as they trap heat inside. There is still a lot of gear going to scrap daily with these shields inside from scopes to avionics. When all else fails, dig around and do a little dumpster diving. Then again - if memory serves me correctly, there was a bulletin telling techs to discard all but certain shields and run the receivers without them - for what it's worth.

Date: Fri, 10 May 2013 20:26:40 -0700 (PDT)
From: John Saxon <johnbsaxon@yahoo.com>
Subject: [R-390] A little OT: Military vacuum tube designations

I would like to have a reference that correlates the military vacuum tube

designations with civilian equivalents.

For example: 6201/12AT7; 5814/12AU7.

I used to have such a document, but can't locate it, and I have been internet searching tonight and haven't found one.

Date: Fri, 10 May 2013 23:52:42 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] A little OT: Military vacuum tube designations

Some of the tube numbers you are interested in may well be industrial type numbers. For individual tube numbers, try this link:

<http://tdsl.duncanamps.com/tubesearch.php>
For summary data on almost any tube you have or have heard of, get Ludwell Sibley's book "Tube Lore". For lots of odd data on foreign tubes and their US equivalents if any, search for the file: TubeEquivalents_AS.xls (It seems to be at: frank.pocnet.net/other/equivalents/TubeEquivalents_AS.xls)

For old military cross reference to civilian type numbers, find the file: vt_to_jan3.txt seems to be at: www.tuugo.ca/Companies/spl-systems/0080004723580 But that link does not work to get the file.

Try: aade.com/links.htm for the file vt_to_jan.txt

For extensive data on most any tube made by RCA, search for this: "RCA HB-3 MANUAL" and download whatever sections you need.

Date: Fri, 10 May 2013 22:32:13 -0700
From: Dan Merz <mdmerz@frontier.com>
Subject: Re: [R-390] A little OT: Military vacuum tube designations

Hi, Tube Lore is excellent and has the VT numbers. I really like the GE tube manual Essential Characteristics, as it has a table of industrial, military and special purpose tubes (4 digit numbers) and their corresponding tube types. I have the 1973 edition, orange cover, which i think AES sold at one time. The version I found as a pdf download was not as complete with regard to the mentioned table. But I didn't explore to see if the 1973 version was available.
Dan

Date: Sat, 11 May 2013 06:46:04 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] Military vacuum tube designations

See if this helps:

http://www.bunkerofdoom.com/tubes/vtcross_1_s_www.pdf

Date: Fri, 17 May 2013 18:22:53 -0700
From: Gordon <gordon@n6wk.com>
Subject: [R-390] 5963 vs 5814

Can I use 5963 tubes in place of some of my 5814 tubes? They both cross

to the 12AU7. I have some extra 5963's and some weak 5814 tubes that need replacing.

Date: Fri, 17 May 2013 22:39:45 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] 5963 vs 5814

Probably, but note two things. First, the 5963 is designed for use as a binary logic element, not as an amplifier, so its characteristic curve may exhibit more distortion than a 12AU7 or 5814 (both of which are designed as class A amplifiers). Second, vacuum state logic used lower supply voltages than most amplifier applications, so the 5963 is only rated for 250 volts on its plate (compared to 330 for the 12AU7/5814). As long as you stay within the plate voltage rating, I doubt you would notice any difference in practice.

Date: Sat, 18 May 2013 18:43:51 -0700
From: Gordon <gordon@n6wk.com>
Subject: Re: [R-390] 5963 vs 5814

I am confused as they both cross to a 12AU7 ?

Date: Sat, 18 May 2013 21:17:18 -0500 (CDT)
From: Jim Haynes <jhhaynes@earthlink.net>
Subject: Re: [R-390] 5963 vs 5814

> I am confused as they both cross to a 12AU7 ?
>

A problem came up in early computers. When a tube was cut off for a long time, as in half of a flipflop, it would not conduct when the time came to conduct. The problem was traced to silicon as an impurity in the cathode material. This caused an insulating layer to form between the cathode material and its metal sleeve substrate, so the cathode was disconnected inside the tube. The problem never occurred in applications such as audio amplifiers where the tube is conducting all the time. The 5963 and 5965 were specified for computer service and were more or less guaranteed to be free of the silicon impurity and thus not subject to the problem, which was called "cathode interface formation". I don't know whether the later 12AU7s and 5814s were also made with the high-purity cathode metal, after the cause of the problem was discovered. So it should be fine to use a 5963 to replace a 12AU7, but you don't want to put a bunch of 12AU7's in your computer.

