BALLAST TUBE HINTS AND TIPS

Date: Wed, 5 Nov 1997 22:53:46 +0000
From: Bob Roach <KE4QOK@...>
Subject: [R-390] Current Limiter Problem

As I mentioned in my previous message I just acquired an R-390. THe info is as follows R-390A/URR SN#1315 . The only problems that I have been able to find so far is that the RT510 current limiter is shot. I have never encountered one of these before so I don't know:

1) Are they available?

2) Is there a temporary fix till I can find one or permanent if I can't?

Looking at it strictly from the point of view of protecting the filaments of the tubes it protects it seems like it could be replaced by a 42 ohm 4W resistor. I am also sure that this thing must be doing something that I am not aware of or it would be a 42 ohm 4W resistor instead of a specialty tube. Although I have some limited knowledge of electronics it is probably best to think of me as very unknowlegable when explaining things, just in case I'm not as smart as I think I am. Thanks in advance for the help.

Date: Wed, 5 Nov 1997 16:10:02 -0800 (PST)
From: Dave Rickmers <rickets@...>
Subject: Re: [R-390] Current Limiter Problem

I use a 50 Ohm 5W power resistor, seems to work fine, for 9 years now...

Date: Wed, 27 Jan 1999 15:46:03 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] Tidbits from Amperite on Ballast Tubes

OK, after listening to all of the hype and BS about the ballast tubes in the R390A, I figured I'd research it a bit an post my findings. Put your boots on bubba, it's gonna get deep... <grin> If one of you guys is saving stuff for an R390A FAQ, the info below would go well in it. Diggin' thru a 1982 Amperite AM-82 application quide, I found a few interesting things that I'll pass on to you guys. If you deal with a distributor that handles Amperite, get them to get you a copy, it's an interesting book. 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 F. 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 ife.

The rated life expectancy when operated as recommended within it's 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. Here's a direct quote from Amperite AM-82 that you'll really find interesting:

- ---snip---

DUTY CYCLE DEPENDENT

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 if 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. - ---snip---

I figure that over the last 23+ years that I've had the old Collins, it's been on for "24 and 7" for at least 15 of those years. 15 years is 131,400 hours. That original 3TF7 is still going just fine. I'm not saying that it won't puke when I finish the overhaul of the receiver and power it up, but even if it did, it gave pretty damn good service.

The folks at Amperite that I've dealt with have been a hell of a nice bunch. I needed some information on some odd "non standard" numbered ballast tubes. They transferred me to an engineer and I received all of the answers that I needed. Very sharp and friendly bunch of people.

For what it's worth, there's another part number for the 3TF7 that was used for tubes that had different testing requirements than the standard mil-spec and was for a Govt contract in 1978, and not for civilian or commercial sales. After I corner the market on them I'll post the number. <grin> Just joking...a friend of mine found a stash of them and sent me three of them last week or so to research and experiment with. After talking to the engineer at Amperite a few hours ago, there's no need to experiment. I now know exactly what they are. The end flap of the boxes is labeled as follows:

Amperite
TJ311M01

The side panel is labeled as follows:

5905-00-681-4707 Resistor Current Regulating 1 ea.
DLA900 78-M-T921 A 5/78

The tubes themselves are labeled as follows:

(circled Amperite "A" with lightening bolt)
Amperite TJ311M01 Ballast 820

So, if you spot any of these TJ311M01 marked ballast tubes, grab a few, they'll work just fine in your R390A.

I'd be curious to hear from any of you that bought an R390A that contained one of these or any of you that have information on the contract number or the FSN for them, listed above.

Date: Thu, 29 Jan 1998 13:19:26 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Solid State

The ballast tube is a poor quality current regulator used to stabilize the heater of the oscillator tubes. Most any solid state replacement should be more effective.

Date: Sun, 15 Feb 1998 01:37:28 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Heat build up in the R-390A

I detect different users have different concerns, and it might not always be based on absolute longevity of the radio and its parts. It may be based on military usage where there were both a superb supply of spare parts, but a shop with NOTHING else to do but maintain radios, along with enough spare radios installed that if one failed, there was no loss of communications. Today there's not that supply of parts and for any individual user besides Chuck Rippel, there's not a back up radio on hand.

I think the Variac is OK to get the heaters down to rated voltage if the line voltage is high (though a bucking transformer would be less easily messed up by a wandering hand), but removing unnecessary dissipation from the series regulators (maybe that's in the 390) and the other tubes has to help longevity a bit. I can show that a choke would reduce total power consumption better than the resistors. I suspect that the ballast tube does more for the longevity of those tubes by softening power up transients on those two tubes and it accomplishes by roughly regulating their heater power. I'm beginning to doubt that the ballast does anything detectable for long term stability, except that by softening the power up transient and keeping the heaters closer to their rated power that those two tubes last significantly longer and so replacing them leads less often to a need for recalibrating those two oscillators. I used the resistor scheme when replacing seleniums with silicons in my old Tek 541 scope back about 1970. With the right resistors, I didn't raise the voltage on any electrolytics, and so didn't blow any which were already old then. I sold that scope at least 22 years ago, and doubt it still is in use. The 475 that I bought to replace it is working fine yet, though I've had to fix it a few times.

From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
To: Chuck Rippel <crippel@exis.net>
Subject: Re: [R-390] Re: Heat build up in the R-390A

You mean it was thermally limited or which? Current limiting is the whole idea of the circuit. An LM317K is good for 1.5 amps, though the power dissipation with cold filaments may cause it to shut down. It could very well be that some of the power dissipation should be moved to a series resistor to remove heat from the LM317...

The 317 shouldn't be current limiting more than limiting the current to 300 ma. At power on its likely going to be dropping 20 volts so the power dissipation can be a limit, if its not supplied with an adequate heat sink. The chip is self protecting based on chip temperature. If the 317 is configured as a voltage regulator, then the turn on current for the tubes likely will put it into current limit and drastically drop the voltage on the tubes, probably never letting them heat. But as a voltage regulator, the softening of turn on for the tube heaters that may well be the major benefit of the ballast is prevented, and made worse by the voltage regulation.73, Jerry, K0CQ

Does 3TF7 ballast mod change alignment? (by Chuck Rippel, WA4HHG)

Q: I'm going to do the 12BA6 mod and was wondering if anything will change or is an alignment necessary for the R390A.

A: No need to do it unless you have a bad ballast tube and cannot locate another. In theory, the only alignments which might charge are:

* PTO endpoints

* PTO linearity

* 1st XTAL oscillator output

In any case, if you were to replace V401 and V701, you'd want to at least check these alinments.

From wa6ube@aol.com Sat Jan 17 19:53:49 1998
Date: 10 Jan 1998 18:25:46 GMT
Subject: Re: R390A mods/fixes anywhere?

>Although I don't want to do any major mods to my R390A, I do think that the audio can be improved, and have heard of others that got more output of the audio stages. Is there a site or faq or mod sheet for R390A material that I can find on the internet? Thanks Bob Keys/NA4G

>I have a couple of R390 receivers. One of the more common problems is having a failure of the >3TF7 Ballast tube that is used in series with the filaments of the PTO and VFO tube.
Note that ALL of the filaments in the R390 are in various forms of series connected circuits in order that all the various tubes can have their correct filament voltages obtained from a 25 volt power source.

* Note that V508 and V701's filaments are in series.
* V508 is a type 5749 tube and is used in the BFO oscillator circuit.
* V701 is also a 5749 tube in the PTO oscillator.

Because both of these circuits effect the frequency stability of the receiver, i.e. if the PTO or BFO freq were to shift, then the received signal would also appear to shift, it is important that the stability of both of these two circuits are held to reasonable tolerances. The purpose of the 3TF7 ballast tube is to allow the two 5749's to be

powered off of the 25 volt filament supply, AND also allow an amount of filament current regulation. This is so that line voltage jumps won't pull the frequency of these two oscillator circuits. New 3TF7's can be expensive I've seen them advertized NEW for around $80.00 ea several years ago. Since one of the functions of the 3TF7 is to act as a series dropping resistor to allow 12 volts @ 300 ma for the two 5749 filaments. that are in series, I came up with a simple replacement for this ballast tube:

* move the wire on pin #2 of the 3TF7 socket to Pin #4...
* move the wire on pin#7 of the 3TF7 socket to Pin #5.
* Plug in a 12BY7A or 12BH7 tube into the socket in place of the 3TF7.

Kind of weird to have a tube with a cathode, grids, and a plate in it only being used for it's filament, but, hey it works and eliminates the need for a rare and expensive ballast tube. :-)

Patricia Gibbons <wa6ube@aol.com>
City of San Jose - ITD-Communications Mobile radio repair shop supervisor

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Date: Thu, 29 Jan 1998 10:06:57 -0600
From: clarence thompson <clarence@kilgore.net>
Subject: [R-390] Solid State

Good Morning all, I have a 390 that has a solid state device in the place of the ballast tube,and has been in there since I received the 390; it seems to work just fine?? what is this replacement for the ballast tube? .... and will it effect the proper operation of this fine receiver?

Date: Thu, 29 Jan 1998 23:28:48 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Solid State

Well yes, but... The circuit is AC and the regulator prefers DC. There was a mod for that problem in the NC-300 published about a third century ago that added a half wave rectifier then a solid state voltage regulator. That's a little easier to set up, at least in concept. The solution of using a 12 volt tube and shorting the ballast will keep the radio working, but tosses out the cathode temperature stabilization that helps keep the radio from slow drifts.

Right now, my 390 is sitting in the barn waiting for me to build a house nearby, then maybe I'll dig it out and see about making it work. If I was to work on the ballast circuit, I think what I would do would be to build a current regulator out of a LM317K, and put it in the middle of a bridge rectifier. E.g. I'd run the AC terminals of the rectifier to the supply and to the tube, the two ballast terminals, and then I'd run the of the bridge to the input of the current regulator, and - of the bridge to the output of the current regulator. Setting the current would be more of a problem, probably shoot for 600 ma on peaks, and then turn it up until the tube drew adequate current to match its operation on 600 ma AC (providing it was 600 ma instead of 300ma. that was needed). Whatever the current, I'd set for that current peak and see if it worked, look at the voltage on the tube with a scope and see how much higher I needed to make it to get the desired heat into the tube. The stability of such an arrangement would

probably be 50 times or so better than the ballast tube. That's what I'd do. I KNOW the diode bridge scheme will work because I used it 15 or 20 years ago to use a single transistor to regulate the AC current to an alternator's field coil when I couldn't get access to the alternator's rectifier but wanted to add a voltage regulator.

Date: Sun, 15 Feb 1998 09:44:10 -0700
From: Doug <doug@alpinet.net>
Subject: Re: [R-390] Heat build up in the R-390A

Hi Jerry....no doubt a good plan. It was kind of a "catch 22" modification, with one problem solved and two more created. But, remember also that the decks also have a bit of filtering on them...the 390A never has been a hummer. I think the choke idea is a dandy....just to find a place to mount it without making too much of a mess. Series resistance would help, and would save the tube complement from too much dissipated heat. Another way to cool things down would be to come up with a nifty little solid state (blasphemy!!!) constant current reg to replace the ballast tube, mounting it on the main frame to allow for heat sinking and dissipation. That ballast really warms things up on the IF deck.

One thing's for sure, heat kills these things. It was an ongoing expense for the Navy for sure to keep the rigs running, but I'd like to hope I can keep both mine a couple tens of degrees cooler and save the cost and hassle of constant maintenance. I dont run mine every day, but use it often and for a long time, so it gets the chance to heat up some, but is mounted in a 7 foot rack that's a framework (telelphone style) only, so the air gets to move through easily.

Date: Wed, 18 Feb 1998 12:40:20 +0000
From: crippel@exis.net
Subject: [R-390] (Fwd) "Solid stating" the ballast tube

I may have my "signals" crossed on this one. Is the LM-338 a TO-220 case or T0-3? I used a TO-220 case device and its only good for 1A. The TO-3 is not acceptable (to me) because of having to either mount it outboard or drill holes somewhere. I plan to simply make up a common emitter regulator with a TO-220 (that will handle the current) case transistor and a zener. Easy, and noholes.

Date: Wed, 18 Feb 1998 12:42:05 -060
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] (Fwd) "Solid stating" the ballast tube

LM338 or LM317 is not a sufficient part number to define case. The 317 is available on to-92, to-220, and to-3 case. Depends on the suffix L, T, or K. Since only 300 ma is needed, either the T or K case 317 should work. There's no need for the 5 amp version. I've used the transistor/zener current regulator. I prefer the LM317 circuit. It can work with less drop across the regulator and the regulation is better. As for mounting, I figure an aluminum piece, maybe an angle 1.3 x 1.3 by 2.5 inches with a tab folded in and bolted to the center of the octal plug would make a mounting and heat sink to fit in where the ballast tube sat. Since it would operate at a lower temperature than the ballast filament, there would less heat transfer by radiation, primarily by air flow and the vertical mounting should run the heat upward.

Date: Sat, 21 Feb 1998 10:50:26 -0500
From: Walter Dail <dail@cebaf.gov>
Subject: [R-390] Ballast tube in 390A

I just went thru a ballast tube in my '390A and no spare:-(Life is the pits for the weekend. Anyway, of all things, WHY did the designers chose to put this thing in there? 6 VAC is already available for the other tube filaments. Why do this? Why not just ground one side of the filament and put them in series with the 6VAC winding like all the other tubes? Was this a factory hack or just a lack of tubes with 12V filaments? Now, I'm debating on replacing the ballast tube (or just buying one) or putting the 12V equiv.(12BA6) in the V505 and V701 sockets and jumpering out the ballast socket. Oh well, no AM listening today...Later,

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Date: Sat, 21 Feb 1998 10:46:19 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Ballast tube in 390A

There's two schools of thought on the need for the ballast tube. Outwardly it appears it might improve the stability of the radio by regulating the heater power on those two oscillator tubes.

I think maybe because it limits inrush current that it also makes those tubes last a lot longer and thus preserves frequency calibrations that might need touching up when changing those tubes.

I have worked up a design for a solid state replacement, but I won't let it out until I test it on my bench. It will use $5 or so of parts mostly available at RS. Chuck Rippel tells me he has about 100 ballast tubes on hand yet. Others are more anxious to try my solid state regulator. Others have gone the 12BA6 and jumper route and detect no drift problems. Which are totally insignificant for AM anyway. A plain fixed resistor of about 42 ohms in the ballast's place would be adeqaute with the original tubes too, though the pair of 12BA6 will reduce the radio's total power dissipation by 4 watts. And thus your electric bill by 14 cents for each 250 hours of operation.

The purist restorationist will want to use ballast tubes until there are no more. The picky will want to go solid state regulation, and the AM listener probably will be super happy with a pair of 12BA6 and a jumper. Since the 12BA6 was the standard IF tube in 4 and 5 tube AC/DC radios using miniature tubes, there should be a million of them about or more.

Date: Sat, 21 Feb 1998 15:04:11 -0500 (EST)
From: trinit69@idt.net (Tom Marcotte N5OFF)
Subject: Re: [R-390] Ballast tube in 390A

I use the 12BA6's with great results.

Date: Sat, 21 Feb 1998 15:31:14 -0500
From: Walter Dail <dail@cebaf.gov>
Subject: [R-390] Ballast Tubes

Thanks for all the responses! I looked and scrounged around the house and found a couple of 12BA6 tubes. The radio is back up and running fine. Now I don't have to go through AM withdrawal syndrome. Although I'm not to crazy about putting them in, it has me going until I get another ballast tube. I will probably just get a couple for safekeeping, knowing I can always change it back the way it is supposed to be. I'll just keep the 12BA6 tubes in for now...

Date: Sat, 21 Feb 1998 21:58:48 +0000
From: "Roger D. Johnson" <n1rj@ime.net>
Subject: Re: [R-390] Ballast tube in 390A

The ballast tube is there for the same reasons as the crystal ovens. This is a military receiver designed to operate under extremes of temperature and voltage. Many of these were used in mobile radio sets powered by generators (AN/GRC-26D for instance). In normal home useage, I'd turn the ovens off and power the oscillator filaments from the 6.3 volt line. GL, Roger

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Date: Sat, 21 Feb 1998 16:17:44 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Ballast tube in 390A

And to still hold the same frequency stability while the line voltage varied from 90 to 132 volts!

Date: Sat, 21 Feb 1998 19:41:37 -0500
From: "Dennis M. Fox" <foxd@mail.grady.public.lib.ga.us>
Subject: Re: [R-390] Ballast tube in 390A

I have the address of a man I met @ Orlando who has them for $15.00 each. Yes, I bought one for a spare, & I'd be happy to provide the info to anyone who need the tube or wants a spare for future use.

Date: Sat, 21 Feb 1998 20:54:50 -0500
From: "Jack Hart" <wa2hwj@worldnet.att.net>
Subject: [R-390] Ballast

Many years ago, when I got my first R-390A and had no idea how it worked, the ballast tube went on me. I poked around a little and found that a simple regulated DC supply, plugged into the ballast tube socket with some small wire for "pins", worked fine. In fact, I believe the radio was even more stable than it was with the ballast tube. I think the regulated supply was set for somewhere around 6VDC to feed the PTO filament (or maybe it was 12VDC for two tubes in series?). Anyway, the recent discussion about the current limited supply is on the right track. Of course, we'd all like to keep the "stock" setup, but some of those tubes are getting scarce. (Just got a KWS-1 with the ballast tube replaced with a "kluge" seven-pin miniature tube's filament connection!)

Date: Sun, 22 Feb 1998 00:37:14 EST
From: MarKB7RJF@aol.com

Subject: Re: [R-390] Ballast tube in 390A

Mine went out some time ago. I caressed the dud with a hammer, and hung a 10 Watt resistor, of I think about 25 ohms, across the pins. I don't put a lot of hours on the rig, but it seems to be working well. I picked the value after pondering the schematic. I may put in a solid state part later, but it is working, and will be a lot of work to de-rack the unit. If I do open the unit, it will be to add an IF output ahead of the filters to feed a panadaptor.

Date: Sun, 22 Feb 1998 10:07:12 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Ballast tube in 390A

I compute the value should be 42 ohms...73, Jerry, K0CQ

Date: Sun, 22 Feb 1998 09:38:18 -0800 (PST)
From: Cheez Ranch <rickets@earthlink.net>
Subject: Re: [R-390] Ballast tube in 390A

A 50 Ohm, 5 Watt power resistor works just fine. They cost about a buck.

Date: Sun, 22 Feb 1998 11:35:38 -0800
From: "Mark J. Blair" <mblair@gruumsh.irv.ca.us>
Subject: Re: [R-390] Ballast

A few years ago, I needed to replace the ballast tube in the AM-65 powers supply for my RT-70. To get the thing working until I found the right tube, I built a solid-state current regulator onto a small piece of perfboard, mounted it on an octal tube base, and enclosed it in some PVC pipe. It regulated a lot better than the original ballast tube, and required no modifications to the equipment's chassis. Plus, I could adjust it to compensate for the excessive drift of a lot of the carbon resistors in the filament chain (it seemed that everything in the chain leaned in the same direction tolerance-wise, thus making the filament voltage too high). The RT-70 is a vehicular set and operates from a DC supply, so my design wouldn't be usable in the R-390A as-is, but maybe somebody would like to modify it for use in the R-390A's AC filament string. For those of you on the Boatanchors mailing list, a brief article about the regulator is available in the archives as "ballast-replace.text" (text description) and "ballast-replace.ps" (schematic in Postscript). If there's sufficient interest, I could repost the files here. The .ps file is around 36k, and the text file is a little under 5k.

I also made a temporary solid-state replacement for the thermal overvoltage-protection relay, but that's another story... :-)

Date: Sun, 22 Feb 1998 15:44:05 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Ballast

DC is much easier to set than an AC regulator. I'm close but I need to refine the calibration. That's next. May get it done yet today. I prefer the current regulation of the ballast or my LM317 circuit to voltage regulation because current regulation

guarantees a soft start for the heaters, while voltage regulation enforces a strong turn on surge unless some current limiting is added. The soft start should have a bit of effect on tube longevity.

Date: Sun, 22 Feb 1998 21:39:04 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [R-390] Solid state ballast replacement.

Its ready and it works on my work bench. The circuit is available in the form of a .gif, a .ps, a .DXF, or an Autocad R12 .DWG. I'd post it but the flames from juno users is too much bother. This is a CURRENT regulator and as such is NOT bothered by the low resistance of the tube heaters when cold. It just feeds them a constant current as they warm up gently. The calibration for current is a bother because the wave form is a clipped sinewave which makes most meters read wrong. A DC meter won't read at all because its still AC, and most AC test meters actually read the peak to peak voltage and then calibrate to the RMS (heating value). I've checked this circuit with several schemes, and a couple actually agreed within 5%. The main one I've used is a graphical conversion of the wave form as observed on my Tek 475 to RMS. The first backup which agrees well is a Kiethley 124R true RMS volt meter. This meter consists of a broad band AC coupled amplifier (out to 10 mhz) feeding a resistor with thermocouple attached. Its TRULY an RMS meter though it suffers from neglect showing up as intermittent switch contacts and likely nearly open electrolytic coupling capacitors. Other meters I've tried with mixed results, sometimes depending on voltage are a B&K 2815 which is supposed to use analog circuitry to compute true RMS, a couple moving vane AC panel meters and a Simpson 260. I trust the Simpson the least, and when measuring voltage across the tube heaters, the moving vane meters took so much current they altered the circuit too much. In my last calibration check (running two 6.3 volt 300 ma tube heaters in series) I used a 28 volt AC transformer. The scope picture shows a current of 313 ma, while the Kiethley measuring across a 0.5 ohm 1% resistor showed 148 mv, or 296 ma. This is close enough and far closer than the ballast tube would do. On the scope the display on that same resistor was 360 mv peak to peak, or 180 mv peak.

With my LM317T held to a small aluminum box with a small crocodile clip, I found no need to try to move heat away from it by using an external series resistor. The heat transfer would have been enhanced with a tiny dab of heat sink grease. I figure about 4 square inches of 1/16 th inch aluminum will be an adequate heat sink. Experiment my prove a smaller heat sink is sufficient. Let me know how that works out. Because this is a current clipping circuit, the exact RMS current will depend a bit on the applied AC voltage and the output is little greater RMS when the tubes are cold, by 10 or 12%. That's just because there's more voltage drop across the regulator under that start up condition. And that changes the width of each clipped sinewave. There are other ways to adjust the current setting, but the use of two power resistors in parallel is adequate. The 3.9 or 4 ohm resistor should be good for about a watt (for stability) though it dissipates about .36 watt. The 27 or 33 ohm resistor can be 1/4 watt. I prefer metal film resistors for this application. I computed a value of 3.48 ohms in my circuit. I used a molded diode bridge, though four 1N4001 will do as well, with more bother for mounting. I used a CK05 style 0.1 mfd, 50v ceramic capacitor. This capacitor is needed to keep the LM317 from oscillating and I like it to have the shortest possible leads. The data sheet says its only necessary

when the chip is an appreciable distance from the power supply filter capacitors. I've found some regulator chips will oscillate with three inches of wire to the electrolytics, so I ALWAYS depend on the .1 as close to the chip as possible. Please notice that the LM317T connections are not the same as the LM340 family. The LM317T isn't hurt by the LM340 connections but it doesn't work at all.
==========Date: Sat, 27 Jun 1998 12:27:33 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] RT510/3FT7

>The former Army tech who sold me my R390-As said to use a 50 Ohm 5W >power resistor in place of the ballast tube. I do and it works fine. Just bend the >leads and stick in the appropriate holes in the socket. The "ballast" limits >filament inrush current to the BFO and the PTO oscillator tubes (that bright >orange light when you first turn on a tube). You can also use any tube with a >12.6 V filament connected to the appropriate pins. The "purists" insist on the >3TF7; I think they're a waste of money.

Are you sure that tube life hasn't been cut from 102,000 hours to 59,000 hours? Are you sure that stability specs are met with line voltages varying from 98 to 142? and ambient temperature varying from 2 to 40¯C? Do any of these side effects affect your operation? If not the resistor works well. Doesn't limit the in-rush current as well as the 3TF7 or my solid state circuit, but does cut it down. 73, Jerry, K0CQ

Date: Sat, 27 Jun 1998 16:08:20 -0500
From: Nolan Lee <nlee@communique.net>
Subject: Re: [R-390] RT510/3FT7

It's funny, but in over twenty three years with probably a half a dozen different R390A's I never had a 3TF7 fail. I've had to replace missing ones but I've never had one fail in service. I don't see why so many people are worried about the thing. Granted, I keep spares, but they're mainly in the event that I pickup a radio that's missing the 3TF7. If the radio is operated with 115 Volt input as designed, are these really prone to failure? I supose that with ~125 volt or so input voltage, the filament voltages would be about 10% higher than they should be. I'd imagine that this would shorten the life of the tubes and the 3TF7. How many of you guys run your radios at the input voltage that they were designed for?

Date: Sat, 27 Jun 1998 15:44:44 -0500
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] RT510/3FT7

I suspect more 3TF7 fail in shipping than in operation. The filament isn't supported well. Because supports would upset its self heating thermal operation. High line voltage would run the 3TF7 at higher temperature.

Date: Sat, 27 Jun 1998 21:00:02 -0500
From: "Jon & Valerie Oldenburg" <jonandvalerieoldenburg@worldnet.att.net>
Subject: Re: [R-390] RT510/3FT7

On this 3FT7 tube you guys have to watch the tube supplier clearance lists... Antique Elctronics was dumping these at $9.00 ea if I remember right in Febuary, hell now I'm set: I grabbed 4 at that price. Jon

- ---------- ----------

Date: Sun, 28 Jun 1998 17:10:24 +0000
From: Dave Rickmers <rickets@earthlink.net>
Subject: Re: [R-390] RT510/3FT7

Well gosh. 59,000 hours is almost 7 years of continuous operation @ 15 cents per kWh=$8850. Whether I will save $5.00 on tube replacement is the least of my worries. My line voltage only sags briefly (a second or two at the most, certainly not long enough to affect emission) maybe a couple of times a month (as indicated by my APC Back-UPS). Ambient temps never below 60 F or above 90 F. My KCS calibration is +/- 200 kHz or better end to end. The thing will zero beat with WWV for days. Ovens off.

Date: 28 Jun 1998 13:09:11 U
From: "Richard McClung" <richard_mcclung@tcibr.com>
Subject: Re: [R-390] RT510/3FT7

The only recurring failures that I ever saw of the 3FT7 was in R-390(*)'s that were in mobile rigs..... .....I had very few fail in fixed/semi-fixed service. This usually could be attributied to OV or Spining conditions. I had 20 go at one time after a lighting strike.

Date: Fri, 11 Sep 1998 23:51:28 EDT
From: JCStott@aol.com
Subject: Re: [R-390] Tube Substitutions?

Fair Radio list the R390A ballast tube as RT510/3TF7 on page 6 of the WS-98-1 catalog. Anything else would be undesirable.

Date: Wed, 11 Nov 1998 08:32:41 -0800
From: "Phil Atchley" <ko6bb@elite.net>
Subject: [R-390] Another Ballast Tube Mod...

When I opened up this R-391 I found a 12BH7 in the Ballast socket. Upon examination somebody has soldered two fine leads to the tube pins, one from pin 2 to pin 4, one from 5 to pin 7. When I plugged this into my R-390A the set works just fine. (those pins are "grid" pins on the 12BH7 and with no cathode connection the tube doesn't even see it) This keeps the R-390A 100% intact wiring wise, looks original and you don't have to do a PTO/BFO re-alignment like you would if you changed the PTO/BFO tubes out. And it is cheap, flat 12BH7's are a dime a dozen as they are used in old tv's, etc. I'm sure other 12 volt .300amp filament tubes would work as well. I just discovered that I probably have a whole slew of "ballast" tubes. (we all probably do)

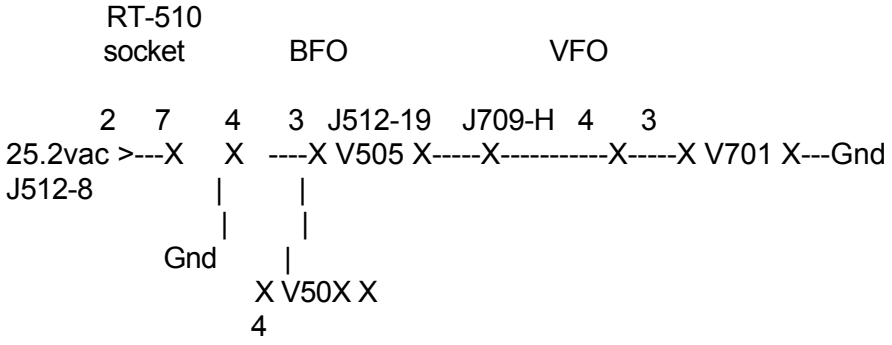
Date: Tue, 12 Jan 1999 22:26:20 EST
From: SBJohnston@aol.com
Subject: [R-390] R-390A Ballast replacement ideas

>Hi, just got into this reflector a short time ago. I am very much interested in >how you hooked up the I/C regulator to replace the ballast tube. I think I'm >using a resistor or something. Haven't looked for a while. Could u pass the pin >numbers and what goes where along to me.

Well, I'm in the same boat - but in my case I haven't thought much about it for ten years! Hold on and I'll go see if I documented the change in the manual... No, I don't see any of my notes on it... but let's figure it out... The ballast resistor tube RT-510 provides some measure of current regulation (and limits the initial inrush current as a byproduct) for the filaments of two tubes: V505 (BFO) on the IF subchassis and V701 (VFO). These tubes each expect 6.3 V on their filaments. Since they are wired in series, they need 12.6 v. The RT-510 is fed from the 25.2 vac line, so there must be a 12.6 v drop across RT-510. I've read here on the list that ballast tubes are not so rare as they once seemed to be, so it may make sense to replace the bad ballast. If not... I see two main ways to operate with no ballast tube:

Plan 1. No special filament regulation.

In my experience, houses and businesses with modern electrical service have very stable primary AC voltage. If you are going to use the R-390A in such an environment, then special regulation is not required. In this case, I would change the tubes from series wiring to parallel, and feed them from the 6.3 VAC line used for the other tubes. To do this, you could remove RT-510, Disconnect the wire from pin 7 of the socket for RT 510 and move it to chassis ground. This puts the BFO tube V505 and VFO tube V701 in parallel. Then connect a new wire from pin 3 of the BFO tube V505 to the 6.3 VAC line which is available on any of the other IF tubes' pin 4 or J512-pin20. I'd get it from pin 4 of a nearby tube.



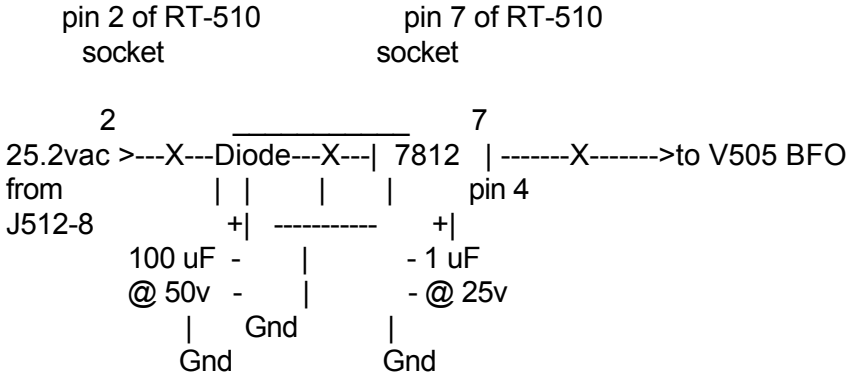
disconnect wire on add new wire pin 7 from pin 3 of V505 and connect to 6.3 v on pin 4 it to gnd. of another tube V50X on IF chassis

Plan 2. Solid-state filament regulation using 7812 IC regulator.

If you feel you need extra-stable R-390A performance, or will be using it on an unstable primary AC power source, you can build a three-terminal regulator into the IF chassis in place of the ballast tube RT-510. The first step is to rectify the 25.vac to DC... connect the anode of a diode such as a 1N4007 to pin 2 of the RT-510 socket. Connect the cathode of the diode to an unused pin of the socket. Connect an electrolytic capacitor with a value something like 100 uF at 50v between the cathode of the diode and chassis ground to smooth the pulsing DC. Mount the 7812 three-terminal regulator on a nearby chassis surface (no need to insulate it - the tab can go

to ground) and connect the left pin (1) to the junction of the new diode and cap. Connect right lead (pin 3 of the 7812 - the output lead) to pin 7 of the RT-510 socket. Connect the middle lead of the regulator to chassis ground (or just use the tba mount to make the connection for you). For added reliability, connect a 1 uf electrolytic or tantalum cap between pin 7 and ground to surpress any tendency for the regulator to oscillate.

For a less intrusive mod, I suppose if you added a ground to an unused pin of the RT-510 socket you could build the regulator on an old tube base and make it a removable module. Be sure to heat sink the regulator appropriately.



In both cases, I would bend the shield ring around the RT-510 socket inward on the upper side of the chassis so that you can't accidentally plug a tube into the socket later on. And perhaps note the change using an extra-fine "sharpie" marker on the chassis surface nearby.

Again, it may be wiser to replace the ballast tube, but this gives you some options...I'd probably do Plan 1.

Date: Wed, 13 Jan 1999 10:27:12 -0500
From: Will Schendel <n8azw@megsinet.net>
Subject: Re: [R-390] R-390A Ballast replacement ideas

The neatest way to eliminate RT-510 was recommended by David Medley. He has an article on his web site.

I have used this method and it works fine, if you have reasonably stable line voltage. Most of us do. Replace V505(BFO) and V701(VFO) with 12BA6 tubes. Place a jumper between pins 2 and 7 in the RT-510 socket.

Dave recommends a paper clip the diameter of a tube pin, making sure it doesn't touch the metal shield. You are now finished with the modification. No need to re-wire anything, just make a note of what you did. If you want to go back to the original configuration, it is very simple.

Please don't re-wire these radios, there is no need for it. It would make it very confusing for the next guy, 20 years or so down the road.

Hope this helps, and thank you, Dave Medley.

Date: Wed, 13 Jan 1999 10:40:52 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] R-390A Ballast replacement ideas

You left out MY current regulator. It handles cold tubes, and regulates closer than the ballast ever could. I still can supply the circuit on a graphic by e-mail. I have not heard from users, though the circuit has gone around the world. The halfwave rectifier stresses the transformer more than the tube load. The 7812 may not get out of current limit from the low cold resistance of the tubes. Rippel has commented such a circuit doesn't work because of that. Regulator chips WILL oscillate if the input bypass is not close. 3" is too far for some. I prefer a small 0.1 disk with as short leads between input and common as I can get wrapped at the IC case. Otherwise you work too hard. The simplest way to replace the ballast is to replace the two 6BA6's with 12BA6 and short the pins of the ballast socket.

Date: Wed, 13 Jan 1999 13:26:34 -0500
From: "Newman, Edward" <newmane@hazeltine.com>
Subject: RE: [R-390] R-390A Ballast replacement ideas

A cheap and dirty fix for your ballast: Years ago when my only ballast tube died I cut off the top, took some nichrome wire from an old pot, and replaced the ballast wire, using enough wire to get the right voltage drop (12V). The new wire was heavier than the original, so it probably doesn't regulate as well, but the fix looks OK and has operated for over 15 years. Just don't touch while the radio is on!

-Date: Thu, 14 Jan 1999 09:47:32 +1100
From: Morris Odell <morriso@vifp.monash.edu.au>
Subject: Re: [R-390] R-390A Ballast replacement ideas

Isn't there an even simpler method than all those that have been recommended? Simply find any old tube with a 12.6 volt 0.15 amp heater with similar pin connections to the 3TF7 and plug it straight in. I'm not sure, but the common 12A*7 type twin triodes may fit the bill here (check this, I haven't got the 3TF7 pin connections handy). You can even use a dud tube with shorts or low emission.

Date: Wed, 13 Jan 1999 18:48:58 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] R-390A Ballast replacement ideas

Will is right. Aren't 3TF7's still available from Fair at moderate cost? $17.50 a pop isn't cheap, but is little more expensive than the two new 12 volt tubes. I'd fall back on the less invasive options when 3TF7's either disappear or get ridiculous.

Date: Wed, 13 Jan 1999 18:12:07 -0600
From: "A. B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: Re: [R-390] R-390A Ballast replacement ideas

I believe the 3TF7 connect is pins 2 and 7. If that is true, the sub is not so easy. The

12a*7 is 4-5. A quick glance at my tube book showed nothing that was 2-7, but I've been wrong before.... It is true that you can sub a 6V6 for a 4H4 ballast in things like an HRO60.

Date: Wed, 13 Jan 1999 18:27:03 -0800
From: Matt Parkinson <mattradi@earthlink.net>
Subject: [R-390] 3TF7s

Hi guys I can't find any information on the 3TF7 tube . I want to know the difference between the 3TF7 and the 3TF4's. Any one have the spec on these tubes? Thanks, Matt Parkinson

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Date: Wed, 13 Jan 1999 18:38:19 -0800
From: "Phil Atchley" <ko6bb@elite.net>
Subject: Re: [R-390] R-390A Ballast replacement ideas

As I've mentioned before, a 12BY7 will do the job very nicely, but you have to jump two pins to the filament connection. And you want a 0.3A tube not 0.15. Your 5749/6BA6 has 6.3V 0.3 amp filaments.

Date: Thu, 14 Jan 1999 04:35:53 -0000
From: "Michael P. Olbrisch" <kd9kc@whc.net>
Subject: RE: [R-390] R-390A Ballast replacement ideas

If I remember, part of that mod was cutting a pin off of the replacement tube. There was a small danger of getting it in the socket wrong.

Date: Thu, 14 Jan 1999 02:33:39 -0800
From: "Glen Galati" <eldim@worldnet.att.net>
Subject: Re: [R-390] 3TF7 vs 3TF4

3TF7 (R-390A Ballast resistor)	vs:	3TF4 (Unkown)
Current Range: 0.04 to 0.26 Amps	vs:	0.29 to 0.32 Amps
Threshold Voltage: 10.2 volts AC/DC	vs:	4.0 volt AC/DC

All other characteristics are the same on Pin outs 2 and 7, 9 Pin minature, envelope type T-6-1/2. The 3TF7 Resistor, Current Regulating (Ballast) also has a Collins PN: 734-0003 and 734-0003-00 NSN: 5905-00-259-1964

Date: Thu, 14 Jan 1999 11:44:40 -0400
From: "Chuck Rippel" <crippel@erols.com>
Subject: [R-390] A Workable, Cost Effective Ballast Tube Solution

There is yet another easy way to solve the ballast tube problem. While this option would not come close to passing my personal muster, it is a reasonable work around. In the radios I have reworked, I note that after removing the labeling with mfg, value, wattage, etc.... from the component..... Rick Mish configures a 40 ohm, 10Watt Xicon Aluminum Housed Power Resistor in place of the ballast tube. He actually removes the tube socket for the ballast tube and mounts the resistor over the hole left in the IF deck. I think that I might mount the resistor to the side of the IF deck

chassis and use a little heat sink grease to allow the chassis to help with the heat dissipation. The part is: Mouser Stock Number 284-HS10-40 an is $1.99 (800) 346-6873 or http://www.mouser.com

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Date: Thu, 14 Jan 1999 12:24:16 EST
From: SBJohnston@aol.com
Subject: Re: [R-390] R-390A Ballast replacement ideas

Jerry wrote: The halfwave rectifier stresses the transformer more than the tube load.

Is the transformer that supplies 25.2 vac running close to max capability?
Does the addition of the mod bring it close to trouble?

>The 7812 may not get out of current limit from the low cold resistance
>of the tubes. Rippel has commented such a circuit doesn't work because of that.

Hmmm... I just set up a test circuit with the filaments of two 6BA6's in series driven by a 7812 fed from 25 VDC. In 25 cold start tests it never failed to supply the desired voltage. I tried five different variations of the 7812 regulator - all worked fine.

The current-limiting feature of the regulator is not a problem, and it could even be considered a slight benefit, as it provides a limit to the inrush current on the tubes in the early moments after cold-start. The 300 mA drawn by the tubes is only slightly above the regulator's capability *without* a heatsink. They are spec'd for 1A on a heatsink. Mount it on the chassis and it should be quite reliable. You could go even further and select one of the 7812C regulators which is spec'd at 1.5 A with heatsink. Admittedly the 7812 only puts a bit under 6v on each tube. This should not be a problem, but so for absolutely correct filament voltage, stand the 7812 up off ground with one silicon diode - then it puts out 12. 6 vdc.

>you work too hard. The simplest way to replace the ballast
>is to replace the two 6BA6's with 12BA6's and short the pins of the ballast >socket.

This is not much different from my "Plan 1" which I recommended over the three-terminal regulator "Plan 2" (except that the 12BA6 scheme costs more since you need to come up with the two new tubes). But if you need filament regulation and don't have or want to use a ballast tube, I'd say the three- terminal regulator option is valid.

Date: Thu, 14 Jan 1999 11:48:24 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] 3TF7 vs 3TF4

So that current rating would make it appear that the oscillator tubes are being run starved at lower than rated current for a lower cathode temperature, lower emission, and perhaps longer life. Lower cathode temperature would mean lower heating of the adjacent frequency determining parts too. We assume that since the tubes are rated at 300 ma that they need 300 ma and that the ballast regulates at 300 ma like my solid state regulator. This rating appears different. Has anyone measured the current in that circuit with the 3TF7? And the effect of line voltage on that current? I

keep wondering if there's more to the use of the ballast than simple voltage/current regulation at rated current.

Date: Thu, 14 Jan 1999 12:05:43 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] R-390A Ballast replacement ideas

Peak current in a half wave is several times the DC output current which causes more wire heating. The the flux is unbalanced tending to send the transformer core more to saturation in one direction which raises the primary current and causes more primary wire heating. The combination is not extremely healthy for the transformer. I've not tested the current limiting of the 7812 feeding tubes. Chuck Rippel had that problem. Could easily be that he didn't have enough heat sink and the temperature limit caught him at a lower current. I believe that the inrush limiting may be as much or more benefit than the regulation.

With the recent posting of the specs for the 3TF7 showing maximum current under 300 ma., I begin to wonder if the tubes aren't intended to be run at lower current to extend their life and reduce the heat applied to the frequency determining parts. And need the current regulator to make sure they stay just on the edge of working instead of falling with age as they would likely without the current regulation. I don't know the answer yet. 12BA6 should be a lot more available than 6BA6 since they were used in 100 Million 5 tube AC/DC table radios for the IF stage. And hence cheaper. Probably not many available in MIL spec though. Using a diode in the ground lead of the 7812 does indeed raise the voltage and also kills off a lot of the output regulation because the current in the ground lead varies with input voltage and the diode drop varies with both current and temperature. I prefer the two resistor circuit because its more adjustable, and you dump enough regulated current from the output to the common resistor to make the changes in chip current negligible in the common resistor.

Date: Thu, 14 Jan 1999 12:39:55 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] 3TF7 vs 3TF4

Dan, with the transformers wound for 50 Hz service, a little below 60 isn't a problem. Some on the r390 reflector have claimed to have run a Variac through the entire range of rated voltages, with either the 12BA6 or a plain resistor mod and detected no frequency changes outside of specifications.

I've not made such a check.

Ballast tubes are light bulbs and at high line voltages would have a shorter life. Also they tend to have long floppy filaments so would suffer from impact shock when dropped and when the big guns on a battleship were fired.

I'm not yet convinced the ballasts are anything more than, "this is a military radio, REGULATE everything!" belt and suspenders, or else starving and limiting inrush for longer oscillator tube life and hence longer intervals between recalibration. Changing tubes can change calibration so I think that longest possible tube life is of

benefit to the calibration of the radio. There's probably a specification in the purchase requisition about regulating the oscillator heaters, or of a time requirement between frequency calibrations.