Date: Sun, 19 May 2013 03:43:53 -0400
From: "Charles P. Steinmetz" <charles_steinmetz@lavabit.com>
Subject: Re: [R-390] 5963 vs 5814

>I am confused as they both cross to a 12AU7 ?

One should always take cross-reference guides with a grain of salt. There are different degrees of "acceptable substitute," ranging from "same tube but sorted for a certain parameter" through "intended to work the same but with some internal change that is not supposed to make them work differently," and "similar," all the way to "different tube design but should work in the socket if you have nothing else and you're desperate." Sometimes the guides tell you which is which, sometimes they don't. And sometimes they're just Internet compilations put together by someone who doesn't know what he's talking about

but once heard both tubes mentioned in the same sentence.

Take the 5814, for example. It is not exactly the same as a 12AU7 -- it draws 175 mA per section of heater current, rather than the 150 mA the 12AU7 draws. If you plug a 5814 into a socket designed for a 12AU7, and the heater supply can't handle the additional load (or, if the heater is wired in series with another 150 mA tube), you have a problem. (The series-heater problem would also bite you if you installed a 12AU7 into a socket designed for a 5814.) So, the 5814 is generally listed as "interchangeable with" the 12AU7, but it is not exactly the same and the differences could matter in some applications. Consider also the 5751, which is often listed as interchangeable with the 12AX7 (it is sometimes called a "mil-spec 12AX7"), but is in fact a quite different tube.

Jim gave a good account of why the "computer tubes" are different. There is no guarantee, however, that nothing but the cathode coating is different -- manufacturers may have made other small changes to make them better suited to computer duty, as long as they were getting a new type number. I do not know specifically why the plate voltage rating is lower on the 5963, but I would not assume it is for no reason. [Perhaps the low-silicon cathode slurry is more sensitive to ion bombardment, or it boils off easier and contaminates the grid, or the electrode geometry was changed a little, and the HV must be reduced to compensate (each of these is pure speculation, but shows that there is a range of possibilities that could lead to a lower plate voltage rating).]

All in all, perhaps it is better to think of the industrial/military/computer variants as "based on a XXXX" rather than as "a XXXX," at least until perusal of the datasheets indicates that they are substantially identical. Generally, the variants will work in a socket intended for the prototype, but the datasheets must be consulted to see if any ratings are different and the particular application must be vetted to make sure any differences in ratings do not cause problems. As noted above, true even with the 5814, which most people think is "the same as" a 12AU7.

Always go back to the data sheets when this sort of issue arises. And these days, it's just as easy to find the actual data on the internet as it is to find substitution guides. Treat the sub guide as an index of which datasheets to pull if you don't already know which tubes you want to compare, then read and digest the datasheets. Impressive collection of tube datasheets (there are many other

collections on line, so search): <http://tubedata.tubes.se/>

Impressive collection of tube manuals for download (again, there are others, so search): <http://www.bunkerofdoom.com/tube/man/>

Date: Sun, 10 Aug 2014 14:16:32 -0500
From: Raymond Cote <bluegrassdakine@hotmail.com>
Subject: [R-390] Tube testers

I recently sold my 3 TV-7 tube testers. I thought I might find out the differences between the TV-2, TV-3 and the TV-7 since they were all made for military before I do anything else stupid. I also have cardmatic, I177 and a lab tester with about 8 meters and too many switches to twist. These last ones keeping for now. Any one know or have a link that compares the TV series of testers? I tried google but gave up after 45 minutes.