Remember the 390(a) was a revolutionary receiver using a single frequency range oscillator with a quality practically as fine as the standard frequency meter that was needed with the standard receivers of the era because their wide coverage and bandswitched oscillators were no where near as stable as the Collins PTO. The PTO in my 75S3B actually does better than my LM frequency meter and I did better than 1 ppm on several occasions in FMT with it barefoot. Having worked in short wave and government transmitters at Collins for a while with the same people that built ham gear and military receivers and transmitters, I have no doubt that the purchase specs that resulted in the 390 actually were written to purchase a SP-600 with its wandering bandswitched oscillators and Collins wanted to push new technology and so bought the contract. They did it with the VOA transmitters that same department built while I was there, to push new auto tuning technology.

The VOA purchase spec wanted tuning by 2 men in 20 minutes, the radios we delivered would tune themselves in 16 seconds or less, and still put out 250KW. And our selling price before penalties for delivering a year late (and then VOA stored them for three or four years waiting for budget to construct buildings to hold them) was about equal to the purchase parts cost.

So I have no doubt the first 390 order was done the same way. And heater regulation was very important in the SP-600 class of radio where the HFO was bandswitched and covered from 1 to 33 MHz.

So oscillator heater regulation may not be necessary in the domesticated 390x. If it is, I have a circuit superior to the ballast tube and cheaper to construct. If not a couple 12BA6 seem to be the most convenient with a hairpin of 18 gauge wire between pins 2 and 7 of the ballast tube socket.

I don't KNOW the reasoning behind using the ballast, it was done before my time. Warren Bruene might remember. He would have been in the thick of the radio's design.

73, Jerry, K0CQ

Dan wrote:

> Dr. Gerald:
>
> I don't think so...If you look at the widely varying voltages that these
> receivers were required to operate over in a stressful military
> environment, and if stability is an issue(it was), then the ballast tube
> was simply required. I remember seeing a R390 in the field operating in a
> tent in 110 degrees with high humidity, and the voltage running anywhere
> from 100-130 v at somewhere slightly lower than 60 Hz. A terrible strain
> on the power supply, but even less stability on system operations if the
> ballast tube wasn't there. I also had a Navy Chief tell me that they

> stocked more ballast tubes for shipboard ops than any of the other kind,
> simply because of the wide swing in voltages that were seen from time to
> time.
> Dan Henderson

Date: Thu, 14 Jan 1999 15:10:48 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] 3TF7 hype

I keep wondering why people are having ballast tube failures. Since 1975, I've never had a 3TF7 fail in an R390A. I've had to install a few to replace ones that were either missing or broken in various sets that have passed thru my hands. I suspect that most of the ones that people are having problems with were weakened from the receivers being stacked, bumped, shipped, banged, dropped, after they were removed from service and before the current owner acquired them.

My old RBC-2 has what appears to be the original 6-8B ballast tube in it. It's over 55 years old. I've had it for 24 of those years and it's still in there "ballasting" away just fine.

Granted, I typically run the receivers at 115 volts on Variacs, but I can't understand all of the hype and mystery over the ballast tubes. Buy a new one, install it, forget it. While your at it, run the receiver on the line voltage it was designed to run on, which is probably less that what's coming out of the outlet. At least the 3TF7's are readily available today.

But Nolan, oooh, oooh, the 3TF7's are SO expensive. <whine> <whine> I could use that money for exotic sixty dollar a pound coffees or fancy twenty dollar a bottle wines, or genuine carnuba wax for my $30K car with the fancy American sounding name that was actually built by the people that hosted the Bataan Death March... <whine> <whine>

They're $17.00 each. <whine> <whine> That amount of money would buy a new set of laces for my $175.00 sneakers. <whine> <whine> Sounds like some lame assed limp wristed excuse that some Generation X'er would use. Makes me wanna walk out back of the barn and have a good long and chunky puke...

There was a time in the late 1970's and early 1980's that 3TF7's weren't readily available and factoring in inflation would be like paying 75 or 100 dollars each today. Hell, I saw them hit $40.00 each for a while back then. I've still got a sleeve of them in my spares that I paid $20.00 a piece for back in 1976 or so.

Stand up on your hind legs, and quit worrying about converting to 12 volt tubes or building a solid state regulator, or stuffing a resistor in, or rewiring the tube sockets for 6.3 volts, or grinding the pins off of a 12BY7, or finding some low cost substitute ballast tube and just spend the money, order a new 3TF7 and the problem is solved.

Date: Thu, 14 Jan 1999 12:44:16 -0800
From: "Phil Atchley" <ko6bb@elite.net>
Subject: Re: [R-390] R-390A Ballast replacement ideas

A few years back I modified a IF for an R-390A using a 7812 regulator mounted to the inside wall of the IF amp. Rectified/filtered the 25 VAC and used a small resistor at the input of the 7812 to bring the voltage to a safe input level for the 7812 regulator. (35VDC MAX) This worked very well with no problems of regulator overload etc. (it is a 1 amp regulator..... (this is essentially the Sherwood Modification). Now I probably wouldn't go to the trouble if 12BA6's and paper clip work ok. (or my choice is a 12BY7 wired to fit the socket.) You can put the wires right on the tube pins and not even bother re-wiring the socket) Fortunately I haven't needed to do that.

Date: Thu, 14 Jan 1999 17:01:16 EST
From: SBJohnston@aol.com
Subject: Re: [R-390] Ballast replacement ideas

For some reason I am having trouble finding my documentation of the mods to my R-390A...this is very disturbing to someone like me, known as "Mr Organized". <wry grin>

The basis of my mods was the article in Electric Radio magazine by Bill Kleronomos, KD0HG. I remember I did some extra stuff, but his design was clearly a winner... hold on... I'll consult the index and see what issue it was in...

OK, the original article appeared in the October '92 ER, with corrections in November, '92. There was another article which described the use of different tubes in the February , '97 issue.

Looking at the ER index I see that Bill also wrote an article on the use of a three-terminal regulator (in current-regulation mode) to replace the Ballast tube. It was in the February '95 issue.

Date: Thu, 14 Jan 1999 18:45:42 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] 3TF7 hype, variac & regulator questions

Hi Nolan & Gang:

That's tellin' 'em Nolan, but ... I don't know that all this indicates some phobic concerns about the 3TF7. I can't speak for the failure rate -- real or imagined. I have to say though, it's interesting to read about all the workarounds and alternatives, for what basically seems like a wire in a bottle. See all the fun you can have with just one small corner of the R390. You'll feel even better about the other guys after you read this because here comes a really dumb idea:

What about some kind of bulb? I seem to (foggily) remember some old stuff using pilot bulbs as current limiters, in addition to serving as a pilot light. I also remember using a regular 120v 50 watt light bulb in series with the AC line to bring up a kit built regen receiver for the first time. Now look what I started. All over the world, guys will be pulling out refrigerator, vacuum cleaner and chandellier bulbs to check their parameters. ;-)

I have a nice 10Amp General Radio Variac which I bought just for the purpose. I have another 4.5 amp unit with meters on the way in. My listening post is at my business location which is a building put up in the late forties for light industry (built to Grumman's spec's to for their subcontractors). The electrical system was expanded over the year, such that some circuits are high, and some are low consistently. So I may actually have an original "110" circuit to use. But to be on the safe side, I want to run off the variacs. Is 110 the right voltage? I would have to keep an eye on the voltage, particularly during the summer. Also, do you bring up the receiver slowly each time you power up, or is that only for powering up an old unit for the first time after a long rest?

What about using external voltage regulator/line conditioners. These are pre-set higher than 110, but I imagine one could be re-calibrated. I have a couple of 15Amp units that we use with our large laser printers, but I suspect these use switching type circuits. Anyone ever use or consider using one of these?

Date: Thu, 14 Jan 1999 18:58:24 -0500
From: Will Schendel <n8azw@megsinet.net>
Subject: Re: [R-390] 3TF7 hype

Nolan is right, it's a good idea to get a new ballast tube while they are available. Twelve volt tubes, resistors, etc. are for when ballast tubes are all gone...

Doing hard modifications to military radios... I have a BC-348Q that has been "personalized". What a shame for a receiver that is well over fifty years old.

I had a long visit with Pete Grave last Thanksgiving. He said he had a R-390A with all the modifications, and it doesn't function one bit better than a stock one in proper working order. Seems like some modifications are "band-aids" for another problem. Some people are new to this list, and I just want to say that you don't have to modify this radio. Just spend some time checking the suspect components, which is all of them, and do a precise mechanical and electrical alignment on the receiver. You will be amazed and very pleased with the results.

Date: Thu, 14 Jan 1999 19:12:05 -0500
From: Dan Martin <dmartin@visuallink.com>
Subject: Re: [R-390] A Workable, Cost Effective Ballast Tube Solution

> In the radios I have reworked, I note that after removing the labeling
> with mfg, value, wattage, etc.... from the component, Rick Mish
> configures a 40 ohm, 10W Xicon Aluminum Housed Power Resistor in place of the ballast tube.

My beautiful '67 EAC had the arrangement Chuck describes. I agreed to have Chuck change Mish's resistor mod back to the original 3TF7 during the course of some other work we did in his shop one day. I just wanted the original ballast tube back. Point is, the resistor mod *does* work OK however, and it could be a consideration for anyone so inclined. (I wasn't.)

Date: Thu, 14 Jan 1999 20:31:32 EST
From: SBJohnston@aol.com
Subject: Re: [R-390] 3TF7 hype

Unless you want to. It belongs to you, after all. With radio gear like the R-390A which are not particularly rare collectibles, but very neat, I can see the logic to keeping some as perfect examples of their stock configuration, and others modified to meet particular needs of folks who use them for communications work. The R-390A remains one of the very best communications receivers. But while the stock R-390A is a great radio, but it cannot be all things to all people in all applications. In my opinion there is room for modification as well as preservation.

Date: Fri, 15 Jan 1999 07:10:13 -0400
From: laffitte@prtc.net (laffitte)
Subject: [Fwd: [R-390] 3TF7 hype]

Well said Nolan. All my R390A and non As have their original 3TF7s and I haven't seen a failure yet. If they did I would grab the phone, call Fair Radio and get one. The modifications should be retained for use in the future when availability of the ballast is really nil. The original ballast makes it look better and gives you the feeling that everything is working according to specs.

Date: Fri, 15 Jan 1999 10:55:43 -0600
From: "M.L. McCauley" <mtech@airmail.net>
Subject: [R-390] "ideal voltage", required current

All this talk of ballast tubes and variacs has sparked an idea. I am considering doing a project involving power regulation for my radio (which I hope to get shipped out of California some day :( ) In case somebody else decides to wish to duplicate what I am going to do, I want to design for worse case conditions and all sets, so: For all r-390x series sets, and stating maximums when applicable -

1) What is the IDEAL post-warmup operating voltage?
2) What is the post-warmup steady state current?
3) What is the startup surge current?
4) Ideally, would to be desirable to limit this surge?
5) If so, on a simple I^2/R basis or would a Di/Dt basis be better?

Thank for all the input.

Date: Fri, 15 Jan 1999 14:18:18 -0500
From: "Newman, Edward" <newmane@hazeltine.com>
Subject: RE: [R-390] 3TF7 hype and tube life

My experience has been counter to Nolan's. I went through two 3TF7s in about 10 years of light usage at home, then put in a resistor for the last 15 years. No vibration, moving etc. But, no voltage regulator on the AC line. Maybe that's part of the problem.

Date: Thu, 28 Jan 1999 08:34:41 -0800

From: "Tom Roddy" <tcroddy@lightspeed.net>
Subject: Re: [R-390] Tidbits from Amperite on Ballast Tubes

I have two of these Amperite tubes running, purchased from Fair Radio. I was always a little curious that they were not marked "3TF7" or "RT510", but rather "TJ311M01". They work fine, although I notice that upon power-up the filament glows red for a second or two, then gives four pulses of increased brightness and color, and then the things settle back down to a steady glow. It's weird, but it works fine.

Date: Sun, 07 Feb 1999 02:07:35 -0500
From: "Charles A. Taylor" <CALLTaylor@cwix.com>
Subject: Re: [R-390] Current regulator tube availability...

That beast is a 3TF7. Somehow/somewhere it got an added designation of RT-510, which is the circuit symbol for the critter in the R-390A. It's available for $25-$50 (and maybe more). Surplus Sales of Nebraska has them, but I think you'd have to get a second mortgage on the wife & kids (oops, grandkids), and sell the house into slavery for what SSN wants. A resistor or diode will probably do you fine, but some purists would have a postconstipation fit. I would probably at least develop runs over the subject, and that's why I have a couple battle spares in case of WW-III. I suggest acquiring a Variac, powering your battleship-anchorpoint off it, and soft-starting the receiver, i.e. bringing the Variac up incrementally over a period of not less than 60 seconds, till you reach not more than 110 VAC. The abrupt turnon is what murders tubes.

Date: Sun, 7 Feb 1999 10:58:13 EST
From: DJED1@aol.com
Subject: Re: [R-390] Current regulator tube availability...

You will probably hear from a lot of people- there has been a lot of discussion about the RT510/ 3TF7. I don't know about the diode, the ballast tube drops about 12V in series with two 6-V tubes. A diode by itself won't provide that kind of drop. Maybe you have several diodes or a regulator? Anyway, I have been using a resistor in place of the tube for about 20 years, and got inspired to pick up some 3TF7 spares. The best price was at a flea market ($10) and the next best at Fair Radio ($17.50). I wouldn't suggest paying $20-30 unless all other sources are exhausted. the consensus on the net, and my experience, is that what reduces the life of the 3TF7 is on and off cycles of the radio. Those who leave the radio on all the time, or use a Variac to ease the startup seem to have little problem with the tubes.

Date: Sun, 07 Feb 1999 11:44:28 -0500
From: Mike Dinolfo <mdinolfo@erols.com>
Subject: Re: [R-390] Current regulator tube availability...

I believe that the reason why a diode does, in fact, work OK is that the diode converts the 26.2 volts (or so) AC applied voltage to a half-wave DC voltage whose RMS value is about half that of the otherwise available 26.2volts. Hence, the targeted tubes (V505 & V701) get applied filament voltage (measured on an RMS value, which is what counts) which is within their allowable range. Note that this analysis

ignores the forward voltage drop of the diode, but because the forward drop of maybe 0.7 -1.0 volts is a lot less than the applied voltages of which we speak, we can consider the net effect being that the filament voltage is cut in half (compared to what it would be if the ballast regulator were to be replaced with a short).

Date: Sun, 07 Feb 1999 11:38:03 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Current regulator tube availability...

This has been a topic of discussion here for more than a year.

A single rectifier diode would cut the RMS value applied to the tubes in half. Hadn't thought of using that. A plain resistor works without regulating the tube heaters. Changing the two tubes to 12BA6 (commonly used in AC/DC radios for eons so more common than 6BA6) and replacing the ballast with a jumper works. My ballast replacement embeds a LM317 current regulator in a diode bridge so the AC current is limited by the pulsating DC the LM317 sees. Because of the relatively low applied voltage and the finite minimum voltage drop of the LM317 I had to increase the peak current to get the RMS value up to 300 ma.

I'm unable to come to a conclusion what the purpose of the ballast tube is. Those that have converted to run without it are unable to detect short term instabilities or significant sensitivities to line voltage. I suspect it contributes to longer oscillator tube life and so to longer intervals between PTO calibrations. I also suspect it was in the receiver purchase specifications left over from Super Pro's with band switched tunable high frequency local oscillators that absolutely needed heater regulation to keep a signal within the pass band and other than a greater sensitivity to shock, it isn't detrimental to the receiver so the purchase specification was never challenged or changed.

Date: Sun, 07 Feb 1999 16:59:10 -0500
From: "Charles A. Taylor" <CALLTaylor@cwix.com>
Subject: Re: [R-390] Why a voltage regulator in r390 non-A????

I believe this goes along with the Signal Corps' tendency to have the R-390 series very overdesigned. They wanted the R-390 to be submersible, and were dissuaded by Collins when the latter totaled up the cost-per- unit to the government. The Army (and the Navy) has a large number of junior and middle-grade officers who have BSEEs, and they know enough about electronics design to be dangerous. These same officers are oftimes assigned to a procurement program for a device just such as the R-390A. Naturally, they wish to have their input into its design.

Some designs appear logical, but are expensive in their implementation. Perhaps the use of 6082s in the R-390 is a manifestation of this, a desire to regulate all circuit voltages to a northbound gnat's southern- most parts.

In any case, the requirements for voltage regulation were eased in the R-390A, a cost-cutting move over the R-390. The rest is history.

Date: Sun, 7 Feb 1999 19:00:49 EST

From: SBJohnston@aol.com
Subject: Re: [R-390] Current regulator tube availability...

>the ballast tube drops about 12V in series with two
>6-V tubes. A diode by itself won't provide that kind of drop.

It will in this case, because the filament source is AC, not DC. Only half of each cycle will make it through the diode, resulting in pulsing DC.

I never thought of it, but feeding a tube filament is quite similar to a lamp filament, and I do often solder a 1N400X diode on the tip of a incandescent lamp that goes in a location that is difficult to reach. The lamp is somewhat dim and perhaps a bit flickery, but will last nearly forever since it is running on half-voltage. It certainly is a simple way to achieve the desired result...

Date: Sun, 7 Feb 1999 17:58:09 -0800
From: "Phil Atchley" <ko6bb@elite.net>
Subject: [R-390] Current Regulator Tubes.& Diodes.....

One thing I forgot to mention in using a diode is this..... Since you are effectively using only "half" of the waveform you are only dissipating about half as much power as heat. Instead of dropping 12.6VAC at .3 Amps which equates to 3.78 watts heat in the regulator tube you have approximately .7Volts at .3 amps which is approximately .21 watts heat. A considerable difference in close proximaty to the BFO. (A 18 to 1 ratio).

Overcoming the current regulator problem (by Dave Medley)

In the R390/R390A series of receivers a current regulator is used to regulate the heater voltage of V505 (BFO) and V701 (PTO) tubes. This was presumably to minimize frequency drift when the radios were used in a military environment where power supplies were unreliable but in the average ham or DXers shack this is hardly necessary. Besides which the 3TF7 tube is expensive to replace. There are several ways to deal with this problem.

1. If you are a purist you can replace the 3TF7 with a solid state current regulator. There is an article in Electric Radio on this subject (No 70, February 1995)

2. Replace the regulator with a 45 ohm 10 watt resistor.

3. This is the one I prefer. Replace the BFO and PTO tubes with 12BA6 tubes. These are cheap and easy to find. Then simply bridge out the current regulator. I make a bridge out of a paper clip and simply insert it in pins 2 and 7 of the tube socket. It is a good idea to put a label on top of the RF cover to remind you about this so you don't replace one of the tubes with a 5749 somewhere down the track.

Date: Thu, 9 Dec 1999 20:30:34 -0500 (EST)
From: Norman Ryan <nryan@duke.edu>
Subject: Re: [R-390] Ballast tube replacement modification?

Does your R-390 ballast tube drop voltage to two 5749 tubes as in the R-390A? If so, a workaround to a bad ballast tube is to use the 12 Volt version of the 5749, which is the 12BA6, and jumper the ballast socket. Alternatively, replacement 3TF7's @$17.50 are still available from Fair Radio, I think. There is another mod which employs a resistor in place of the ballast tube, but I don't know it offhand.

Date: Thu, 9 Dec 1999 21:10:05 -0500
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] Ballast tube replacement modification?

Thanks for the help, guys. I finally found the page I was looking for, and it mentions three options.

http://www.mindspring.com/~tirevold/faq-tubes.htm

1. Jumper the ballast tube socket pins 2 & 7 and replace the 6BA6 tubes with 12BA6 tubes (probably my preference, but I don't have those tubes right now).

2. Put a diode across pins 2 & 7 of the ballast tube socket. This gives you pulsating DC of the right voltage.

3. Put a 40 to 50 ohm dropping resistor (5 to 10 watts) across pins 2 & 7. I did this for now, and it seems to work. Perhaps not the best solution. I had a 50 ohm 10 watt resistor. Instead of the 12.6 VAC needed, I'm getting by with 12.0 VAC. But it seems to be working fine for now.

I may eventually go for option 1 when I have a chance to pick up some 12BA6 tubes.

Date: Thu, 09 Dec 1999 19:30:37 -0700
From: "jordana@nucleus.com" <jordana@nucleus.com>
Subject: Re: [R-390] Ballast tube replacement modification?

If I recall , there was a mod in an OLD 73 magazine that used a pair of Zener diodes to provide regulation on both the negative and positive sides of the voltage..the 12 volt tube trick may be the best way to do it, but I once used a 12BH7A tube (controlled Heater Char.) in place of the 3TF7, and it worked as well as the 3TF7 tube as far as PTO/BFO stability was concerned

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Date: Fri, 10 Dec 1999 11:36:59 -0600
From: "Anderson, Craig - Ext. 1365" <CAnderso@stp.tec.mn.us>
Subject: [R-390] Ballast Tube replacement

I don't know if it has already been mentioned but the KD0HG article in ER is the most elegant way in which to eliminate the ballast tube. It uses a LM117K (TO-3) mounted very neatly on the rear panel of the IF deck. I did this to my EAC R-390A and it worked great. It uses a few parts but it gives excellent regulation, something the ballast tube could never do. I changed only one thing and that was to add a finned heat sink to the LM117K. There was plenty of clearance for it and it really dropped

the temperature of the TO-3 device. As written, Bill used the chassis as a heat sink. I went the extra mile for added reliability.

Date: Fri, 10 Dec 1999 15:23:26 -0500
From: km1h@juno.com
Subject: Re: [R-390] Ballast Tube replacement

Tnx for the info Craig. Bill also wrote so guess I was on the right track. My concern was several articles in the past that cautioned against DC on the filaments in some applications. The Clegg Zeus uses a 6BK7 (I have a 6BQ7 in place now) as a VFO tube and I do not remember ever seeing them in DC/mobile use. Heck, even if tube life is slightly reduced it sure beats the cost of ballast tubes! Drive is plentiful so I will probably run a straight 7806 regulator as a way of reducing filament stress.