Date: Sun, 10 Aug 2014 16:32:29 -0400 (EDT)

From: Glenn Scott via R-390 <r-390@mailman.qth.net>
Subject: [R-390] Tube Testers

I bought a book on Amazon recently, "Tube Testers and Classic Electronics". By Alan Douglas and it had a lot of good info but nothing in-depth. Others have complained that the book is a little unorganized and scattered. I liked the book and will keep it for a general reference.

http://www.amazon.com/Tube-Testers-Classic-Electronic-Test/dp/1886606145/ref=sr_1_cc_1?s=aps&ie=UTF8&qid=1407701661&sr=1-1-catcorr&keywords=tube+tester+books

He does cover the TV series tube testers with models that I was unaware of. His basic issue with the TV2 vs 7, is the TV2 was too much trouble to set up compared to the TV7. I use my TV7 to quickly test tubes for go/no-go and to basically quantify the general quality of a tube before testing it in a real application circuit. I use the TV2 for more thorough design work in conjunction with my Tektronix Curve tracer. You can get a used copy of the book for about \$15 and a new one for a little over \$22. I recommend it as a reasonable resource for some vintage test gear.

Date: Sun, 10 Aug 2014 20:45:38 -0400
From: Steve Byan <stevebyan@verizon.net>
Subject: Re: [R-390] Tube Testers

How do you do that, since the TV-2 reads transconductance in "percent quality"? Have you calibrated the shunt control? If so, how? Have you added plate current metering test points?

Date: Sun, 10 Aug 2014 20:55:37 -0400
From: Frank Hughes <fsh396ss@gmail.com>
Subject: [R-390] TV series overview

Overview of TV models from Roger Kennedy's site:
http://www.alltubetesters.com/articles/tester_guide.htm

The Military Models

Most all military testers utilized the Hickok circuit design. TV-2 series, TV-3 series, TV-7, and TV-10 series. And the AN/USM-118A/B series Cardmatic models as well.

The TV-2 is very good tester. Time consuming and a little complicated to setup. All the parts were military grade and built for battle so the testers are rugged. This is a very good tester if you don't mind the setup procedure. The meter displays percent quality which is not direct Gm but the actual Gm value can be obtained by the use of a chart or some basic math calculations.

The TV-3 series are also good testers. They also contain a built in VOM (volt ohm meter) which in today's environment is mostly useless. However, it does display Gm directly and measures shorts/leakage to 300K ohms and has three Gm range scales: 3000, 6000, 15,000

The TV-7 series is a good and popular tester. The meter displays in a

single numeric scale which can be directly converted to actual Gm by using a chart or doing the math. This unit has up to 5 Gm ranges depending on the model you obtain. The TV-7 D/U was the final model built and has the most Gm ranges with the latest upgrades and best overall performance of the TV-7 series.

The TV-10 series is yet another good tester. The TV-3 and TV-10 are almost identical except the TV-10 series does not have the built in VOM operation. This unit measures directly in Gm.

The military cardmatics AN/USM-118A or B versions are the same as the commercial Hickok 1234A or B version or the Western Electric KS-17xxxxxx L1 or L2 versions. The only difference is the military grade components and the cost to make them, which the US taxpayers covered. This is an excellent tester with a +/- 4% accuracy in readings when properly serviced and calibrated. You do need to obtain, or punch the cards for the tubes you will be testing. The meter reading is percent quality but the tube reference manual that came with the unit makes it easy to calculate the actual Gm test value. No knobs to switch all operation set up by the tube test card you put in.

I sent him a TV-10 to be updated and calibrated, plus some solid state mods. As he is a one-man operation, I was not in a hurry, and in a few months I received a very nice TV-10 that I have used for many years now.

Date: Sun, 10 Aug 2014 21:35:52 -0500
From: Raymond Cote <universal_comm@reagan.com>
Subject: Re: [R-390] TV series overview

Thanks for the link Frank. That's what I wanted.

Date: Sun, 10 Aug 2014 22:51:37 -0400 (EDT)
From: Glenn Scott via R-390 <r-390@mailman.qth.net>
Subject: [R-390] Tube testers TV2 Tek 576 curve tracer

you asked: > I use the TV2 for more thorough design work in conjunction with my Tektronix Curve tracer.