Jerry, K0CQ, also mentioned an AC regulator he developed so I'll look at that also.

Now that winter is approaching I just may get time to actually plug in my EAC R-390A. Then the fun begins. I worked on them in the early 60's but have no experience with all of their age related problems.

On a completely different subject...excuse the drift....I have a RatShack 22-129B Voltage Inverter that I would like to use on my 53 Ford Vicky (full 50's era custom) to power a 12V SS radio. The Ford is 6V Positive ground and the Inverter is rated for a 6V Negative OR a 12V Positive ground input to give a 12V Negative output. I do not have the schematic and wonder if there is any way I can use this???

Date: Fri, 10 Dec 1999 17:40:41 -0800 (PST)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Ballast tube replacement modification?

I'll bet something else. The ballast tube should be dim if the radio is up and running. The best way to check its operation is to watch it while turning the cold radio on, it should light up the whole filament when first turned on and then should dim slowly to only, maybe, two small points.

Date: Fri, 10 Dec 1999 19:55:57 -0600
From: "Jon & Valerie Oldenburg" <jonandvalerieoldenburg@worldnet.att.net>
Subject: Re: [R-390] Ballast tube replacement modification?

Had one fail earlier this year, it leaves the radio deaf- no signal received, some white noise in the phones at high volume only. The ballast tube only glows (dimly) at initial power-up. Typetronics had new 3TF7's for about $15.00. Earlier discussions felt they provide some inrush current suppression due to high cold filament resistance. -

---Date:
Sat, 11 Dec 1999 09:59:38 EST
From: SBJohnston@aol.com
Subject: Re: [R-390] Ballast tube replacement modification?

Keep in mind that those mods do not provide any regulation of the filament voltage. That's probably not a problem given the usual well-regulated incoming AC line

voltage to the power supply and/or non-critical uses of the receiver.

Another easy, non-regulated option is to move a few wires to put the two 6BA6 filaments in parallel instead of series and then add them to the regular 6.3 VAC filament supply.

If I remember correctly, to do this in my receiver I removed the bad ballast, lifted and then grounded the wire that was on pin 7 of the ballast socket, and connected the 6.3 VAC line from a nearby tube to pin 3 on V505. Both tubes now get 6.3 VAC. If someone later mistakenly plugs in a ballast, no problem - it doesn't do anything, but also does no damage.

Date: Sat, 11 Dec 1999 19:55:28 -0500
From: "Howard Rawls" <howard@cconnect.net>
Subject: Re: [R-390] Diode "ballasts", a Bad Idea

Gary, I may have started this "diode" idea. When my R390A failed I did the only thing I could to get it going again. (I live out in the boondocks, not many spare parts). I'm not a mathematician, so I just put the darn diode in and it worked..... voltage measured real close to "right" as I remember it. Recently I pulled the diode and put in some 12 volt tubes. As near as I can figure (I'm not a mathematician) that diode performed well for about 29 years.....and I honestly don't remember any problems with tubes. I hope I have not led anyone astray by reporting my experience with my "temporary" diode fix on the ballast tube problem.

Date: Sat, 11 Dec 1999 21:00:08 EST
From: Llgpt@aol.com
Subject: [R-390] The never ending ballast tube saga

This ongoing saga of the R-390A ballast tube has been taken to new limits. Now we are getting scientific equations to tell us something most of us have known all along..I'm not going to tell you which of the many, many mods is the best, but I have been without the 3TF7 for over 12 years now. And guess what, it doesn't make a damn bit of difference. I can still hear a hetrodyne from Pitcairn island when I want to.

Even Collins told the Signal Corps. That it wasn't needed, but the powers that be decided different. I've heard the age old stories about frequencies changing when a light switch is turned off etc. Bunk I say. That person must be using generator power with somewhere between 40 to 70 cycles (oops hertz) . Myself, I say Fair Radio can keep 'em I'll spend my $17.50 for some more beer. Les Locklear, Gulfport,MS.

Date: Sat, 11 Dec 1999 22:12:31 -0600
From: "Joe L. Reda" <joer@reda.com>
Subject: Re: [R-390] The never ending ballast tube saga

Couldn't agree more. I use a plug-in mod from one of the issues of Hollow State Newsletter, the one with the zener diodes, and it works just fine. My 3TF7 is now in a tube box somewhere and I haven't looked back. No need to pay overinflated usurious prices for a hunk of glass and some wire, priced as it is just because "It's for the (gasp) R-390A!". It's a good day when you can rig up an elegant solution *and*

thwart the high-priced tube sellers!

Date: Sat, 11 Dec 1999 22:14:39 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: [R-390] Solid state ballast replacement.

I've found my docs again. A text file with a the drawing in autocad version 12, post script or a .gif. With attachments I'll refrain from posting. But I can send to anyone who asks and can use one of these graphics forms.

Date: Sat, 11 Dec 1999 23:18:19 -0700
From: Wally Gibbons <rockwall@sourceoneinternet.com>
Subject: [R-390] RE: ballast tube

My 1 cent, haven't been on the list long enough to warrant two. The r-390 I just acquired had a 40 ohm resistor in place of the ballast, wired on a 9 pin test socket adapter. Plays great, no drift noticable. When the ballast in my 390A burned out, in went 40 ohms on another 9 pin test adapter plug. I'll leave them that way till I can replace the 6 volt tubes with 12 volt tubes. Great receivers, but we already know that!

Date: Tue, 14 Dec 1999 09:17:27 -0600
From: "Anderson, Craig - Ext. 1365" <CAnderso@stp.tec.mn.us>
Subject: [R-390] ER Article on Ballast replacement

Several people asked what ER issue contained the article on the LM-117K circuit replacement for the ballast tube in the R-390A. It is issue 70, Feb. 1995, p.24.

Date: Tue, 14 Dec 1999 13:04:43 -0600
From: "A. B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: [R-390] Apology to Gary Gitzen

This is regarding the use of a diode as a substitute for the ballast tube. I owe Gary Gitzen an abject apology. I had one of those "Oh S--T!" moments last night about midnight. Bottom line, no equations: The RMS voltage delivered by a half-wave rectifier is one half of the peak voltage. In this case, that would be 17.82 volts across the two 6.3 volt tubes. Yes, it would fry them in pretty short order. A Bad Idea.

Date: Tue, 14 Dec 1999 15:58:41 -0600
From: "Dr. Gerald N. Johnson, P.E." <geraldj@ames.net>
Subject: Re: [R-390] Apology to Gary Gitzen

I sure am glad you guys aren't designing radios for me! According to the rectifier chart in the sixth edition of "Reference Data for Radio Engineers", page 14-6, table 3, for a half wave rectifier, the RMS transformer voltage is 2.26 times the average DC voltage on a resistive load without filter capacitor (plus the rectifier forward drop). Presuming a perfect rectifier and no loss in output voltage from the half wave load DC bias causing transformer core saturation, 25.2 volts AC delivers 11.15 volts average to the resistive load such as tube heaters.

Seems like these numbers say the diode mod should work, though at the expense of

tube life because of the low heater voltage. e.g. at low heater voltage, emission falls sooner than at normal heater voltage.

Check other references, they should agree. Then if you don't believe those, do a graphical RMS calculation. Sine wave now, no square waves!

Date: Mon, 17 Jan 2000 10:31 -0800 (PST)
From: rlruszkowski@west.raytheon.com
Subject: [R-390] Power supply resistors and other changes

I modified the PTO filament to run directly 6,3 V from IF deck because my ballast tube failed. But PTO and BFO have the filaments originally in series. So you can't feed them both just connecting to 6,3 V. If you stick to feed your PTO and BFO from that 24 V, you simply have to, in one way or an other, to drop 12 V with 0,3 A, that means 3,6 W.

But if you forget that 24 V line and modify your rx to run directly from 6,3V also for PTO and BFO, then you run with that 3,6 W less power (consumed by the ballast tube), which actually should increase your voltages, including 6,3ACV line, assuming there is some marging for 6,3 V winding for extra 0.6A. But I think there should be since it is mil-spec equipment.

I didn't notice any problems after mod, actually I had 6,3 V filament line running too low, was about 5,7 V earlier, now its 5,9 V after removal of ballast tube + BFO tube. I didn't notice any increase on hum.

Date: Wed, 12 Apr 2000 15:47:19 -0700
From: lynn rosa <k6iyd@garlic.com>
Subject: [R-390] Ballast tube

Got a question about the ballast tube in the R-390A that I'm rehabing. I pulled all the tubes from the IF deck prior to washing the thing, and I discovered that my Motorola ('56) deck has a 3TF4 installed. Remembering that a 3TF7 is the number that I've heard of, I grabbed my Field and Depot Service Manual and went looking to see if there was any mention of the type of ballast there. Hummm^≈, no mention of the actual device number anywhere in the whole book that I could see. I've got both types in my spares, so no problem either way. Ideas?

Date: Wed, 12 Apr 2000 19:53:48 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Ballast tube

The 3TF4 IS NOT a replacement tube for the 3TF7.

Date: Wed, 12 Apr 2000 20:56:45 EDT
From: DJED1@aol.com
Subject: Re: [R-390] Ballast tube

The 3TF4 is intended for a 4 to 8 volt drop, versus the 3TF7 with an 8 to 12 volt drop. Since the circuit is designed to drop 12 volts at nominal current, the 3TF4

won't last very long. I tried one before finding the data on it, and it lit up brightly when the filaments were turned on. It didn't blow, but I would expect it's just a matter of time. Ed WB2LHI

Date: Thu, 13 Apr 2000 13:12:25 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] RE: In-Rush Current and R-390A's

<Economic Analysis Mode ON>

Current AES price for a 3TF7is $36.45.
Assume one ballast tube failure due to on/off cycling.
Assume no other tube or component wear.
Estimate R-390A power consumption at 150 watts (ovens off).
$36.45 worth of power at $0.07 per kilowatthour is 520 kilowatt hours.
520 kilowatt hours at 150 watts is 3471 hours.
3471 hours is 144 days or about 6 months.

Conclusion: If ballast tube failures occur less often than every 6 months due to on/off cycling, you should spend your money on tubes not on electricity. </Economic Analysis Mode OFF>

Date: Thu, 13 Apr 2000 18:39:42 EDT
From: Llgpt@aol.com
Subject: [R-390] Tube Class 101 for 3TF7 substitutions

Concerning the replacement of the 3TF7 with the 3TF4.

1. ballast tubes have two ratings, a voltage range where current regulation takes place, and the regulated voltage.

3TF7 8.6 - 16.6 volts 200 - 300 milliamps 3TF4 4.3 - 8.3 volts 280 - 320 milliamps.

2. If you substitute a 3TF4, it will be operated beyond its recommended operating voltage rating. and the two filaments it regulates will operate beyond their recommended or maximum voltage ratings.

3. Sure it will work, but rather than replacing a 3TF7 with an improper tube, sub one of the resistor or other mods.

Date: Sun, 30 Apr 2000 06:54:55 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] THE R-390 COOKBOOK - Warning

It was called to our attention that one or two of the mods described in the "cookbook" may be incorrect. In particular, the 6080 replacement for 6082's was mentioned. The appropriate factor for the silicon rectifier might be closer to .707 rather than half of the 24 volts. (Wiring the 6080 filaments in series was supposed to bring the voltage down the rest of the way to 6.) Apparently, the resulting voltage also

depends on the load, so an actual measurement should be taken, lest ye be operating the 6080 six volters at something more like 8 volts.

It was also pointed out that replacement of the 26Z5W's with ss rectifers may call for a dropping resistor which is not mentioned in the cookbook, although I recall threads on this on the list. Subbing out the ballast tube has always been grist for the discussion mill. While the "book" uses a tube rather than a resistor, I don't know whether this actually provides any regulation action similiar to the ballast tube.

All of those may be further affected by running the receivers at 120-125 VAC, rather than the 115 for which they were designed.

What's left? Replacing the rear panel C connectors with SO-239's and pulling out the relay -- not exactly running to do that. SO-239'ing everything is pretty much an outdated fetish and it is still possible to find C-connectors at reasonable prices, and even twinax connectors as well.

Let's see ... that leaves the noise test, and there has been a question raised about the impedance matching network/voltage divider shown for that.

So, as it turns out, "The R-390 Cookbook" may serve more as a list of what not to do to your R-390(x). I was thinking of taking it down, but just added verbiage to the html page similar to the above as a warning to visiting pilgrims. I guess it's nice for an historical perspective or piece of short term nostalgia.

Maybe it's time to update the cookbook? It was suggested to me that the best way to determine the net voltage of the 6082/6080 mod was to try it and take an empirical reading (at 115 vac and 125, perhaps, AC supply voltage.) I think there has been some mention of appropriate starting values for the dropping resistor for the 26Z5W sub in the A's, not sure about the non-A's if there'd be a difference. We could discuss and resolve the other items as well.

What's nice about the Cookbook though is the format. It provides a consistent sequence with Purpose, Reason, Tools Required, Parts Required, and Procedure. I would modify the format so that Reason would be Rationale with two sub-sections -- "Pro" and "Con". Maybe some classification headings, such as A/Non-A/Both, Reversability, and Version number of the piece.

While many of you would be opposed to practically all of them in principle, at least there'd be a place where the mod would be described accurately along with dissenting opinion and considerations. Then, when the subject comes up on the reflector again, as they're wont to do, there would be a handy, efficient and complete reference on it.

So, for openers, does anybody have a non-A where the 6080 sub has been done? Have you checked the actual filament voltage lately? For the time being, I prefer to stock up on some spare 6082's for about ten bucks apiece and use a muffin fan. But if they become @SCARCE@ or @RARE@, then my preference could change in a heartbeat. ;-)

Date: Sun, 30 Apr 2000 09:42:08 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] THE R-390 COOKBOOK - Warning

MEASURING rms values with most meters that are NOT TRUE RMS is confusing and guaranteed to be wrong. In this situation where the voltage is rectified, there is a DC component, and a meter with only AC coupling will be further in error.

There are effective methods for measuring this result. One is the thermocouple type of RF ammeter. That is a TRUE RMS measurement because its based on heat. Another technique requires a vacuum tube diode, preferably filament type operated at a temperature where the plate current is limited by the filament emission and hence filament temperature. Measure the plate current while the filament is heated by the potential in question, then separately find the DC potential that applied to the filament results in the same plate current. THAT's TRUE RMS. Or with less sensitivity, mount a suitable resistor in an insulated chamber, immersed in oil, such as a thermos bottle. Starting with the resistor and oil at room temperature apply the unknown voltage and monitor resistor and oil temperature (if the oil is circulated adequately the oil temperature should be essentially the same as the resistor temperature) rise versus time. Then disconnect the unknown and find a DC voltage that gives the same temperature rate of rise. That's TRUE RMS. As for the ballast, using tube or resistor or a pair of 12BA6 removes any regulation benefit of the ballast. So far no one who has made such a mod has been hit by severe drift problems or shortened oscillator tube life. I believe that the greatest effect of the ballast is to lengthen tube life by softening turn on so that those tubes which are critical to the frequency calibration of the receiver need to be replaced less often. I believe that the ballast was left over from earlier receivers with tunable first oscillator that needed that regulation to keep a AM signal within the bandpass (such as the Super Pro family) and the military testers of radios would not accept any new design that didn't have that fundamental circuit design even though the HF oscillators being crystal controlled and the PTO being of far superior design to the band switched HF oscillator of other receivers made the ballast of little benefit. Though where the shelter was being powered by a generator with a bad plug wire and mistuned transmitter drawing excessive current might have benefited from the regulation of the ballast. I suspect that without the ballast, the agencies looking at the new receiver would have rejected it without turning it on and testing for frequency stability.

Using a pair of 12BA6 does reduce the heat in the receiver. That's some benefit. I have that solid state ballast replacement that works fine on my bench, I'm still waiting to hear of it working in receivers.

Its probably that the 6082 might be replaced by a power MOSFET on a heatsink with a fan. Likely something like a IRF820 with a ten volt zener from gate to source to protect the gate insulation. The shunt parts of the regulator might be replaced by a TL431CP and a transistor or two and suitable resistors. That would replace the 6BH6 and 5651 reference tube. I've not worked out all the details of such a circuit. I do have a circuit on paper for replacing the 0A2 family using a TL431CP and power MOSFET, but I've not yet tried it. I did built a voltage regulator for a 32 volt steam driven generator in the last week and it works fine away from the generator. Won't get steam to the generator for about three weeks but I plan to watch the first firing as they warm

up the steam engine. These solid state variations on the regulator circuits probably will give better voltage stability and for sure the 6082 replacement will operate cooler because of needing no heater power.

Maybe my ballast circuit and write up could be posted some place like the cookbook.
----------Date:
Sun, 30 Apr 2000 19:35:18 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Wacko Ballast Idea

Have an older letter from Chuck Teeters, regarding the 3TF7 Ballast Tube. As many of you know, Chuck was the former Director of radio at Fort Monmouth.To quote Chuck...." I got a chance to talk to Harold Gade, who did the 3TF7. Harold was in the mech/elect engineering section, and I don't think he knew which end of a soldering got hot. But he knew his chemistry. He told me the requirement was for a 300 ma regulator and they did it with iron wire in hydrogen. He said it has a limited life operation and also a shelf life depending upon storage temperature. He explained why, but I didn't understand, some reaction with the hydrogen. I'm going to get with him and have him write it up. Will send it along when he does ".

This letter was written November 5, 1997. In the Collins Engineering report to the Signal Corps, it was mentioned that the Ballast Tube wasn't required...in the wisdom that prevailed in the days of " damn it all defense spending " the Government wanted it and got it. My thoughts??????? This has got to be the " Deadest Horse " that has ever been beat/flogged. I have used 12BH7A's, 1% resistors and the old standby 12BA6 tubes.

Date: Sun, 30 Apr 2000 19:48:30 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] Wacko Ballast Idea

This may well explain the varying degree of service that most of us have experienced with the 3TF7 Ballast/regulator Tube. Most look as though they were homebuilt by 7 year olds. I have some last years and years (6 to 7) and just days. Even some of the NOS from Fair don't last too long from discussions I have had with other users.

A 10 watt 39 or 40 ohm 1% Dale (or equivalent) resistor works great. Rick Mish @ Miltronix has done this mod for years. I have tried it, works great.

Date: Sun, 30 Apr 2000 19:26:09 -0500
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] Tidbits from Amperite on Ballast Tubes

I originally posted the following message to the list here on Jan 27th of 1999. I've corrected a few spelling errors and added a few more comments to it with this posting. Al, you might want to replace the original message with this one at your R390A FAQ site. - -----<snip>-----
OK, after listening to all of the hype and BS about the ballast tubes in the R390A, I figured I'd research it a bit an post my findings. Put your boots on bubba, it's gonna get deep... <grin> If one of you guys is saving stuff for an R390A FAQ, the info below

would go well in it. Digging thru a 1982 Amperite AM-82 application guide, I found a few interesting things that I'll pass on to you guys. If you deal with a distributor that handles Amperite, get them to get you a copy, it's an interesting book. 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. Since I'm one of those people that refuses to use the metric system, you know WHICH 160 degrees I'm talking about. <hint> It ain't Kelvin either.

<added comment> One of the posts I read today mentioned a shelf life with ballast tubes. I suspect that it's related to ballast tubes that use helium as the filler gas. Helium is famous for it's ability to pass thru the wall of sealed steel high pressure cylinders. I ain't no engineer or chemist but have had some experience with high pressure gases and have see firsthand that helium will "disappear" from sealed bottles. If I'm not mistaken, the 3TF7 ballast tube is filled with hydrogen rather than helium. OK, back to my original post... 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 it's 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. Here's a direct quote from Amperite AM-82 that you'll really find interesting: - ---snip---

DUTY CYCLE DEPENDENT

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 if 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.- ---snip--- I figure that over the last 23+ years that I've had the old Collins, it's been on for "24 and 7" for at least 15 of those years. 15 years is 131,400 hours. That original 3TF7 is still going just fine. I'm not saying that it won't puke when I finish the overhaul of the receiver and power it up, but even if it did, it gave pretty damn good service.

<added comment> I finished my OH of my 67 EAC back in the middle of October of 1998. It's been running 24 hours a day and seven days a week since then. That's about 18 and a half months or more than 13,300 hours on the very same ballast tube that was installed in it when it was assembled back in 1968. If the gas hasn't leaked out yet, I suspect that it won't. Back to my original post...

The folks at Amperite that I've dealt with have been a hell of a nice bunch. I needed

some information on some odd "non standard" numbered ballast tubes. They transferred me to an engineer and I received all of the answers that I needed. Very sharp and friendly bunch of people.

For what it's worth, there's another part number for the 3TF7 that was used for tubes that had different testing requirements than the standard mil-spec and was for a Govt contract in 1978, and not for civilian or commercial sales. After I corner the market on them I'll post the number. <grin> Just joking...a friend of mine found a stash of them and sent me three of them last week or
so to research and experiment with. After talking to the engineer at Amperite a few hours ago, there's no need to experiment. I now know exactly what they are.

The end flap of the boxes is labeled as follows:
Amperite
TJ311M01

The side panel is labeled as follows:
5905-00-681-4707
Resistor Current Regulating
1 ea.
DLA900 78-M-T921
A 5/78

The tubes themselves are labeled as follows:
(circled Amperite "A" with lightening bolt)
Amperite
TJ311M01
Ballast
820

So, if you spot any of these TJ311M01 marked ballast tubes, grab a few, they'll work just fine in your R390A. I'd be curious to hear from any of you that bought an R390A that contained one of these or any of you that have information on the contract number or the FSN for them, listed above. nolan

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Date: Sun, 30 Apr 2000 20:37:27 -0400
From: "Dale Hardin" <aiti@gate.net>
Subject: RE: [R-390] Wacko Ballast Idea

Personally, I used the 12BH7A because it was so simple and easily reversible. Seems to work just fine and I must have four or five extra tubes just waiting for their turn if the lifespan isn't long enough.

Date: Sun, 30 Apr 2000 20:40:39 EDT
From: Llgpt@aol.com
Subject: Re: RE: [R-390] Wacko Ballast Idea

There ya go, the old KISS principle. Dale, I too have used them with no degradation in performance.

Date: Sun, 30 Apr 2000 20:14:53 -0500
From: Randy & Sherry Guttery <comcents@mississippi.net>
Subject: Re: [R-390] Tidbits from Amperite on Ballast Tubes

A few thoughts on various ballasts... The TJ311s were fairly common in R390As in the Pacific in the mid 70s. I still have 3 new ones -- unfortunately - they aren't in original boxes. It seems like the RT510's FSN had a "cross" to the TJ311s FSN... but it's been a long time - I may be wrong on that. It also seems that there were some notes about that in one of the EIB's or other bulletin. But yes - the TJ311s seem to work fine in all of the R-39xxs. While we're on the ballast / Amperite subject --- does anyone know what the following ballasts are / are for:

1HTF10 3HTF4 06TF30 (all Amperite) 6345 Chatham (Tung-Sol)?

Date: Sun, 30 Apr 2000 21:07:17 -0500
From: "Dr. Gerald N. Johnson" <geraldj@ames.net>
Subject: Re: [R-390] Wacko Ballast Idea

Hydrogen penetrates the iron crystal lattice and causes imbrittlement. The government insistence on a ballast for the oscillators confirms my suspicions that it was needed in every other good radio of the era and so had to be in the 390 to make the radio acceptable for testing even if with the better inherent stability of the low frequency PTO and crystal first LOs in the Collins made it have no detectable benefit.

Date: Mon, 01 May 2000 10:47:05 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] THE R-390 COOKBOOK - Warning

When the thread about using diodes in place of the R-390A ballast tube went by some time ago, I believed that half wave rectifying an AC filament supply would get you half the heat in the filament. I did not think the situation through carefully, though. This is true.. it will give you half the heat you would have had with the full AC voltage. But WHICH AC voltage?

It turns out that if you run two 6.3 volt filament tubes in series and apply half wave rectified 25.2 volts, you will get half the filament power that you would get if you ran them on 25.2 volts (assuming the filament resistances are constant with changes in dissipated power which is not actually the case.) Half that power is too much by twice!

Think of it this way: if you double the voltage, you get four times the power. Half of that (half wave rectified) is twice the power. NOT GOOD. Twice the power would be delivered by a voltage 1.4 times as high as the original. which is 0.707 times twice the original.. This is what Barry reports.

WARNING: Think before you measure some voltages as Barry suggests.

If you measure a half wave rectified version of 25.2 volts ac with a peak reading AC meter (such as most digital VOM and most AC VTVMs) you will get - guess what!?

25.2 volts. If you measure half wave rectified 25.2 volts with a true rms reading meter, you will get - guess what!? 17.8 volts

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Date: Mon, 01 May 2000 13:14:54 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Wacko Ballast Idea

No. It is a specially developed alloy of iron and other metals. It is in a mixture of gasses (including nitrogen and helium I think).

>Is it possible that some kind of miniature lamp, e.g., with a candelabra
>base or bayonet or whatever, could have similar characteristics by sheer
>coincidence?

No. Amperite engineers went to a lot of trouble and experiments to develop a device with VERY different characteristics than any available light bulb.

>Any thoughts on this? Is there something so very special about the
>filament in a ballast tube that makes this unlikely?

Yes there are a lot of things very special about a ballast tube filament and the enclosed gas mixture. In my opinion:

1) The R-390 family of radios does NOT need a ballast tube under the circumstances we hams and SWL people use them. Whether the ballast was needed for any of the military applications, I do not know.

2) It would be easy to lash up some lamps and see what happens. I would expect to see higher turn-on filament surges, and current regulating action less than a ballast tube but more than a plain linear resistor. Some benefits to be expected from this activity would be: a) a pleasant time messing with your radio b) bad experience by the tubes from high in-rush currents c) yet one more glowing thing to watch inside your radio.

Date: Fri, 5 May 2000 01:11:06 -0400
From: km1h@juno.com
Subject: Re: RE: [R-390] Wacko Ballast Idea

..... I used the 12BH7A because it was so simple and easily reversible.....

Yep and wasting a perfectly good tube in a no brainer application. Instead go for a pair of 51 Ohm 3W or 5W MOX resistors in parallel and wire underneath. Plug the defunct ballast tube in the socket to placate resto freaks and for e-bay photos and then enjoy trouble free reception until the next Millenium. That is true KISS

Date: Fri, 05 May 2000 08:53:08 -0500
From: Randy & Sherry Guttery <comcents@mississippi.net>
Subject: Re: [R-390] Wacko Ballast Idea

> ...the 12BH7A, IMHO is just a little [kinder] because one would presume that its

filaments would reduce the inrush current effects whereas the resistors wouldn't. Dale

The problem is that the 12BH7's filament when cold - presents a much lower resistance causing (until it heats) higher current through it and anything in series with it (the other filaments) - actually increasing in-rush current over what it would be were the 12BH7 replaced with a fixed resistance. If you truly want to reduce in-rush in this circuit (over the already fixed resistance's contribution) - you could include an in-rush limiter (special type of Thermistor) in series with the fixed resistor - one that starts out (cold) at say 47 ohms - and drops to 0.5 or so at load current that will soft-start your tubes. These are available from digikey for around $2.50.

Date: Fri, 5 May 2000 11:50:39 -0400
From: "Tetrode" <tetrode@sprynet.com>
Subject: Re: RE: [R-390] Wacko Ballast Idea

The series resistor would offer some current limiting during start up as its value is constant. A tube filament would not, as its cold resistance is much lower than its hot operating resistance, but that's fine since the other tubes in that filament string are doing the same thing. Reduced start up current in the BFO/VFO filament string is not a requirement, it's just speculated that its a benefit that the ballast tube provides. Probably doesn't matter either way.

Date: Fri, 5 May 2000 13:37:16 -0400
From: "Tetrode" <tetrode@sprynet.com>
Subject: [R-390] Re: {R-390] Wacko Ballast Idea--12BH7

Carl, you sure are cranky at 2:47 AM! <g> The tube may not be fully utilized in this application, but is a far cry from being wasted. It is providing the proper filament voltage to the 390 BFO/VFO tubes, a worthy cause for extra tubes rolling around in the junk box.

I think the the 12BH7 mod is a GREAT R-390 mod option. Simply by adding two wire jumpers to the ballast tube socket you now have the ability to use either the 3TF7 or the 12BH7 tube interchangeably in that socket. That's the beauty of the mod, when the 12BH7 is plugged in the filamentvoltage from the original ballast tube pins is harmlessly applied to its unused and isolated grids. Plus, the 12BH7 fills what might otherwise be a empty socket, its bulb size is nearly identical to that of the original tube, it will be good for a very long time since you don't care about its cathode emission, and it rewards you with a nicely glowing filament to see.

I did this mod on the bench 391 that I'm working on as I needed a ballast tube and I wanted to keep my few good ones for my 'resto freak' R-390A. <g> I say few good ones because the 3TF7 I originally plugged into the 391 was delivering 14 volts to the filaments, and another I tried was delivering only 10 volts. The 12BH7 was dead-on. (Some time I need to go back and look at these ballasts and check them out again, maybe some burn-in time would help them out or something. Anybody ever do this?)

>Instead go for a pair of 51 Ohm 3W or 5W MOX resistors in parallel and

>wire underneath.

That value is too low, you want 12.6/.3 = 42 ohms or so.

Date: Fri, 05 May 2000 12:41:45 -0600
From: Jordan Arndt <jordana@nucleus.com>
Subject: Re: [R-390] Re: {R-390] Wacko Ballast Idea--12BH7

If I recall the 3TF7 tube is designed as a current ballast not a voltage ballast... the fact that the voltage is not exactly 'on the nose' didn't really matter too much... as long as it held the current within a few mA ... There are some figures for replacement methds on this site... mostly Japanese, but worth a long look:

http://member.nifty.ne.jp/radioRM/r_390a/r_390a.html#R_390A_0

Date: Fri, 5 May 2000 16:03:21 -0400
From: "Tetrode" <tetrode@sprynet.com>
Subject: Re: [R-390] Re: {R-390] Wacko Ballast Idea--12BH7

Yup, I'm in agreement with you, it is a series current regulating device of about 300 ma. But for a controlled set of identical test conditions (line and load) you should get identical voltage output (within device tolerances) as well. When I was making my measurements I kept the line voltage constant at 115 volts, and the load (the BFO/ VFO filaments) was the same as well.

From other emails it seems like the current spec is about +/- 20 ma, but my measurements on the two other tubes I mentioned indicated a +33 ma and -62 ma differences, which is why I flagged them as suspect and set them aside to take a closer look at some other time. Another couple I tested were pretty much right on the money. There may be other failure modes to these devices
than just going open.

Date: Wed, 17 May 2000 07:05:54 +0000
From: "B.L.Williams" <B.L.WILLIAMS@prodigy.net>
Subject: Re: [R-390] Nice find

I have 2 R390A's, one with the jumper/12BA6 mod, and one with a good 3TF7. You aren't going to tell any differences between the two radios except that the non-3TF7 probably runs cooler in the rack. When the 3TF7 goes kaput I'm going to spend about 30 minutes putting the jumper in between pins 2 and 7, and plugging in the12BA6s. That's it unless you want to realign since you are changing the PTO tube. NIB 12BA6's are dirt cheap and plentiful. I have a lot of junker $1 plastic tube radios in the basement and each has at least 1 maybe 2 in them for spares, but I don't think the supply is going to dry up. That is the nice thing about the All-American-5-tube-lineup radios- they all had the 12BA6 in them. If you do the jumper mod then you don't have any more scarce tubes to worry about. It's a done deal without major mods or sand mods to ruin the radio. I checked my tube lists from some sources and none list the 3TF7, so I can't help you there. Conversely, the price on NIB 12BA6s are $3 each.

Date: Tue, 8 Aug 2000 18:54:13 -0400
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] 3TF7 bypass

I've opted for using a 12BH7 with pins 2&4 and 5&7 jumpered together. The 12V heaters in this tube are rated at 300mA, and this has been suggested previously by others.

I had originally used the 12BA6 tubes with the wire jumper in the 3TF7 socket, but that makes it hard to swap IF or PTO decks separately. The first time I forgot and swapped in an unmodified IF deck (which didn't work because of the 12BA6 in the PTO), I opted for the 12BH7.

Date: Sun, 10 Dec 2000 15:38:17 EST
From: Llgpt@aol.com
Subject: [R-390] Ballast Tubes & Replacements Etc.

I have never felt that the 3TF7 ballast tube was needed (with today's power regulation) and, Collins Radio Co. told the Signal Corps. that it wasn't needed. But, in the days of " damn it all defense spending ", the powers that be decided to include it. Probably a good idea with the typical military portable generator unstable voltage. But, in today's home use, it's hardly necessary. Now, I'm not going to say what I think is the best modification, as many of them are.
I have tried the usual replacements, diodes (yeah, right the engineers say they won't work), resistors (no, when someone flipped a light on, the R-390A didn't jump frequency). At present, I have been using Chuck Rippel's solid state ballast tube replacement module. Mine is the adjustable (spelled more expensive) one. Chuck told me recently, that the less inexpensive version (non-adjustable) is just as good. Mine has been in place for several months, when received from Chuck, it measured 6.2 volts DC between pin # 3 and ground of V-505. Checked it a few times, and it stayed there as though " glued down ". Now, several months later, it's still there. I suppose I could " tweak " it to 6.3 volts, but I'm so inclined to constantly " screwdriver adjustments ". Another great feature of the module, is a " soft start ' feature it takes approximately 38 seconds to start compared to a " normal " approximately 25 seconds. YMMV.

But, many on this list will tell you that I am a heathen, because I dont use rectifier tubes either. hey, the 1N5408 3 amp 1,000 Volt diodes will be there forever, (however long that is). I have NEVER had problems with short tube life and all the other ailments that are supposed to go along with these above mentioned mods. But, as with most mods, one man's mod is another's
nightmare. Just a few thoughts on this sunday afternoon.

Date: Sat, 30 Dec 2000 09:00:15 -0500
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: {Collins} Re: [R-390] R-390A Newbie Questions

.....the ballast tube is bad.....

I use a mod which connects pins 2 to 4 and 5 to 7 underneath the 3TF7 tube socket.

Then you can replace the 3TF7 with a 12BH7 tube for about $3. The 12BH7 heater draws 300 mA. I have this mod running in two R-390As. This modification was documented in Hollow State New issue #10.

Date: Sat, 30 Dec 2000 11:02:58 -0500
From: "Wm. L. Townsend" <wlt@tesnet.com>
Subject: Re: [R-390] R-390A Newbie Questions

..... Replace the 3FT7 with a diode - only the positive (or negative) pulses
> get to the heaters, causing 50% less dissipation, and near zero watts in the diode;
OR....

Using the diode doesn't really give half the dissipation. This has come up several times in the past - seems like nobody wants to believe it, though.You can prove this easily if you take two identical light bulbs (like 40 or 60 watts) and run one from a variac and the other directly from the line with a diode in series. Now take a VOM and adjust the output voltage from the Variac to be one half of the line voltage. If you compare the brightness of the two bulbs, you'll find that the one on the variac is a lot dimmer than the one with the diode. (Hence, the dissipation in the bulb with the diode is higher than that in the one on the variac that is running at half the input voltage.) If you adjust the variac so that the two bulbs are of equal brightness you'll find you need something like 75 volts or so for a 115volt line, not one half the line voltage. If you really want to be picky you can use a photo light meter to make sure the brightness is the same, but it will be close enough to just look at the bulbs. Note that you will not be able to get an accurate measurement of the voltage on the bulb with the diode unless you have a meter that reads true RMS. The half wave rectified line voltage cannot be read accurately on most meters, but you can read the line voltage and the output of the variac since it is sinusoidal. There's no doubt that if you put a diode in for the 3TF7 the radio will work and the tubes will probably last quite a while since the dissipation is only about 15% more than the rating for the tubes, but there is bound to be a reduction in tube life because the filament dissipation is considerably higher than if you were running the tubes at 12.6 volts, as they are rated...

Date: Sat, 30 Dec 2000 10:40:08 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R-390A Newbie Questions

<snip> There are multiple solutions for the ballast..... 3TF7's do exist.I've created a circuit that replaces the 3TF7 with a diode bridge and a LM317 as a current regulator. One of the R-390(a) restorers sells a plug in module that replaces the 3TF7, I suspect with a diode rectifier and a LM7812 voltage regulator. I don't think the transformer appreciates the unbalanced direct current component of the load. A resistor, such as a 12BH7, in place of the ballast works. So for no one has detected poorer stability as the result of the lack of regulation. The diode mode has been debated that it doesn't really apply 12.6 volts RMS to the tubes. A jumper and replacing the 6BA6 by a pair of 12BA6 (very common in the later 4 and 5 tube AC/DC radios) works. Means the tube socket labels need to be amended for the future. The best I can figure, ballast tubes were an absolute necessity in the receivers of the era prior to the R-390 where the tunable oscillator was at HF, up to 32 MHz and band

switched. That made the potential military customers expect a ballast in the R-390 even though it had virtually no effect. I suspect the military buyers would have rejected the R-390 without the ballast. The one engineering report that we have says the ballast was included "just in case" it might help. I can send you my circuit, I have it in various forms, including text with .GIF, .PS and .DXF.

Date: Sat, 30 Dec 2000 16:40:46 -0500
From: "Wm. L. Townsend" <wlt@tesnet.com>
Subject: Re: [R-390] R-390A Newbie Questions

Well, it has been pointed out that my 15% number on increased filament dissipation was wrong. Apparently, there's a lot of variation in light bulbs. I repeated the measurements using the same bulb in both cases. The actual increase in power dissipation is 2x. (Thanks, Gary.) Anyway, regardless of the actual value, the tubes will dissipate a whole lot more than what they are designed for if you replace the 3TF7 with a diode. They may last quite a while, but at twice the rated filament dissipation their life is bound to be a lot shorter. Sorry about the screw-up.

Date: Sat, 30 Dec 2000 17:18:14 EST
From: Normiehall@aol.com
Subject: Re: [R-390] R-390A Newbie Questions

I guess a lot of us figured that if you only passed half of the AC through the diode you would only end up with half the effective power. Could someone explain please?

Date: Sat, 30 Dec 2000 17:37:29 -0500
From: "Howard Rawls" <howard@cconnect.net>
Subject: Re: [R-390] R-390A Newbie Questions

Hey, am I the only one that ever actually used a diode to replace the ballast tube?? I did it about 20 years ago and forgot about it until recently. I un-did the mod after reading so much about it being a bad idea (I agree, it's not the best solution).....but in my case it did last a loooong time with no problems. My favorite fix is to use 12 volt tubes.....but if a diode is all you have, use it until you get something better.

Date: Sat, 30 Dec 2000 23:31:45 -0500
From: Thomas W Leiper <twleiper@juno.com>
Subject: Re: [R-390] R-390A Newbie Questions (diode mod)

Elementary, my dear Watson. First, consider the nature of the situation leading up to the crime. The victim ("stock" R-390A) is perfectly content to coast along using a so-called ballast tube to drop the 25V supply voltage in half for the series 6V filaments. Apparently, it didn't understand that the current through the ballast tube and the other tubes is equal... since they are all in series, and the voltage drop across the ballast tube is equal to the voltage drop across the pair of 6BA6's, thus the power dissipated by the ballast tube is equal to the power dissipated by both 6BA6's .

Now here comes the nasty diode (the "perp") claiming that it can achieve the same result by simply clipping out half the AC cycle...thus half the power. The thinking is

that twice the voltage for half the time gives the same result. This is where the clever con artist and three card monte player seizes the advantage. All is not what it appears.

What the diode did NOT tell you is that it dissipates no power on it's own part (why have to work, anyway?), so, other than the 0.7 volt forward voltage drop, the CURRENT is not limited during the half cycle of conductance where it would be in the case of the ballast tube. If you were to look at the 25V AC on a scope, you would see that the peak to peak voltage is significantly higher, but the diode doesn't know RMS from PMS, so it just conducts for all its' worth through the peak. The ballast tube would be dissipating more power through that peak. So even though you may think that you have cut the voltage in half, you really are delivering more power because the diode is not current limiting the way a resistance is.

This is about the simplest way I can explain it without any math...long since "dissipated" within my own "ballast". Although an illusion of the opposite extreme, you might entertain yourself by pulling V505 (after adding the diode mod) and plug a 47MF 50V electrolytic cap in place of the filament (pos on pin4, neg to gnd) and measure the DC voltage on pin 4. You'll wonder why you didn't blow up the tubes the moment you put the diode in... My preference? Use a pair of 12BA6's and a jumper with a warning tag attached.

Date: Sun, 31 Dec 2000 02:16:11 -0500
From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] R-390A Newbie Questions

.....it should probably be deleted or at least changed.....

Sound's like it's time for a compendium of Un-FAQ's or "R-390(x) Fallacies". I seem to recall from that lengthy thread about ballast tube alternatives that the 12BA6 replacement didn't do anything for regulation -- but then there's the idea that we don't need that regulation any more. I question that notion -- there are still power jumps and sags here, and brownouts during the summer. I've measured line voltages ranging from the usual 126 down as low as 97 or so. At the moment, I don't remember what the advantage of the 6 to 12 v. tube change is over just using a resistor.

Date: Sun, 31 Dec 2000 12:06:53 +0200
From: "Paul Galpin" <galpinp@sabc.co.za>
Subject: RE: [R-390] R-390A Newbie Questions

Did this raise a hornet's nest!

1. The diode method does work correctly. The heating effect is proportional to the area under the curve of the sine-wave. One half of the sine-wave is missing, therefore it goes down 50%, but the amplitude is double, so it goes back up to 100%. Unlike light bulbs, the heater element has plenty of thermal lag to overcome the effect of the missing half-cycles. Since one of our correspondents has been using it for 20 years, I think the case is proved. The uneven load on the transformer is small compared to the overall load. This is a non-linear circuit, so doing silly things like

putting in a big C will really screw things up. You can only measure the effective voltage with a TRUE RMS meter, which does not assume that all AC is a sine wave. Most AC/DC meters make that assumption.

The 3FT7 ballast is a fairly crude device (iron wire in hydrogen atmosphere, I believe), but hi-tech for its day. Sorry, I had forgotten that 110 volt countries really do suffer from regulation problems, here in Africa we are 220 Volt (+- about 5 volt), with an earth trip at 20 - 30 mA. If you really want ultimate stability, replace the (missing?) 3FT7 with a solid state regulator, and never mind about historical correctness.

So the options appear to be:

1. Solid state regulator: best stability, not historically accurate, heat depends on design.....
2. 3FT7 ballast: good stability. historically accurate, dissipates about 4 Watts
3. Resistor: OK stability (mains dependent), dissipates about 4 Watts
4. Diode: OK stability (mains dependent), dissipates very little
5. Short circuit, use 12BA6's: OK stability (mains dependent), no extra dissipation

The set is designed to have a hot 4W device in this position, so that is not really a problem, but I think that the 12BA6 is the most elegant answer if your mains regulation is reasonable. <snip>

Date: Sun, 31 Dec 2000 05:05:06 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R-390A ballast

Based on the engineering report and on other's experiences, I'm more and more of the opinion that the ballast is only present to make the receiver palatable to military purchasers accustomed to the wanderings of the Super Pro and that its effect is not detectable. That's essentially what the engineering report says, that its value was negligible. Certainly crystal oscillator frequencies are determined primarily by the crystals and changing tubes has essentially no effect on calibration. And since the inductance of the PTO is varied, not the capacitance (like all other brands of that era and of prior history) the capacitance swamping tube changes in the PTO can be very large, on the order or 100 times that of the tube, so incremental changes in tube C or tube gain have essentially no effect on frequency. Which means the minor effects of tube heater power changing have even less effect on frequency. Going to the 12 volt tubes instead of the resistor has two benefits. 12BA6 were commonly used in AC/DC table radios and so were probably produced in much greater quantities than 6BA6 making them a bit easier to find globally. The power dissipation in the receiver is reduced by 12.6 volts 0.3 amp or 3.6 watts.