How do you do that, since the TV-2 reads transconductance in "percent quality"? Have you calibrated the shunt control? If so, how? Have you added plate current metering test points? -Steve

That bench for my tube work is very involved with HP low and High power DC and AC supplies, A Tektronix 576 curve tracer, TV 2 tester with a proprietary interface between the TV 2, Tek 576 and fixtures/interfaces. I use an HP 3580 spectrum analyzer for base band signals and an 8566B spectrum analyzer for signal interest to the GHz range, should I ever have the need. Additionally there are several counters, sig gens converging to test fixtures with proprietary interfaces/cabling between the various test apparatus.

There was an excellent article in Vacuum Tube magazine about 2 or 3 years ago about using a TeK 576 curve tracer with tubes and this spurred my interest in eventually taking all of this several steps further. At least one audio tube vendor has videos on youtube demonstrating tube matching with a Tek 576 curve tracer. The 576 was designed for SS devices but it didn't take much work to use it as an excellent tube equivalent. <https://www.youtube.com/watch?v=ayLjvgcyfTc>

I did not infer any kind of direct connect between my TV 7 and curve tracer, However, rest assured everything that I need for looking at various distortions and noise with regard to variations in plate voltage and grid/screen bias(s) of the tubes of interest at specific frequency ranges is available with this somewhat elaborate set up..

I did my mods on the TV2 so they can be reversed without any new holes. The TV2 proved to present many challenges and as sophisticated as it looks it seems to have been poorly or partially thought out. IMO. I may work it out of the test setup soon since other processes I have in place are proving to be much more adequate.

Actually, most tube testers are deficient with regard to a number of parameters. As I said in my post, I use the TV7 as a go/no go indicator and to get a general sense of the tube quality and if it MIGHT work well in a specific application. I have tested tubes in numerous tube testers as good and in real applications they proved micro-phonic, noisy, or lacking gain at higher freqs. However, most of the time if I test a tube as good with a standard tube tester, it does fine.

Date: Sun, 10 Aug 2014 23:10:05 -0400 (EDT)
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] TV series overview

Thank you for the education of the tube testers.
Now I know what to shop for a the meets.

Date: Mon, 11 Aug 2014 09:36:34 -0700
From: Joe Foley via R-390 <r-390@mailman.qth.net>
Subject: Re: [R-390] [Milsurplus] Tube testers

What? No mention of the TV-10?

Date: Wed, 12 Nov 2014 15:47:40 +1100
From: Pete Williams <jupete@internode.on.net>
Subject: [R-390] R-390A.... 12BA6 in PTO and BFO

Probably been mentioned, but 12BA6 can be used in PTO and BFO while waiting for a replacement ballast tube. Jumper pins 2 and 7 on the 3TF7. You have to replace both of course as the heaters are series from the 25 V supply. I only noticed this on a PTO being checked out. Stability /performance not checked.

Date: Wed, 12 Nov 2014 01:26:02 -0600
From: Raymond Cote <universal_comm@reagan.com>
Subject: Re: [R-390] R-390A.... 12BA6 in PTO and BFO

Yes it has but I misplaced the reference to it. Thanks for spelling it out again. I'll save it correctly this time.

Date: Wed, 12 Nov 2014 16:01:17 -0500
From: "David C. Hallam" <dhallam@knology.net>
Subject: Re: [R-390] R-390A.... 12BA6 in PTO and BFO

Unless you are operating with extreme temperature variations or mobile, I don't

believe you will detect any difference. I used them for years in my R-390.