Date: Sun, 31 Dec 2000 10:14:30 EST
From: Llgpt@aol.com
Subject: Re: [R-390] R-390A Newbie Questions

I have the adjustable version, been sitting at 6.2 volts for months on end. But, I get tickled when I read all the rhetoric about shortened tube life etc. I have tried all the mods over the years, guess what ? They ALL work. Les Locklear

---
Date: Sun, 31 Dec 2000 11:16:15 EST
From: G4GJL@aol.com
Subject: Re: [R-390] R-390A Newbie Questions

Dr Jerry's mod works well. I have it in a Blue Striper I have rebuilt. Totally reversible and better for the fingers than the original 47 ohm rsistor, I poked into the Ballast socket. (BTW That worked too, but I kept burning my fingers on it)

Date: Sun, 31 Dec 2000 10:35:36 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R-390A Newbie Questions

When a transformer is designed for no unbalanced DC in any winding, it's most compact and has no air gap in the core. A bit of unbalanced DC can cause it to be driven into saturation in one direction to increase the core losses significantly. This will be more probably when operated at 50 Hz than at 60 Hz. My current regulator circuit, a resistor, a 12BH7, and the ballast all dissipate the same power. I think the R-390 oscillator circuits are adequately independent of tube parameters to make secondary effects of heater voltage to have insignificant effects on frequency. The engineers who designed it said that in the engineering report.

Date: Sun, 31 Dec 2000 10:35:33 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] R-390A Newbie Questions

Les, isn't 6.2 volts a bit low for a pair of 6BA6 in series?

Date: Sun, 31 Dec 2000 12:03:09 EST
From: Llgpt@aol.com
Subject: Re: [R-390] R-390A Newbie Questions

I should have said that there was 6.2 volts between pin # 3 of V-505 and ground. The pair would be 12.4 volts.....thanks for catchinjg that Jerry..

Date: Sun, 31 Dec 2000 12:04:24 EST
From: Llgpt@aol.com
Subject: Re: [R-390] R-390A Newbie Questions

<< I think the R-390 oscillator circuits are adequately independent of tube parameters to make secondary effects of heater voltage to have insignificant effects on frequency. The engineers who designed it said that in the engineering report. >>

That says it all.....very well put Jerry.

Date: Sun, 31 Dec 2000 12:23:32 -0500
From: "Wm. L. Townsend" <wlt@tesnet.com>
Subject: Re: [R-390] R-390A Newbie Questions

> 1. The diode method does work correctly. The heating effect is proportional

> to the area under the curve of the sine-wave. One half of the sine-wave is
> missing, therefore it goes down 50%, but the amplitude is double, so it goes
> back up to 100%. Unlike light bulbs, the heater element has plenty of
> thermal lag to overcome the effect of the missing half-cycles. Since one of
> our correspondents has been using it for 20 years, I think the case is
> proved. The uneven load on the transformer is small compared to the overall load.

Sorry to keep dragging this out, but I must be missing something here... Let's ignore all the math and look at the light bulbs again. The only thing that generates light in a bulb is power being dissipated as heat in the filament. If there's more light then there must be more heat and, hence, more power dissipated. The same thing must be true for the filament in a tube. The tube also generates additional heat from power dissipation in the other elements of the tube, but I think it's safe to ignore that for this discussion. Why is it that a light bulb running from a sine wave at half the voltage is MUCH dimmer than the same bulb running from twice the ac voltage with a series diode? If you actually try this, it is obvious that the lamp with the diode is brighter.

If you run a bulb with a series diode and it's a lot brighter than when you run the same bulb at half the voltage with no diode, it must be dissipating more power when you use the diode - how else can we account for the additional brightness (heat)?

What does thermal lag of the filament have to do with this? A watt of power is the same, no matter what you use to dissipate the power. One watt dissipated in a light bulb for a particular amount of time is the same as one watt dissipated for the same time in anything else, including a tube filament.

I suppose there might be some small variation in light output since the rectified line voltage is a pulse train at the line frequency, but the effect of this on light output has got to be fairly small. In any case, all this would do is decrease the light output if the filament was able to cool slightly between half cycles. The brightest lamp is the one with the diode, so if this is happening the situation is even worse than it appears...

I don't understand how the diode mod can really be equivalent to running the tubes at the rated voltage when there is clearly a big difference in power dissipation in the light bulbs. It seems unlikely that there is anything magic about a tube filament which makes it behave so much differently than the filament of a light bulb.

As to somebody having used a diode successfully for 20 years, all I can say is that I guess the tubes will work a long time when you run them at much higher than rated filament dissipation. 6BA6s are still pretty easy to find so it probably doesn't really make much difference...

It is interesting how much abuse some equipment will take and still work normally. Some time back in the early 80s a technician who worked for me was doing final checkout of a piece of equipment we were preparing to ship to the UK. He was running the equipment from a 240v 50Hz supply and using a scope to make final adjustments. Somehow he managed to plug his Tek 465 scope into the 240v 50Hz supply. The scope ran fine for almost a week before he noticed! <snip>

Date: Sun, 31 Dec 2000 13:00:58 -0500

From: "Mike B. Feher" <n4fs@monmouth.com>
Subject: Re: [R-390] R-390A Newbie Questions

I have been putting in 50 ohm 10 watt chassis mount Dale resistors in place of the 3TF7 for about 12 years in all the R-390As that I have owned and kept. It is simple to do and lasts forever.

Date: Sun, 31 Dec 2000 16:15:59 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] R-390A Newbie Questions

>1. Replace the 3FT7 with a diode .....

NO, NO, NO. this will apply about 150 percent of the proper power to the two tubes.. Do NOT do this.

Date: Sun, 31 Dec 2000 16:27:08 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] the 3TF7 problem...<yawn>

>I have been putting in 50 ohm 10 watt chassis mount Dale resistors .....

I've owned and ran R-390A's in the "native" 3TF7 configuration since the mid 1970's and have never had a 3TF7 fail. I must have the equivalent of 15 years or 130K+ hours of "power on" time on my old Collins over the last 25 years. Lot's of failures, yes. Some were pretty damn spectacular, but the 3TF7 lasted just fine. This past October I finished a two year 17,600+ hour endurance run with my '67 EAC. It didn't eat any 3TF7's either. The original 3TF7 that was in the set when it was built is still chugging away just fine. Here's a clip from a message I posted on the subject a couple of years ago here in the list from Amperite publication AM-82: - ---snip--

DUTY CYCLE DEPENDENCY
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 if 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. - ---snip--- If you think about it, turning the set off and on many times is probably hard as hell on every tube in it along with lots of other components. At eight cents per kilowatt hour, it costs about twenty one cents a day to run an R-390A with it's ovens off. No big deal, even on my salary.

One thing that the endurance run with the EAC did was to change my opinion of several of the tubes used in the R-390A. Namely, the 26Z5's and the 0A2's. I never had good luck with these particular tubes in the R-390A's up until the EAC test. In fact, I had so many of them fail that I made it a point of simply replacing them from the start in any receiver that I acquired or worked on. After watching them run for more

than 17K hours and still test well above the minimum values, my attitude has changed as far as these particular tube numbers. I think that it's very possible that they are a lot more sensitive to developing problems due to "cycling" than the other tube numbers in the R-390A.

I've chatted with dozens of people here in the list that have been using the same 3TF7 for ten or fifteen years without any problems. I've also chatted with people that have had several fail in one year. I never really queried any of these guys about the "power on" duty cycle of the set or if the 3TF7's that failed were new or used. Or, if they used a variac to run the receiver, etc.

I think that the "duty cycle" statement by Amperite is the key to the "problem". If you are the type person that simply lets the receiver run for weeks on end, odds are that you won't have the same problems as people that listen to it for one hour or so a night, and then turn it off and repeat the cycle again the following night. If my usage pattern paralleled those people, I'd look at "soft starting" the R-390A on a variac each time I powered it up. I suspect that this will help not only the life of the 3TF7 but all of the tubes in the beast. I ain't no engineer, and I never played one on TV, so my whole theory may be flawed and your mileage may vary...

Date: Sun, 31 Dec 2000 17:39:04 EST
From: Llgpt@aol.com
Subject: [R-390] Beating A Dead Horse/3TF7 Ballast Tube

You'll never get a disagreement out of me on what you just said. That said, I have never been so lucky on 3TF7's. The longest i ever had one last was about 1-1/2 years (of intermittent use).

I decided several years ago to experiment, the diodes, resistors, 12BH7 etc. They all worked just fine. I decided that when Fair Radio ran out of the $ 17.50 3TF7's, that I wan't going to buy anymore of them.

I now use Chuck Rippel's Solid State (gasp) regulator module. Since installed, it has stayed on 6.2 volts between pin 3 and ground of V-505 for months. I would suspect that that kind of regulation isn't going to happen with the 3TF7.

Having said that, and the hornets are buzzing, I'll agree with Nolaan's test. But, how many of us leave our R-390A's (or other receivers) on 24/7 ??? That alone is the reason why Nolan has not had a 3TF7 problem, of course having a properly aligned/ repaired R-390A helps immensely.

Date: Sun, 31 Dec 2000 17:49:34 -0500
From: "Ronald Reams" <wa4mjf@worldnet.att.net>
Subject: Re: [R-390] Beating A Dead Horse/3TF7 Ballast Tube

I leave both mine on 24/7..understand that it is the best thing to do!

Date: Sun, 31 Dec 2000 17:50:15 EST
From: Llgpt@aol.com
Subject: Re: [R-390] Beating A Dead Horse/3TF7 Ballast Tube

Undoubtedly.....but, most of us don't.

Date: Sun, 31 Dec 2000 17:56:46 -0500
From: "Ronald Reams" <wa4mjf@worldnet.att.net>
Subject: Re: [R-390] Beating A Dead Horse/3TF7 Ballast Tube

Well, perhaps all y'all should think about it..no brainer for me...cycling on and off can't be as good as leaving on...

Date: Sun, 31 Dec 2000 17:57:18 EST
From: W2ZR@aol.com
Subject: Re: [R-390] Beating A Dead Horse/3TF7 Ballast Tube

Mine is on 24/7 too!

Date: Mon, 01 Jan 2001 02:48:50 -0600
From: Nolan Lee <nlee@gs.verio.net>
Subject: [R-390] Re: Beating A Dead Horse/3TF7 Ballast Tube

>have never been so lucky on 3TF7's. The longest i ever had one last was about 1-1/2 years (of intermittent use).
That sucks. ;-(

>I decided sevral years ago to experiment, the diodes, resistors, 12BH7 etc.
>They all worked just fine. I decided that when Fair Radio ran out of the $
>17.50 3TF7's, that I wan't going to nuy anymore of them.

I wonder just how many they had?

>I now use Chuck Rippel's Solid State (gasp) regulator module. Since installed, it has stayed >on 6.2 volts between pin 3 and ground of V-505 for months.

I measured the voltage across the 3TF7 and the two tubes it feeds but don't remember what it was. It seems that with the line voltage fixed at 115, it was in line with what you have.

>I would suspect that that kind of regulation isn't going to happen with the 3TF7.

Actually, according to Amperite, the regulation of the 3TF7 is plus or minus 1%. <grin> Pretty damn impressive for something that at first glance seems so primitive. And, they'll keep that spec with either AC, DC, or pulsating current. :.) I'm guessing that the current crop of solid state mods supply DC to the filaments rather than AC. I wonder if tube filaments run on DC are as susceptible to the same life shortening phenomena as that shown by lamps run on DC? Oooh, new THREAD!

>Having said that, and the hornets are buzzing, I'll agree with Nolaan's test.
>But, how many of us leave our R-390A's (or other receivers) on 24/7 ???

Several dozen people emailed me to tell me that they ran theirs 24/7. I do have some

reservations about running some R-390A's unsupervised though. Namely, any receiver that hasn't been recapped, and any single fuse R-390A. Ditto for any receiver not running a 2 amp or less AC fuse, any receiver not having first rate spike suppression in the Ac line, and any receiver running in an area that could catch fire.

>That alone is the reason why Nolan has not had a 3TF7 problem, of course
>haaving a properly aligned/repaired R-390A helps immensley.

A recap is a good idea regardless of which duty cycle someone chooses. I've had some really bad failures in the past due to shorted caps. One of these days, I'll shoot some pictures of some of the fried modules.

Date: Mon, 1 Jan 2001 07:00:25 -0800 (PST)
From: "Tom M." <courir26@yahoo.com>
Subject: [R-390] We Don't Need No Stinkin' Ballast Tubes

I'm with Les, it's generally too damn hot down here to leave the rigs on. But what I did on the ballast tube is to short it, and replace the BFO and PTO tubes with 12BA6's. It worked fine for years. I've since replaced the IF deck with one from a R-390, and at that time installed a ballast tube I got for free from a well known Mississippi R-390A collector. Ballast tube (or any other gadget) optional.

Date: Mon, 01 Jan 2001 10:33:44 -0600
From: "Dr. Gerald N. Johnson, electrical engineer" <geraldj@ames.net>
Subject: Re: [R-390] Re: Beating A Dead Horse/3TF7 Ballast Tube

My current regulator supplies a peak clipped AC. A square wave but with slopes on the rise and fall. The amplitude is corrected for the slopes. The potted module that's sold appears to put out DC. I covered that thoroughly in my write up. You don't remember reading it? I don't think tube heaters are bothered by DC because they operate at a much lower temperature than tube or lamp filaments. Too low a temperature for electron emission to be a factor in their life. That's because the oxide coating on the cathodes they heat doesn't need nearly as high a temperature for electron emission as tungsten or thoriated tungsten. The thorium makes the thoriated tungsten filament work at a lower temperature also, but not as low as the oxide of a cathode.

Date: Wed, 10 Jan 2001 22:44:31 -0500
From: Gene Beckwith <jtone@sssnet.com>
Subject: Re: [R-390] We Don't Need No Stinkin' Ballast Tubes

Agreed...just put in a 12BA6 (socket jumpers) and forget the strain and agony of the 3T.... and by the way, use a black tube shield on it and it'll last longer than you have time to listen to the radio...and if the cosmetics of not having a "3T" in there, the black shield covers it up and you'll soon forget... especially if you get the line voltage under control with a variac and use some soft start techniques... <snip>

Date: Wed, 10 Jan 2001 23:13:36 -0500
From: "Jim Miller" <jmille77@bellsouth.net>
Subject: Re: [R-390] We Don't Need No Stinkin' Ballast Tubes

I preferred the 12BH7 mod, adding some simple jumpers under the 3TF7 tube socket, and installing a 12BH7 in the socket, using the 12BH7 filament as a voltage drop. The 3TF7 can still be installed if desired, or you can put a 12BH7 in there and either way there's a real tube in the socket and a tube cover. Works good.

Date: Fri, 12 Jan 2001 04:43:28 -0500
From: "Jim Miller" <jmille77@bellsouth.net>
Subject: Re: [R-390] We Don't Need No Stinkin' Ballast Tubes

The 12BH7 replacement for the 3TF7 modification can be found at KK4DF's page:
http://www.knology.net/~wewilson/.....

When you get to his page, select "Productions Modifications, Field Changes, and Optional Modifications for the R-390A" This and other modifications will be described...

Basically it is as follows: Add jumpers on RT510 socket (on the IF module) between pin 7 and pin 5, and another jumper between pin 2 and 4 (I soldered 2 short pieces of wire to these pins underneath the socket).

This allows you to substitute a 12BH7A tube in place of the 3TF7. This simply uses the filament of the 12BH7 as a voltage drop. It provides no regulation as the 3TF7 does.

The 12BH7 is about the same size as the 3TF7 so you can also use the tube cover.

Date: Sat, 7 Apr 2001 19:52:33 -0400
From: "Tetrode" <tetrode@sprynet.com>
Subject: Re: [R-390] BFO

I've got a pretty good idea what's going on with your radio, although it's not a big deal. In both the 390A and nonA the BFO and VFO tube filaments are in series and their filament current is derived from the infamous 3TF7 ballast tube. I once had the same problem you do with one of my nonA's except that it was the VFO that took a while to start up, and sometimes it wouldn't even want to start unless the line voltage was a few volts on the high side. The problem was the ballast tube was only delivering about 10 VAC to the filament string instead of the nominal 12.6 VAC, so the VFO tube's cathode emission was reduced and the oscillator had a hard time starting.

For a short term fix I put in a fresh VFO tube that had more emission and wasn't bothered by the low filament current, but later I did the usual mod to the ballast tube socket so that I could substitute a 12BH7 and things have been fine since.

Out of six 3TF7 tubes I have only two have an output current that is within 10% of their 300 mA spec, which is supposed to supply a nominal 12.6 VAC output in this particular application. The other two were well below, and two were well above. I

would guess not many folks bother to check their ballast tubes and just assume that if they aren't open they are OK. However, my experience tells me they can degrade over time just like any other component, or maybe they were never quite good to start with (rejects?).

Date: Thu, 10 May 2001 06:37:35 -0700 (PDT)
From: N1ZR ARS <N1ZR@excite.com>
Subject: [R-390] 390A Ballast Tube Alternative

I'm a 390A newbie, so forgive my basic question. What's the consensus on this alternative to the 3T-Ballast tube: simply pull the ballast, short pins 2 and 7, and then replace the 6BA6's in the bfo and vfo with 12BA6's. I do not wish broach discussion of originality, rather, I'd like to learn how to make use use of my R390A more practical. This is my first post to the group.

Date: Thu, 10 May 2001 07:57:34 -0700
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: [R-390] 390A Ballast Tube Alternative

I have this change installed into my R390/A this way. I like it, It works clean. It is easy to install. It gave me an excuse to install to new tubes into the VFO and BFO. This helped the receiver noise.

Date: Thu, 10 May 2001 10:02:09 -0600
From: Jordan Arndt <jordana@nucleus.com>
Subject: Re: [R-390] 390A Ballast Tube Alternative

I use a 12BH7A tube as the ballast tube as it has the "Controlled Heater" warm-up characteristic... it also makes for a good product detector if you decide to go that route... the power for the P.D. cna be taken from the B+ line to the BFO which is switched from the front panel... small relays do the rest ... You can switch the Lankford AGC mods in and out with the relay(s) using the same switched voltage.... 73 de Jordan....

Date: Thu, 10 May 2001 09:17:53 -0700
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: Re: [R-390] 390A Ballast Tube Alternative

Yes, I installed two new tubes that were new. These new tubes were less noisy than the old tubes that were in the receiver. This effect should last until these tubes age. I have a stock of 5749's in used state. I can not spend my allowance on new 5749's until I use my current stock. I have a significant other involved in this allowance factor and, that's the rule.

Date: Wed, 23 May 2001 14:29:39 EDT
From: NE7X@aol.com
Subject: [R-390] RT510 replacement

The 3TF7 ballast in my R390A is bad. I was informed at Dayton that there is a simple mod in ER that describes replacing the 3TF7 ballast with a 12BH7 tube, using the filament of the 12BH7 as the 3TF7 ballast. Is anyone using this mod? If so, what are the pro-n-cons in doing so. Neb Surplus sells 3TF7s for $45 + shipping. Using a 12BH7 for $.10 would be a lot cheaper, if indeed, it works as well.

Date: Wed, 23 May 2001 17:40:59 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] RT510 replacement

That mod will work fine. Hope this news doesn't send SSN into bankruptcy.

Date: Wed, 23 May 2001 18:24:50 -0400
From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] RT510 replacement

The 12BH7 or 12BH7A tube works fine for me. Add jumpers under the RT510 socket between pins 2&4, and between 5&7. Then you may freely substitute a 12BH7 tube for the bad ballast tube. I saw this modification in Hollow State News.
(HSN issue 10, pages 1&2 or HSN reprints, page 1)

Date: Fri, 3 Aug 2001 12:56:34 -0700
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: Re: [R-390] contacts

<snip> Tiring of this intermittent action, I replaced the PTO and BFO tubes with 12BA6, and jumpered the ballast tube out. No more intermittent action.

>This is strange, Why does jumpper wire make good contact in the socket when the tube does not.

Did you try sanding the ballast tube pins to clean up that side of the contact pair? (socket socket and tube pin)

>But I would like to find a neater way to jumper pins 2 and 7 than using a piece >of wire in the tube socket. I would expect it to eventually oxidize and become >intermittent...

Maybe make a dummy plug out of a dead tube? 9 Pin connector plugs are made. Gate Way Electronics has some on the shelf in San Diego. These fit the 9 pin socket and you need to add a jumper to the plug. Been there done that.

>Maybe solder a small jumper across 2 and 7 of the ballast tube and stick it back >in for looks?

Yes, This works, You could sell the ballast tube as @RARE@ @SPOOK@ @NOS@ you know where. Then leave the socket open. I plan to use that socket for a product detector mod for use with SSB. However that is about project 16 down my hobby list. (4 years from now)

Date: Fri, 03 Aug 2001 15:59:53 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] contact

Is it the 12BH7 that makes a nice ballast tube replacement?

Date: Sat, 4 Aug 2001 11:10:13 -0400
From: "Warren, W. Thomas" <wtw@rti.org>
Subject: RE: [R-390] contact

Yep, it's the 12BH7A with V/A for the filament being 12.6/0.3. I bought a couple of them at the Cary (NC for those not around here)hamfest for $8 each. Kinda expensive for a glowing resistor, but the golden-eared crowd has done it to us again. Pins 4 & 5 are the heater on the 12BH7A, so make appropriate connections on the ballast tube socket.