Date: Tue, 25 Oct 2016 23:18:36 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: Re: [R-390] bfo hum and s meter not on zero

One of the least expensive trouble-shooting aids is a complete set of tubes. They don't have to be new or special just good. It is a PITA to pull all the tubes out and replace them one by one. But if you have a very limited test equipment budget it may be the only good choice that one has. Also, spend time reading Roger R's comments in the Y2KR3 manual. One won't become an expert overnight. But over a period of time one will become more familiar of the way it works. Seeing all the slugs go up and down as one tunes through the bands is intimidating. But if the cams line up properly with the marks on the rear panel, you're probably good to go. Really, the more you study and "spend quality time" with your radio(s) they become far less intimidating. (but still weight a ton) BTW, remember the old car radios where you pushed the button to the station you wanted They employed a slug tuning system also. The "A" just does it on steroids.

Date: Tue, 25 Oct 2016 23:41:16 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] Learning about vacuum tubes

If one wants to learn about vacuum tubes, Ebay has a list of mostly RCA manuals and some are on CD. IIRC mine are version RC-21 but any in that vintage will do. Besides learning how tubes and tube circuits work they have listings or the proper voltage levels under the specific tube number. One quickly learns that at least many SP 600's were built to non- recommended values. I wouldn't be surprised if other name brand B/A radios suffer a similar fate.

Date: Tue, 25 Oct 2016 19:58:54 -0400
From: Norm n3ykf <normanlizeth@gmail.com>
Subject: Re: [R-390] Learning about vacuum tubes

The one I have has a diagram and explanation of a "relaxation oscillator". Looks much like the calibration oscillator in the -390A

Date: Tue, 25 Oct 2016 20:55:49 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: [R-390] TR: Learning about vacuum tubes

If you are lucky enough to locate one and if you can read at bedtime, try the RADIOTRON DESIGNER'S HANDBOOK.

Date: Wed, 1 Mar 2017 9:19:41 -0500
From: <wb3fau55@neo.rr.com>
Subject: [R-390] 6C4- 6C4WA- 6100- 6136

I need to buy some of these for my repairs. I have read that I should not use 6C4WA? Or can I use any of these in my R-390As? Russ.

Date: Wed, 1 Mar 2017 09:40:11 -0500
From: Dan Martin <pitfit@comcast.net>
Subject: Re: [R-390] 6C4- 6C4WA- 6100- 6136

Hmmm ... either seems fine to me. A 6C4WA is just a ruggedized 6C4. There may be modest differences in noise and gain but only what you would see between otherwise identical tubes all the time. I've always considered the 6C4, 6C4WA, EC90, etc., to just be sorta-kinda half of a 12AU7A. See what others say. I'd have to check but I think I have some of each in my 390A.

Date: Wed, 1 Mar 2017 10:04:38 -0500
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] 6C4- 6C4WA- 6100- 6136

All the variants behaves equally.
The 6136 is a 6AU6 variant !
6135 is a 6C4 with a higher filament current (half of a 5814).

Date: Wed, 1 Mar 2017 20:17:04 +0000 (UTC)
From: Bryan Stephens <bryanste@yahoo.com>
Subject: Re: [R-390] 6C4- 6C4WA- 6100- 6136

The Troubleshooting section of the R-390A manual advises not to substitute type 6C4W for a 6C4 tube: "The differences in characteristics are such that the type 6C4W will not operate properly in the receiver." The 6C4's are used in the 1st, 2nd, and 3rd mixers. Inter-plate capacitance varies among types 6C4, 6C4W (aka 6100), and 6C4WA (aka 6135). The 6C4W capacitances are higher than the 6C4 values, while the 6C4WA capacitances are lower. I think you want to avoid the 6C4W variant due to the higher inter-plate capacitance even though it's considered a premium tube. The 6C4W in mixer service may be prone to distortion or even oscillation. The 6C4WA/6135 is probably ideal, since it is a premium tube engineered for low inter-plate capacitance (although it does require a slightly higher heater current). See RCA Essential Characteristics for detailed specs.

Date: Wed, 1 Mar 2017 21:03:09 +0000 (UTC)
From: Bryan Stephens <bryanste@yahoo.com>
Subject: Re: [R-390] 6C4- 6C4WA- 6100- 6136

Actually Essential Characteristics is a GE reference. Also, Sibley's Tube Lore has some interesting notes, and is a must-have for the boatanchor enthusiast's bookshelf.