Date: Sat, 4 Aug 2001 12:41:37 -0400
From: "Gary E. Kaufman" <gkaufman@bu.edu>
Subject: RE: [R-390] contact - 12BH7

The 12BH7 was used in all of the Mcintosh amplifiers, hence the continued demand. Even heavily used 12BH7A's should work fine as a filament - and I've never seen an open filament on a 12BH7. Just pick'em out of the used bin at the next hamfest. It is apparently still in production in Yugoslavia (around $12) so future supplies should hold up. As far as I can tell, the only characteristics of the 12BH7A that are really important are the 12.6/.3A filament and the controlled warmup characteristics. The tall bulb is probably why the 12BH7 was chosen as it "looks" like a 3TF7 at a distance. The 12AU7A has the same pinout, same filament requirements, and is also spec'd for an 11 sec. warmup. If you don't care about the shorter bulb it should work fine, caveat is that I haven't tried it personally.
---Date:
Sat, 4 Aug 2001 13:30:55 -0400
From: "Warren, W. Thomas" <wtw@rti.org>
Subject: RE: [R-390] contact - 12BH7

Thanks for the inputs. I didn't bother too much about finding other equivalents. I simply did the mods recommended in HSN and bought two 12BH7A's at those premium prices. I did a bit of a scramble to see if the 12AU7 will work also, and it appears that it doesn't. The BFO and PTO 6BA6's are in series with a current draw of 0.3 amps. The 12BH7A draws 0.3 amps at 12.6 volts, but the 12AU7 or 12AU7A draws 0.15 amp at 12.6 volts (and of course, 0.3 amps at 6.3 volts when the parallel configuration is used). I did a quick search of my 1956 Handbook and found these minature tubes with 12.6v/0.3A filaments: 12A4, 12B4 (evidently a VERY close relative of the 12A4!!), 12BH7, 12BV7 , 12BY7 (the BV and BY look essentially the same according to the '56 Handbook), and 12BZ7 (looks like a close relative of the 12BH7). The RCA RC22 tube manual (it's fabulous that the tube manuals are on CD-ROM) says that the 12BH7A, the 12BY7A, and the 12B4A have controlled heater warm up times suitable for series connection of filaments. So it is apparent the the

non-A tubes hadn't been designed for series filaments and the -A's were Dr. Jerry could probably tell us all the details about the filament design - --

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Date: Sat, 04 Aug 2001 13:50:05 -0400
From: "Bruce Ussery" <bruceussery@hotmail.com>
Subject: Re: [R-390] contact

Norman, I guess I stalled long enough on checking out those VR tube resistors. They measure: 50.7, 43.0, 43.3, 47.9 ohms..... Guess I'll order some replacements, since these are not likely to drift back to nominal values any time soon.

While inspecting this module, I found a broken wire that I thought MIGHT be the reason for another little problem, a low level squeal on the line audio output. The wire connecting C611, a cap that's across xfmr T603 input was banjo string tight and had broken. But fixing it didn't affect the squeal. Oh well, there's still a lot left to check.

And BTW, the rectifiers are solid state. I've measured UNregulated B+ at 350vdc at 110VAC input; 385vdc at 120VAC input. I don't know if that's much higher than it would be with tube rectifiers. I've looked in the manual but haven't found info on that yet. That's why I was so skittish about my AC input setting. Now I'm gonna go outside and play...

Date: Mon, 06 Aug 2001 12:36:43 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] contact - 12BH7

>The 12AU7A has the same pinout, same filament requirements, and is also spec'd for an 11 sec. >warmup.

HAH! A fine use for the 5814's you retire from elsewhere in the radio.

Date: Thu, 9 Aug 2001 08:28:40 -0700 (PDT)
From: <jlap1939@yahoo.com>
Subject: [R-390] Ballast

The question of ballast arrangements has come up again and I mentioned the sources on the web. Got a query back, so am passing it on. It was simply asking for sources that cover the often mentioned but never well addressed idea of a candelabra (Chandelier) type bulb. Has anyone ever put this correctly, and can you refer to source? Should it be, in fact put to terminal rest??

Date: Mon, 5 Nov 2001 17:49:49 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: [R-390] Frequency Stability Mystery Solved

If you just want the advice, skip to the bottom. A few months ago I bought a '54 Motorola from a guy on this list. In the course of slowly making it mine, I've added an inrush current limiter. I've also worked over the PTO linearity. While doing this I found that if I turned the thermostat's adjuster screw one half turn clockwise, the temperature setpoint was about 105 degrees F, which is just hot enough to maintain

control in my basement. I decided, why not? and resolved to run the oven. It's not possible to change the crystal deck's setpoint, so I would insulate one oven pin with Kapton tape so only the PTO oven would heat with the OVENS switch on.

This was all fine and good, but I noticed that the stability sucked with OVENS on and was good with OVENS off. What I found was that the ovens cycling on and off changed the ICL's drop by about a volt. This doesn't sound like much, but it's enough to wobble the PTO 70Hz, and that's what I traced it back to.

The story doesn't end there. I thought, "Gee, that hifalutin 3TF7 ain't so hot after all", but I didn't believe it, and dug in. What I found was that my regulator was not regulating. It was just a resistor as far as the BFO and PTO were concerned. After some head scratching, it dawned on me that its filament was dark. "That can't be right, it's supposed to be partway glowing." I set up a test rig to *make* it light up.

Diagnosis: It's not a 3TF7. It regulates to 300mA all right, but only with an 18-26V drop, not the 12V drop of the R-390A. By the way, when my mystery ballast is in regulation, its time constant is a small fraction of a second, which would easily filter out any line dips or surges. If only I could make it work.

Any ideas? All I can think of is a 26-to-34 boost transformer, but I'm skeptical as to whether I'd find room on or in the IF deck. To stay 3TF7-compatible, I'd wire the boost through pins 1 and 6, cut pins 1 and 2 off mine, and insert it with pin 3 in the socket's pin 1. Alternatively, I could make a box with a cable that plugs into the RT510 socket, and a socket for the mystery tube. Less work, I think.

Advice: If you buy a set where the guy says it has a ballast tube, grill him about its ID. If it doesn't say 3TF7 or TMJ-whatever-it-is, don't believe him.

On sets with a resistor, an ICL is a good mod as long as you don't use the ovens. If you do (not normally recommended but consider my special case above), or IN ANY CASE IF YOUR LINE IS UNSTABLE, the resistor doesn't cut it; you really do want some kind of regulator.

Date: Tue, 06 Nov 2001 07:33:44 -0500
From: Bob Camp <bob@cq.nu>
Subject: Re: [R-390] Frequency Stability Mystery Solved

I would not try to get the existing ballast tube running. One possibility is that it really is the real part but it is not running up to it's original specifications. As far as I know they put "almost a vacuum" in them to get proper operation. If they leak over time then the regulation voltage would go up. The obvious fix is to turn off the ovens and simply put a dropping resistor in place of the ballast tube. Assuming that isn't going to work then here's what I would do:

Build a nice full wave bridge with about a 100uf cap on it to convert the 25 volt filament AC into DC. Put a good set of chokes at both input and output. Make sure you can get the RFI down on with a dummy load on it before you go very far into the process. Now you have DC for the filaments in the regulator string. Take your favorite three terminal regulator, say a 7805 maybe. Find a nice place to heat sink it to the

chassis. It has three terminals : input, output, and common.

Input goes to the +25 volt DC supply, and a 1 uf cap to ground Output goes to a set resistor and a 1 uf cap to ground Common to the set resistor, a 1 uf cap to ground and to the filaments

The set resistor is sized to give you the proper regulated current for the filament string.

That's a lot of work. It will do a *very* good job of regulating the filaments in a constant current mode.

Date: Tue, 6 Nov 2001 07:41:18 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] Frequency Stability Mystery Solved

That hadn't occurred to me. My tube might be a 3TF7 that's out of spec. Hard to say. It has no markings. It has not seen a lot of use: the filament segments are straight and tight. It regulates very well -- provided it sees 18V or more instead of 12V.

> The obvious fix is to turn off the ovens and simply put a dropping resistor
> in place of the ballast tube. Assuming that isn't going to work then here's what I would do:

Further frequency monitoring reveals that with the thermostat set at 105F, the temperature up-down cycle is so long and slow (5-10 minutes) that the frequency changes by up to 50Hz. I no longer advocate continuous [low-temperature] oven use in a shirtsleeve environment. If I use mine at all, it will merely be to get a quicker warmup.

If your line voltage is stable, a resistor is ok. Mine is just unstable enough to pique my engineer sense. Solving problems is what I do for fun as well as for a living. Last night I realized that a CRT Brightener might do the trick.

This is a little autotransformer designed to boost 6.3 on a tired CRT cathode. If it boosts 6.3 to 8.4 (i.e. 4:3) and can stand 25.2 instead of 6.3, it will output 33.6 which is just right.

I wonder if I can make a socket adaptor small enough to keep the exhaust tip below the top cover. I also though of rectifying and filtering the 25.2, but I think DC through the ballast will shorten its life, the way it does for lamps.

[Description of rectifier, filter, and 7805-based current regulator snipped]

> That's a lot of work. It will do a *very* good job of regulating the
> filaments in a constant current mode. Enjoy!

Spoilsport :-) Your solution is IMO very doable and could be made about as unintrusive as mine. One point. If you want to keep the intrusion to a minimum, you can't use a bridge; it has to be half-wave, because the winding and load have one

side grounded. But if I can make one more tube glow instead of adding sand, I'll do it!

Date: Tue, 06 Nov 2001 11:37:22 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: RE: [R-390] Frequency Stability Mystery Solved

.....a CRT Brightener might do the trick.....

Extremely unlikely. Those things are built to a very tight economic/engineering margin, I would suspect. If you put four times the rated primary voltage on most *any* transformer, I predict most of the smoke will be let out.

Date: Tue, 6 Nov 2001 15:26:44 -0800
From: "Roger L Ruszkowski" <rlruszkowski@west.raytheon.com>
Subject: RE: [R-390] Frequency Stability Mystery Solved

I do not want to cut into your fun, One of the guys here has a solid state plug in for the ballast tube. We been there done that and the solid state thing functions very well. We also been the tube route. Will some one please post the tube number for the 12 volt tube that has the current rating that matches the 5749 filament current.? You do need to rewire the ballast socket for this.

A jumper wire in the socket and 12BA6's installed in the BFO and PTO also work.

The IF deck can be rewired to provide 6 volts to the BFO and PTO tubes from the 6 volt IF deck filament circuit.

If your line voltage is so unstable as to give you hearable frequency shift in your receiver, may I suggest you relocate to a new public utility.

My public utility drowns the HF spectrum with wall to wall noise. But the voltage is rock solid. I am 60 feet from a 30,000 volt line at twice my antenna height.

Date: Tue, 6 Nov 2001 16:02:54 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] Frequency Stability Mystery Solved

The 3TF7, as used in the R-390*, is operated with a 12V drop or 5V above the supposed 7V threshold. My mystery ballast regulates from 18V to at least 26V. (Straining my memory here) I think that at 26V almost all of the segments were lit. The limit might be more like 30-32V. But for a given current, I'd suppose that the same thickness wire was used, which would mean that the 3TF7 would have what, maybe 7/18ths as much wire? With less wire, the range would also be less because there would be fewer segments; it would be 5V at the most, which would mean that in the R-390* the 3TF7 would be running right at its limit. This kind of smells; I don't really believe it. I also think that specs have been posted before. Anyone remember?

It would be fairly easy to adapt a lower-threshold ballast: just add a series resistor to soak up the excess. The bigger job is to maintain 3TF7 compatibility. I can't think of

a way to do it with zero intrusion, unless you put the resistor in a box, and my worry about tube height suggests that perhaps the new ballast has to be socketed on said box. For glow junkies like me, this hurts: neato glowing ballast tube... on the bottom deck! What it does have going for it is portability: you don't have to modify a radio to fit it with a 3TF4.

IMO the next level would require an IF deck mod, but the resulting deck could use either tube with no fuss. I'd go to the socket, and drill a hole between pins 1 and 9, effectively undoing the keying. If you use a 3TF7, you insert it in the normal orientation; if you use a 3TF4, you insert it with pin 2 in the drilled hole. Inside, you'd wire pins 6 and 7 together, and wire the resistor between pins 1 and 2. The messy part is the lack of keying. Nothing to keep you
from putting it in wrong except your knowledge and your eyesight.

Alternatively, you could cut off pins 1, 3, and 8 on your 3TF4, and insert it with pin 2 in the pin 1 hole. It's still an exercise to put in the tube, but the original tube goes in like it always did. What do you think?

Date: Tue, 6 Nov 2001 19:52:51 EST
From: Llgpt@aol.com
Subject: Re: [R-390] Frequency Stability Mystery Solved

This has been discussed ad naseum and was once pondered in the "beat the dead horse" theory. Here it is..... A ballast tube has two ratings, a voltage range where current regulation takes place and the corresponding regulated current range. For the 3TF7 the ranges are 8.6-16.6 volts and 290-330 milliamps. For the 3TF4 4.3-8.3 volts 280-320 milliamps. In a typical R-390A the total voltage drop across the 3TF7 and the two filaments it regulates is about 27.4 VAC, the voltage across the 3TF7 alone is about 14.2 VAC, and the voltage drop across bothfilaments is about 13.2 VAC or about 6.6VAC each. Note that the 3TF7 is operating within its specified voltage operating range, and the filaments are operated only slightly above their recommended operating voltages of 6.3 VAC. The latter is not particularly serious because moderate voltage fluctuations upward will not reduce the life of a filament to an unsatisfactory degree. Now, suppose you replace it with a 3TF4, 3HTF4 or a 3TFV4. It will operate substantially beyond its max voltage rating. The two filaments it regulates will be operated beyond their operating voltages. Stability will suffer.

Of course, everyone knows that I'm a witch and have used solid state rectifiers to replace thge 26Z5W's and various devices to replace the 3TF7, including the best, which is Chuck Rippel's solid state voltage regulator/ballast tube replacement. But the above is just my .002 worth.

Date: Tue, 13 Nov 2001 09:49:08 -0800
From: David Wise <David_Wise@phoenix.com>
Subject: RE: [R-390] R390-A VFO Jitter (and ballast tubes)

<snip> So far: ballast tubes suck. A measly 1V of line voltage change pulls the VFO about 10Hz. I was so bothered that my ballast wasn't glowing, hah! it's only a little worse dark (12Hz). Soon I'll report back with a comparison to a plain resistor. For really good regulation, solid-state is the only way. Now I'm working on a

temperature-compensated regulator that causes a filament current induced drift equal to and opposite the temperature induced drift. Fat chance! but I may achieve *some* improvement, and what the heck, I'm having fun fun fun... Oh and by the way, as predicted, the CRT booster didn't work, too much primary current. I love this radio,

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From: "Kenneth Crips" <w7itc@hotmail.com>
To: r-390@mailman.qth.net
Date: Sat, 29 Dec 2001 19:24:06 -0700
Subject: [R-390] My R390A lives again!!!

Well My 67 EAC R390 lives again. The Ballast tube was bad. I replaced it using a 12BH7 as suggested here and nicely documented in A.J. Carmody's (AAR2QR/ W2LE) excellent "The R390 Cookbook". It turned out I had more then one problem. There was a bad 6C4 in the RF deck. I have a ample supply of brand new JAN 6C4's in their original packaging so I replaced all of them. The radio would now play for a few seconds and then go away to white noise. I noted an interesting thing, V505 (5749) did not light because the 3TF7 was bad, with the change out to the 12BH7 it lit up but it seemed to be too bright. I decided at this point to change out the tube on the PTO V701(5749)(Cosmos). This time when I turned on the unit V505 lit up at what I would consider a normal brightness, and the R390 worked. I haven't taken a look at the schematics, but it would seem at this point if V505 is overly bright it might indicate a problem with V701. Thanks Hank, and company, I could not have done this without the "MANUAL".

From: Llgpt@aol.com
Date: Thu, 14 Feb 2002 18:05:12 EST
Subject: Re: [R-390] 389 inquiry
To: amcdonald@toyodatrw.com, r-390@mailman.qth.net

Thats not a problem, you can buy new ones for around $40.00, as Amperite still manufactures them. But why bother? If you think the 3TF7 is critical to the operation of the R-390 or R-390A, just pull it out while it is receiving.....it will be several seconds before you even noticed that it isn't plugged in anymore. Now, that's food for thought. Of course the others know that I'm a witch as I have had several with diodes in place of 26Z5W's and don't use ballast tubes.

From: "CORYHINE" <CORYHINE@msn.com>
To: <R-390@mailman.qth.net>
Date: Thu, 14 Feb 2002 17:39:02 -0600
Subject: [R-390] 3TF7

If Amperite is still making the 3TF7 tube, then the Government must still be using R390A radios..... I wonder if the CIA repair shop (don't even ask how I know) is still refurbing them. There could still be thousands out there. One thing about the U.S. Government is that they know a good thing when they have it. Shades of the B-52 which is still going strong. And yes, it is my understanding that the line in WA. is still maintained if there should ever be a need for more..... did you know that there are radio stations in NYC that are still using the Collins transmitters they bought in 1945? Amazing, this good stuff just never dies.....

Date: Thu, 14 Feb 2002 16:04:16 -0800
To: r-390@mailman.qth.net
From: Leo Jormanainen <lexa@mail.island.net>
Subject: [R-390] 3TF7

Ouch, I just checked their 3TF7 price, $96.65, list price $101.73.

From: "Michael Melland" <w9wis@charter.net>
To: <r-390@mailman.qth.net>, "Leo Jormanainen" <lexa@mail.island.net>
Subject: Re: [R-390] 3TF7
Date: Thu, 14 Feb 2002 18:12:24 -0600

Last week I purchased the last two NOS Amperex 3TF7's that Antique Electronic Supply had in stock for $12.80 each. Glad I beat the price increase. <grin>

From: "CORYHINE" <CORYHINE@msn.com>
To: <R-390@mailman.qth.net>
Date: Thu, 14 Feb 2002 19:03:27 -0600
Subject: [R-390] 3TF7

Antique Electronics is out of stock..... Surplus Sales has them for $45.00...typical of them. Let's see if AE gets some in soon.

From: DJED1@aol.com
Date: Sun, 17 Feb 2002 20:09:47 EST
Subject: Re: [R-390] I Hope Everyone Is Happy Now....
To: cthulhu@fhtagn.org, r-390@mailman.qth.net

Maybe if I had a couple of dozen R-390As on hand, I'd wory more about these tubes. For my solitary radio, I've got a spare 3TF7, and a pair of 26Z5s. the radio has been operating for 25 years with a homemade resistor in place of the 3TF7, and the original rectifier tubes. So let's see- in another 25 years my kids can plug in the 3TF7 and sell the radio on e-Bay for about the price of a new car, or they can keep the radio, continue with the resistor and plug in a 26Z5 as needed. So I figure the spares I've got are good for at least 2 more generations. Seriously, I think I've replaced a total of 3 tubes in 25 years of light duty listening. Way back when, before the internet, I couldn't find a spare 3TF7 when the one in the radio died. I cut open the top of the tube, pulled some nichrome wire from an old wirewound pot, and wrapped the wire around the glass envelope. This homemade resistor has been working for at least 20 years. Who needs a high-vacuum pump anyway!

Date: Sun, 17 Feb 2002 22:23:29 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] I Hope Everyone Is Happy Now....

Not for ballast tubes - they're supposed to have iron wire and be filled with hydrogen, not a hard vacuum. Not sure if the hydrogen needs to be hard or regular. I suppose you have to make sure there's no air mixed in it. Dunno if it would blow up or fog up.

Date: Sun, 17 Feb 2002 23:13:51 -0500
From: Bob Camp <bob@cq.nu>
Subject: Re: [R-390] I Hope Everyone Is Happy Now....

If you have air in the ballast tube the iron wire burns up. I guess you could also say that it rusts. Either way it converts to iron oxide and stops working. Nicrome probably has to flat a temperature characteristic to work well in a ballast tube. Copper goes at to low a temperature. Iron is just right .....

From: DCrespy@aol.com
Date: Fri, 19 Jul 2002 22:10:20 EDT
Subject: [R-390] Re: R-390 net (was Antenna question)

<snip> By the way the 3TF7 resistor is (E=I*R, E= 12.6, I= 0.30) around 42 ohms, at least 5 watts (10 would be better).

From: "Glen Galati" <eldim@worldnet.att.net>
Subject: Re: [R-390] 6T4F
Date: Tue, 23 Jul 2002 01:50:45 -0700

<snip> Here is some interesting info on the the 3TF7 Current Limiting Resistor as specified for the R-390 Series. The FEDLOG description specifically identifies this as Application = R-390/URR, AC/DC, 0.040 to 0.260 Amperes, 10.2 Volts Threshold, 9-Pin Miniature with T-6-1/2 envelope. NSN 5905-00-259-1964, and was last procured $118.27. Measured DC Resistance is approximately 12-12.75 Ohms. Now, here is an interesting twist to the story. Amperite PN: TJ311M01, NSN 5905-00-681-4707; DC, Current Range 0.31 to 0.33 Amperes, 8.0 Volts
Threshold, 9-Pin Miniature with T-6-1/2 envelope. The FEDLOG states "WHEN EXHAUSTED USE 5905-00-259-1964" which is a 3TF7. Hmmmmm! Makes you wonder-What we really need here is to do a close scrutiny of the TM/TO's for the R-389, R-390, R-390A. and R-391 Part List and see what part number and stock number was listed. I use an outdated FEDLOG (OCT 98) since there is a lot of purging of older parts and stock numbers. I still have the old micro-fiche but only the MCRL-1 and MCR-II which does not have the descriptions. Also, I will trust the facts of the manuals for the particular equipment before I fully endorse the info as presented in the Federal Supply Systems. Errors have been made such as requisitioning 1000 bolts for tower rehab and receiving 1000 anti-tank mines with the SAME NIIN which used to be FIIN. I WAS THERE!

If some-one has the parts manuals for the above equipment, perhaps they can shed additional light on the subject. STAY COOL !