Date: Wed, 1 Mar 2017 17:14:38 -0500
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] 6C4- 6C4WA- 6100- 6136

About the 6C4Ws: I just looked at the 6C4Ws I have and they are really made different from the run-of-the-mill 6C4s. I have only two, branded Raytheon, they are shorter than a "normal" 6C4, and the internal structure is identical to the one of a 9002 tube. Remember here that a 9002 is the 7 pin variant of a 955, originally designed as a VHF triode.... o OK for the inter-electrode capacitances, but for me, those 6C4Ws are completely different tubes. No wonder they can cause trouble in a R-390A... Another thing: a 6100 is not equal to a 6C4W, but half of a 6189 (industrial grade 12AU7/ECC82). A 6135 is half of a 5814A, but not equal to a 6C4WA (different filament current). But all three (6C4WA, 6100, 6135) are OK to be used in the R-390A (internal structure identical to a 6C4).

Date: Sat, 11 Mar 2017 03:53:42 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] R-390A Alternative to 6DC6 RF amp

I've been testing various tubes over the past few weeks to see if there is an alternative type that would work as well as a 6DC6, without any circuit modifications. Here's the list of the ones I started with: 6AW6, 6BJ6, 6BZ6, 6CB6, 6CF6, 6DE6, 6DK6, 6GM6, 6HQ6, 6JH6, 6662, 6676, 7694, 7732. These have the correct basing diagram. Unfortunately, I do not have all of these types to test. Here's the ones I have and the quantity: 6BZ6 (2), 6CB6 (3), 6DC6 (8), 6GM6 (5), 6JH6 (2). As you probably know, some of these are 'sharp' cutoff and 'remote' cutoff designs, with the grid 1 (control) cutoff at about -6 volts for sharp and -20 for remote. The 6DC6 is designed at -12.5.

The first thing I did was to go through all of my 6DC6's to find the best one and document the range of quality I had. The range was not as great as I thought it would be, about 16%. But, the best one I found was 7% better than the one I was originally using. I was pleased about that.

I had heard a number of times that the 6GM6 was very good and that the Equivalent Noise Resistance (ENR) of it (490/480) was considerably better than the 6DC6 (1,400/1,800). Well, I had high hopes for them, but after testing the 5 that I had, I was quite disappointed. None of them were close to the 6DC6, perhaps due to the plate resistance being half of the 6DC6.

I measured all the tubes 2 ways, noise level and signal gain. I started with my best 6DC6, injecting about a .4 microvolt unmodulated signal into the balanced ant connection. I measured the diode load voltage in mgc mode with max RF gain, and adjusted the line gain for -5 on the line meter. The reason I chose .4 uv, is at this level the noise is elevated above the noise level with no signal and it's quite a ways from the quieting threshold. The input and output alignment was tuned for each tube. I recorded each tubes 'noise level' and diode load voltage. This established a base for comparison of the rest of the tubes. Keep in mind that these measurements were made in mgc mode with RF gain at max, so the bias on the control grid is kept at 0. This means that the tubes cutoff level is not a factor here. To eliminate errors, I measured all the tubes twice.

To make a long story short, only 3 tubes had a better 'noise level' than my best 6DC6, BUT they had less gain. Only 1 6GM6 had a better noise level, but its much lower gain made it less effective. There were 2 6CB6's that had better noise, but only 1 had sufficient gain to make it about equivalent to the 6DC6. Since many of these tubes were sharp cutoff, I tested the effect with agc on. Although the agc voltage was only slightly less, the noise level at low signal levels was higher at certain low levels. The agc issue could be fixed with a simple change to the RF tube bias wiring. The sharp cutoff tubes also affected the RF gain linearity, and I don't see an easy fix to that.

And the winner is: 6DC6. But, a 6CB6 could be used in a pinch. My 3rd and 4th choices would be a 6GM6, and then a 6JH6 or 6BZ6. Of course, any in the 1st long list will work in an emergency. The following tubes are remote cutoffs and would not be an issue when using agc (as we normally do): 6GM6, 6HQ6, 6JH6, 7732, 6BZ6, 6662, 7694, 6BJ6.

Date: Sat, 25 Mar 2017 23:04:50 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>

Subject: [R-390] 6C4 variations

A quote from the service manual said: "The differences in characteristics are such that the type 6C4W will not operate properly in the receiver." <snip> While the original author is unknown, this is totally inaccurate. "Some capacitance values are different" ?Maybe. The tube manuals a 0.1 to 0.2 pF differences in their listing of interelectrode values. Well within a margin of error but still irrelevant at B/A frequencies.

I did a search in both my different RCA tube manuals as well as three or four more online, I also consulted the "Tube Substitution Hand Book" by Smith and Buchanan which lists all 6C4 variants as the same for any use. The same was also true for all the tube manuals I viewed. There was no mention anywhere of 6C4 differences. I got the torches, wooden stake(s) and garlic.

Date: Wed, 19 Sep 2018 13:46:01 -0500 (CDT)
From: Ken Perales <kenperales@comcast.net>
Subject: [R-390] Further on problem getting my R390A working

I have had my 390 turned on for 4 days now and checking many times a day for heat build up and two days ago went the the full CAL function all the way from 0 MHz to 32 MHz every one hundred KHz. Other than some zero shifting in the higher bands, 2 to 3 KHz. There is a CAL signal all the way. Then I changed to AGC and went the full range from 10 KHz to 32999 KHz. I found a lot of carrier signals all over the bands and a lot of what we used to call teletype signals. But did not find any Morse signals from bottom to top and only some AM radio signals scattered on a number of bands. From 10 KHz to 1999 KHz there are all kinds of radio stations in all kinds of languages given I am right outside Houston, I guess that is normal. From there the only radio signals I picked up were 8580, 9400, 9222, 9480, 11761, 11788, 11863, 11940, and 17867. No radio or morse anywhere else.

Of the vacuum tubes looking from the top, very few have any glow showing. V505, V506 slightly glowing, V401, V501, E209, V204, V203, V207. That does not change no matter what MHz I am on.

So with this brief look at the radio and with no test equipment available, Does this point to anything identifiable or do I need to take it to a shop that can test all the individual tubes to see if what looks like a dozen tubes might need to be replaced in which case this was nowhere close to operational when I received it. Everything else looks very clean and no sign of corrosion or broken or disconnected wires. The slugs look reasonably clean without trying to remove them. If there is something else I can check without taking it to far apart, I am willing to try.

Date: Wed, 19 Sep 2018 22:07:24 +0200
From: SGS 126 <brloper@gmail.com>
Subject: Re: [R-390] Further on problem getting my R390A working

The bands are pretty dead

Date: Wed, 19 Sep 2018 19:39:33 -0400
From: Roger Ruzzkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] Further on problem getting my R390A working

Rustle up a few spare tubes and start testing them in place. Cal Tones and the line meter will get the receiver up to best mechanical and electrical alignment. A signal

generator and two meters are just more elegant.

Your mission is to grade the tubes in hand, cherry pick, Easter egg hunt, test tubes. Set the receiver up and listen to some TTY. idle and active CW and modulated The world chooses your meter reading moment.

Run all the 6C4's and put your best three in the receiver. Second mixer above 8 Mhz. In the IF deck and the 6BA6's in the R390 or the 5749's in the R390A get the same treatment. First IF amp Run all the dual triodes through the audio deck and consider even grading each side if good tubes are not on hand. Ask the children to fold you some Chinese finger cuffs in a couple different sizes. Use them as tube pullers. A couple lengths of 1/4 wide ribbon from a gift package works well.

If the tube lights up and functions it passes the short test. The receiver will let you cook a shorted tube for some time for slow speed educational demonstrations After you swap a few tubes you will start to hear the difference and get an ear for judging the best of two tubes. There is a pecking order for the placement of a tube set into the receiver for the best use of the tubes in hand to yield the best sensitivity and signal yield.

Put your hand on the radio. Fifty years ago the clamber was no room for all the needs. Wait until you can get some of the audio out of your receiver and into a computer sound card. It is all there but it's different now.

Visit <http://www.r-390a.net> and <http://www.r-390.com> Different sites all of it is useful.

Date: Wed, 19 Sep 2018 20:51:20 -0400

From: Roger Ruzzkowski <flowertime01@wmconnect.com>

Subject: Re: [R-390] Further on problem getting my R390A working

Rustle up a few spare tubes and start testing them in place.

Cal Tones and the line meter will get the receiver up to best mechanical and electrical alignment.

A signal generator and two meters are just more elegant.

Your mission is to grade the tubes in hand, cherry pick, Easter egg hunt, test tubes.

Set the receiver up and listen to some TTY. idle and active CW and modulated The world chooses your meter reading moment.

Run all the 6C4's and put your best three in the receiver. Second mixer above 8 Mhz. In the IF deck and the 6BA6's in the R390 or the 5749's in the R390A get the same treatment. First IF amp. Run all the dual triodes through the audio deck and consider even grading each side if good tubes are not on hand. Ask the children to fold you some Chinese finger cuffs in a couple different sizes. Use them as tube pullers. A couple lengths of 1/4 wide ribbon from a gift package works well. If the tube lights up and functions it passes the short test. The receiver will let you cook a shorted tube for some time for slow speed educational demonstrations. After you swap a few tubes you will start to hear the difference and get an ear for judging the best of two tubes. There is a pecking order for the placement of a tube set into the receiver for the best use of the tubes in hand to yield the best sensitivity and signal yield.

Put your hand on the radio.

Fifty years ago the clamber was no room for all the needs. Wait until you can get some

of the audio out of your receiver and into a computer sound card. It is all their but it's different now.

Visit <http://www.r-390a.net> and <http://www.r-390.com> Different sites all of it is useful.

Date: Thu, 20 Sep 2018 10:56:58 -0500
From: Don Reaves <donreaves@gmail.com>
Subject: Re: [R-390] Further on problem getting my R390A working

I'm sending a link to the handout I used back in 2001 to conduct a short introduction workshop on the R-390A. It may be of some use to you. At a minimum, if you are to do any troubleshooting of your receiver, you need a voltmeter. Even a throwaway digital meter for \$10 from Harbor Freight is better than guessing. With the ohms function of the meter you can test a tube to see if it has filament continuity, which would answer one of your questions. You can use the meter to check for basic voltages present in the receiver. Be careful - high voltage is present.

However, if you are hearing signals from your receiver, chances are most if not all of the tubes are working, at least somewhat. You can't always tell if a tube is glowing properly by looking under normal lighting conditions. Try looking at night or in a darkened room.

I would ignore any noise you hear from the radio below 500 KC, it's specified low end range. Tuning below 500 is going to reveal nothing useful. You should be able to find WWV standard time broadcasts from Ft. Collins CO at 5 MC, 10 MC, or 15MC depending on the time of day and propagation. That will help verify your receiver is working.

<http://militaryradio.com/manuals/Misc/R390ABasicMaintenance.pdf>
Good luck, have fun!

Date: Thu, 20 Sep 2018 15:43:04 -0400
From: dog <agfa@hughes.net>
Subject: Re: [R-390] Further on problem getting my R390A working

The only CW you are likely to hear is on the bottom end of the ham bands and 30M ham band. Listen in the evening, on the lower bands, nothing above 18MHz. You should hear something. Lots of the tubes look like they don't light up, check it in the dark. If you're hearing stations, it most likely works to some degree. You need a calibrated sig gen to test if it's working right.

Date: Fri, 1 Mar 2019 13:27:33 -0800
From: Larry H <larry41gm@gmail.com>
Subject: Re: [R-390] R-390A Power On Voltages, OA2 Operation Document

The link has been corrected. Sorry for the inconvenience. Here's a direct link to it: <http://www.r390a.net/R390A%20Pwr%20On%20B+%20OA2%20reg%20operation.pdf>

Or you can use the link to the 'tutorials' here:
<http://www.r-390a.net/faq-refs.htm#Tutorials>