Date: Thu, 25 Jul 2002 00:39:10 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: Re: [R-390] 6T4F

Hi, Glen, Nice research! I have an Amperite TJ311M01 that measures cold at 13.3 Ohms DC resistance on my Fluke DMM 8024B. I'm patiently waiting for it to exhaust so I can replace it with a 3TF7. :-) All seriousness aside, the above ballast doesn't carry the designation "3TF7." Thus the FEDLOG may have assigned a different NSN

when the 3TF7 appeared. (I'm assuming 3TF7 is a newer designation for Amperite's catalogue number TJ311M01.) It came out of a spare IF deck. I'm too lazy to pull my working R-390A out of its case to do voltage checks and substitution with a 3TF7 to see if the regulated tubes are getting similar voltage, but expect it's close enough for government work. The lettering is that notorious stuff that wipes off easily. I couldn't make out that any lettering is gone. What's there is is there-- that is, no smudges.

Date: Thu, 25 Jul 2002 01:21:19 -0400
From: Norman Ryan <nryan@intrex.net>
Subject: [R-390] More Ballast Thoughts in re 6T4F and 3TF7

Hi, Glen and gang, Just looked in an old (1969, 33rd edition) Radio-Electronic Master catalog and came away with the following.
Amperite numbering system in general (not consistent!):
First digit-- threshold current in tenths of an ampere.
Letters-- envelope type.
Last digit-- threshold voltage in volts.
Last letter-- not sure; version perhaps?

Thus 3TF7 = 0.3 ampere threshold current,
T6-1/2 bulb 9 pin miniature, 7 volts threshold voltage.

6T4F = .6 ampere threshold current,
T5-1/2 7 pin minature, 4 volts threshold voltage.

List price for all these ballast tubes back then? One price: $1.80.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Utah 3956
Date: Thu, 25 Jul 2002 00:10:04 -0700

Anyone know what a Utah 3956 ballast is, or where it is used? Somehow I recall looking it up once, and finding it nowhere near the spec. of a 3TF7. It is in a 7-pin miniature shell.

From: "Glen Galati" <eldim@worldnet.att.net>
Subject: Re: [R-390] 6T4F
Date: Thu, 25 Jul 2002 01:51:27 -0700

I looked in my NAVSHIPS manual for the R-390A and it shows onlythe 3TF7 for RT-501. I tend to believe that the 3TF7 was the predecessor to the TJ311M01 which is contrary to the FEDLOG as explained below. We nood some real AMPERITE experts to explain the 'THRESHOLD VOLTAGE' and WHY the 220ma spread vs the 20ma spread in operating currents. I have Date codes on the 3TF7 of 5/66 & 9/66 vs 7/69 up to 1/81 on the TJ ballast. DC Resistances vary on th TJballast from 10.8 to 14.5 ohms using a Fluke 87. Of course I would rather measure this using a 4-wire set up to get better accuracy. Does anyone out there have a AMPERITE CATALOG on these Current Regulating Resistors or Ballasts?

Date: Mon, 12 Aug 2002 18:44:25 -0500

Subject: Re: [R-390] R-390 and Jagrolets
From: blw <ba.williams@charter.net>

Not all 3TF7 substitutions are solid state. My Motorola has the jumper and 12BA6's instead of 6BA6's. Hope you kept some boatanchors around.

From: "scott" <polaraligned@earthlink.net>
Subject: Re: [R-390] Ballast question and OT comment
Date: Sat, 17 Aug 2002 07:37:32 -0400

I see no reason not to use a 3TF7. All tubes for these radios are available and we certainly are not in need of any solid state replacements. It is all a matter of how much the tubes cost. A NOS 3TF7 will set you back $30. Other "hard to find" one's are even less, but still available. So my opinion is keep it all tubes 'till you can't find one that you need to operate it. And this may not come for another 50 years. As for the OT stuff....I am new here.....only 3 months and I will miss the OT stuff. It just got carried away this last month or so. Sad to see it get completely snuffed. It really just needs a little more restraint so it does not get completely wacky like we just had. I am not a fan of OT stuff but it really sometimes is necessary as it gives the list some personality. Too bad some people just get carried away with their postings.....I wish their was a way to limit it but I know that some people can't control themselves. I think the beer was the final straw..

SEE CHUCK RIPPEL'S WEB PAGE FOR A DESCRIPTION OF HIS BALLAST TUBE REPLACEMENT PLUG-IN MODULE $55 AND $109

From: DJED1@aol.com
Date: Sun, 22 Dec 2002 12:32:01 EST
Subject: Re: [R-390] in rush current limiters

You can pay a lot or do it another way. Speaking of the current regulator- I replaced my dead 3TF7 with a resistor 20 years ago -didn't know where to get a replacement.. I cut off the tube top, wound enough nichrome wire on the tube envelope to get the correct voltage drop, and fastended the nichrome to the tube elements. Cost= 0, and still going strong. Unless you've got widely varying supply voltages, you'll never see the difference. I suggest you spend the $50 on a 3TF7 and put it away for when you want to sell the radio-

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From: Llgpt@aol.com
Date: Sun, 22 Dec 2002 13:17:06 EST
Subject: Re: [R-390] in rush current limiters

Laughing.....just in time for the holidays, the never ending ballast tube thread!! Your cure parallels the ones I've used over the years Ed. It sure as hell won't affect anything one way or another.

From: "Walter Wilson" <wewilson@knology.net>
Subject: Re: [R-390] in rush current limiters
Date: Sun, 22 Dec 2002 14:09:50 -0500

So many choices, and it doesn't seem to really matter which one you choose. They all work. I still like putting jumpers between pins 2 and 4, and between pins 5 and 7, and inserting a 12BH7. It's a tube of the same size as the 3TF7. With a tube shield on, you can't tell the difference.

From: "Kenneth Crips" <w7itc@hotmail.com>
Subject: Re: [R-390] in rush current limiters
Date: Sun, 22 Dec 2002 14:18:06 -0700

While we are on the subject of ballast tubes. I have another radio with one of these pesky tubes, a Zenith Transoceanic, and the infamous 50A1. I wonder why I couldn't replace this turkey with a resister. Has anyone done this? I would love the have a ballast tube free hamshack.

Date: Sun, 22 Dec 2002 17:38:56 -0500 (Eastern Standard Time)
From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: Re: [R-390] in rush current limiters

Interesting that you happened to bring up the Transoceanic and its ballast tube. The general fix in the Zenith world if you don't have the bucks for a 50A1 is to replace the ballast tube with a 50A1 replacement which is actually a diode. Of course the TO boys then start worring that there radio is going to lose it's tube sound! In my 390a I've been using a diode. I've tried other ways except using a 12 volt tube, which I think is a real cludge, and the $50.00 regulator which is overkill. Haven't been able to find a manufacturer that makes a constant current diode with a high enough rating yet, which would be a nice replacement for the
3FT7

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Sun, 22 Dec 2002 17:33:13 -0600 (CST)
Subject: Re: [R-390] in rush current limiters

Question, then: what is the regulating current of this curious tube? Three-terminal regulators can be configured as constant-current devices.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] in rush current limiters
Date: Sun, 22 Dec 2002 16:03:01 -0800

The current is 300 ma. AC. It is simply the filament current of two 6-volt miniature tubes (v508-6BA6/5749, V701-6BA6/5749) in series. The source voltage is about 25 volts. 12 volts is taken by the two tubes in series, and the ballast and decoupling inductors drop the other 13 volts. The idea is to build a 9-pin miniature tube plug-in replacement with no modification to the R-390A. Only two wires are fed to the ballast socket. Ground is not available unless obtained by a tertiary wire or the socket shield. Heat dissipation might be the biggest challenge in a plug-in solid-state replacement. A very simple modification is to simply jumper the ballast pins 2 and 7 with a simple plug-in wire jumper and replace the 6-volt tubes with their 12-volt equivalents. The receiver remains very stable even when the filaments are not current regulated by the ballast tube. Funny thing, think I put a 12AU6 in the PTO in

the receiver here. Will have to check. It is working, but have always wanted to make an endpoint adjustment. Perhaps a 12BA6 will save the need for this adjustment. As mentioned, another way is to solder-jumper 2&4 and 5&7 and plug in a 12BH7. The 12-volt filament of the 12BH7 drops the voltage in a somewhat similar amount as the ballast tube.

Date: Sun, 22 Dec 2002 19:47:34 -0500 (Eastern Standard Time)
From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: Re: [R-390] in rush current limiters

> Question, then: what is the regulating current of this curious tube?

It's not a tube, it's basically a FET diode. They come in different values but not as high as .3 amps which is what is needed.

> Three-terminal regulators can be configured as constant-current devices.

I know and what it's being used for is overkill. Why reconfigure a voltage regulator, three- terminal current regulators are also around.

Date: Sun, 22 Dec 2002 20:38:24 -0500 (Eastern Standard Time)
From: Helmut Usbeck <vze2gmp4@verizon.net>
Subject: Re: [R-390] in rush current limiters

> The idea is to build a 9-pin miniature tube plug-in replacement with no
> modification to the R-390A. Only two wires are fed to the ballast socket.
> Ground is not available unless obtained by a tertiary wire or the socket
> shield. Heat dissipation might be the biggest challenge in a plug-in
> solid-state replacement.

Put a diode (1N4007 will do) between pins 2 and 7. No muss, no fuss, no heat. You now have 12 vac for the two 6 volt tubes to fight over.

> A very simple modification is to simply jumper the ballast pins 2 and 7 with
> a simple plug-in wire jumper and replace the 6-volt tubes with their 12-volt
> equivalents. The receiver remains very stable even when the filaments are
> not current regulated by the ballast tube.

This was the first thing I tried when my first 3TF7 went bye-bye. One thing I noticed was one tube was brighter than the other. Second thing was my freq calibration was off over 2 khz. Measuring the voltage drop on the tubes one was sitting at 7 volts and the other at the other at 18. I went though a pile of 12BA6's before I got two of them to drop 12 volts apiece. Similar thing happens with using a resistor and 6BA6's. If you want good performance out of your receiver the correct filament voltages are mandatory. **5.7-6.9 vac for 6.3 volt tubes.**

> As mentioned, another way is to solder-jumper 2&4 and 5&7 and plug in a
> 12BH7. The 12-volt filament of the 12BH7 drops the voltage in a somewhat
> similar amount as the ballast tube.

And as I mentioned, it's a useless cludge, extra work and some people actually think that a 12BH7 has to be used. Any 12 volt tube will do. While one rewiring the socket, put in a 12AU7 and set it up as an internal product detector (one of those things I,m going to try when I get a round tuit). At least it does some thing besides producing heat and a rewired socket. It's attribute as having a controlled warm up filament is lost since the other two tubes are not. My conclusion is that the best thing to put in the 3TF7 socket is a 3TF7. I think some people should also check the voltage drop across there tubes. Yeah, I know they all work. But at the expense of other problems. Unfortunately my 390A seems to go though one every 2 months or so and it's a bit expensive. One can buy alot of good German lager for $45.00.

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Sun, 22 Dec 2002 19:42:20 -0600 (CST)
Subject: Re: [R-390] in rush current limiters

>It's not a tube, it's basically a FET diode. They come in differant
>values but not as high as 0.3 amps which is what is needed.

I was referring to the original ballast tube, not a solid-state replacement.

>> Three-terminal regulators can be configured as constant-current devices.

Why? Because they're cheap and common as dirt (I've got a ton of them in my junque box, including a couple of odd voltages, adjustable, and LDO); and because their behaviour is well documented and understood, including the need for adequate bypassing. One resistor of the proper value is all you need to make it a CC source. How it behaves with half-wave rectified AC is another question, however...

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] in rush current limiters
Date: Sun, 22 Dec 2002 17:48:35 -0800

> A three-terminal regulator configured as a constant current source would not need a ground connection. Just a heatsink.

Is this practical in an AC circuit? Perhaps two circuits could be configured for each half-cycle and diode isolated. Think it is a bit of overkill, though. The oscillators don't appear to be that sensitive to typical changes in filament voltage. Fun to think about, though.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] in rush current limiters
Date: Sun, 22 Dec 2002 17:56:39 -0800

> This was the first thing I tried when my first 3TF7 went bye-bye. One
> thing I noticed was one tube was brighter than the other.

A ballast tube won't help that problem, the two tubes in series will always draw the same current.

> Second thing was my freq calibration was off over 2 kHz.

This is something I wish to examine in my receiver.

From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] in rush current limiters
Date: Sun, 22 Dec 2002 20:18:26 -0600

The issue, as I understand it, with the three terminal voltage regulators is that they are noisy. They generate hash as they do their jobs that adds to the receivers internal noise level. I think you will agree, any mod that detracts from the performance of the radio is not an acceptable mod! Talk with Chuck Ripple.... he has been down this road...that is how he came to develop the device he offers.

From: ToddRoberts2001@aol.com
Date: Sun, 22 Dec 2002 22:17:28 EST
Subject: Re: [R-390] in rush current limiters

Some interesting points were brought up about unequal voltages occurring across two tubes with their filaments wired in series, either 2 - 12BA6's or 2 - 6BA6's when used in the R-390A BFO and PTO circuits. Unless the tube filaments have exactly the same cold resistance and the same hot resistance when running this unequal heating can occur - using a ballast tube or even a
voltage or current regulator will not correct this problem of two tube filaments wired in series.
I wonder if anyone else has tried the modification for the R-390A where the filament wiring for each of the BFO and PTO tubes is re-routed in parallel to the 6.3VAC filament buss used in the rest of the IF strip? It is not complicated to do and only involves unsoldering, re-routing and re-soldering a few leads in the underside of the IF strip. No extra wiring leads are needed. I have done this mod. on an R-390A to eliminate the need for the 3TF7. The 3TF7 socket is left empty and is non-functional after this mod. The receiver works fine and this insures the exact same 6.3VAC across the BFO and PTO tubes and retains the original 6BA6's for both. I confirmed the receiver stability by varying the line voltage + and - several volts with a variac. When tuned in to an AM broadcast station with the BFO turned on I could not detect any change in pitch when varying the line voltage several volts up and down to simulate line-voltage fluctuations.

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Sun, 22 Dec 2002 21:31:28 -0600 (CST)
Subject: Re: [R-390] in rush current limiters

>Put a diode (1N4007 will do) between pins 2 and 7. No muss, no fuss, no
>heat. You now have 12 vac for the two 6 volt tubes to fight over.

Oh, I get it now. Half-wave rectify the filament voltage to accomplish a reduction in the average voltage. Average value of a half-wave output is .318 of peak, according to my reference. Doing the math, 25 VAC RMS into the rectifier would give 11.21 volts. Close enough. What about rectifier hash?

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Sun, 22 Dec 2002 21:33:09 -0600 (CST)
Subject: Re: [R-390] in rush current limiters

>A three-terminal regulator configured as a constant current source would not >need a ground connection. Just a heatsink. Is this practical in an AC circuit? >Perhaps two circuits could be configured for each half-cycle and diode isolated.

My question exactly. Think it is a bit of overkill, though. The oscillators don't appear to bethat sensitive to typical changes in filament voltage. Isn't the whole design of the radio overkill? :-)

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Sun, 22 Dec 2002 21:38:51 -0600 (CST)
Subject: Re: [R-390] in rush current limiters

>The issue, ...with the three terminal voltage....regulators is that they are noisy. They generate hash as they do their jobs that adds to the receivers internal noise level. I think you will agree, any mod that detracts ..... is not an acceptable mod!

Agreed. That subject has been discussed in several circles involving sand-state radios, and anecdotal evidence exists claiming that proper bypassing can resolve this. I've seen lots of commercial designs (not just in radios) where the manufacturer ignores the bypassing recommendations provided by the device manufacturer. The way I figger it, they put that stuff in the databooks for a reason.

>Talk with Chuck Ripple.....that is how he came to develop the device he offers.....

I wouldn't expect Chuck to reveal his trade secrets to us... :-) Frankly, I'm leaning towards the guys who say to get rid of the dern thing entirely and run the tubes from 6.3v. And I haven't even begun working on my 390a yet...

From: ToddRoberts2001@aol.com
Date: Mon, 23 Dec 2002 00:57:36 EST
Subject: Re: [R-390] in rush current limiters

> If tubes are connected in series and equal voltage drops are required for
> tube performance then shunt series regulation is called for. That's why
> the ballast tube is there, it's not just there to drop 12 volts, or
> because the navy had crummy generators on board ship. Same can be
> accomplished with a current regulator or constant current source. It's
> good design practice. The better receiver's of the past that had some
> tubes in series have ballast tubes going back to the 1930's.
> Try it. Measure the voltage drop on a 390a with it's ballast tube in
> place and you'll find they're quite equal.
>
> If the above statement you made came from a book, throw it away and get a
> good one.

The last time I looked at ohms law, E=IxR. Unless the hot resistance of each filament in series is exactly the same, unequal heating can occur. I guess some people don't remember ohms law.

Date: Mon, 23 Dec 2002 10:23:16 -0500
From: tbigelow@pop.state.vt.us (Todd Bigelow - PS)
Subject: Re: [R-390] in rush current limiters

> While we are on the subject of ballast tubes. I have another radio withone
> of these pesky tubes, a Zenith Transoceanic, and the infamous 50A1. .....

I thought they had a little phenolic plug that inserted into the socket when the tube wasn't used? I would guess it has the correct pins jumpered? I'll take a look in mine over the Christmas holiday and see what it says. Seemed to me the 50A1 was an optional thing only needed where current wasn't stable? It's in the manual I think.
~Boomer, KA1KAQ

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Sun, 22 Dec 2002 19:32:59 -0600 (CST)
Subject: Re: [R-390] in rush current limiters

Thanks for the info. This makes the comment about using a diode somewhat puzzling. ISTM that a diode is going to half-wave rectify the AC filament voltage and change the whole game about what exactly '300 mA' is. Which would start another never-ending thread, no doubt.

>The idea is to build a 9-pin miniature tube plug-in replacement .....two wires ...

A three-terminal regulator configured as a constant current source would not need a ground connection. Just a heatsink.

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] in rush current limiters
Date: Mon, 23 Dec 2002 11:19:31 -0500

> I thought they had a little phenolic plug .....

I don't think so on that -- I've got a bunch of T/O's -- various series. All the 600 series I have or have seen came with the 50A1 -- which started with the very late 500 series and the military version of the 500 -- R-520. All the 600 series had it. (500 was last of the round dial, 600 was the sliderule dial). That phenolic plug may be an aftermarket replacement or someone's homebrew thing. Check out Padgett's TO pages ...
http://www2.gdi.net/~padgett/tubedto.htm
There's also something there about the selenium rectifier and ballast tube replaced by a silicon rectifier, etc.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Mon, 23 Dec 2002 17:37:02 -0500
Subject: [R-390] Ballastubes (was inrush current limiters)

I see that the old BallasTube Thread is alive and well. If you want to read the lively and animated discussion of this topic from several years ago, go to r-390a.net. Click on References, Pearls of Wisdom, Ballast Tube. There is a problem with substituting a diode for the ballastube.

> >Put a diode (1N4007 will do) between pins 2 and 7. No muss, no fuss, no
> >heat. You now have 12 vac for the two 6 volt tubes to fight over.

>Oh, I get it now. Half-wave rectify the filament voltage to accomplish
>a reduction in the average voltage. Average value of a half-wave
>output is .318 of peak, according to my reference. Doing the math, 25
>VAC RMS into the rectifier would give 11.21 volts. Close enough.

RMS voltage and current are what define heating power in a waveform (DC "waveform" included). Since what we are doing here is heating cathodes, peak or average current and voltage values do not apply (when peaks are within reason and waveform's period is much less than cathode's thermal time constant). RMS is what counts. One of my references lists RMS value of a half wave rectified sinewave to be half the PEAK value. Peak voltage of the 25.2 VRMS winding powering the series ballast, PTO, and BFO tubes: (25.2)(1.414)=35.6v peak. The half wave rectified RMS value: (35.6)(.5)=17.8 VRMS. Hence, with diode in place of ballastube, each 6BA6 tube heater receives 8.9 volts instead of the 6.3 volts it was designed for. The single diode modification will work, but the life of the PTO and BFO tubes will be reduced. I read of one List Member using this modification for 20 years! The amount of abuse these tubes will take is amazing. (Helm's comments regarding adding jumpers to 3TF7 socket so that 12BH7 can be substituted...) A number of tubes can be used instead of 12BH7....the 12BY7 comes to mind. The tube needs to have a 12V heater at 300 mA. A 12AU7 will not work as it draws 150 mA when configured for 12 volts. The 12BH7 could also be used for a product detector. Yes, if it's current regulation you're after, that 3TF7 is hard to beat. In the aforementioned "Pearls of Wisdom" reference Nolan Lee quoted information from Amperite, the 3TF7's manufacturer, showing +-1% current regulation over a fairly wide voltage range. MMMMM....German Lager!! The major brand American "beers" cannot hold a candle to what Germany has to offer. Some American microbrews are pretty good though. The BallasTube can also be replaced by a power resistor. Under IF deck mounting would be a poor choice because of heat buildup, but above deck mounting looks ugly (to some). The calculated value is 43 ohms. A 47 ohm, 5 or 10 watt unit works well.

>..... simply jumper the ballast pins 2 and 7 witha simple plug-in wire jumper and replace >the 6-volt tubes with their 12-volt equivalents. The receiver remains very stable even when >the filaments are not current regulated by the ballast tube.

I like this ballast solution. It involves no rewiring and heat generation in the R-390A is reduced by about 4 watts (not much, but eva' li'l bit he'ps). 12BA6's are cheap and easy to find. Use a piece of paperclip for jumpering.

>..... Ithe filament wiring for each of the BFO and PTO tubes is
>re-routed in parallel to the 6.3VAC filament buss used in the rest of the IF
>strip? It is not complicated to do and only involves unsoldering, re-routing

>and re-soldering a few leads in the underside of the IF strip. No extra
>wiring leads are needed. I have done this mod. on an R-390A to eliminate
>the need for the 3TF7. The 3TF7 socket is left empty and is non-functional
>afterthis mod. The receiver works fine and this insures the exact same 6.3VAC
>across the BFO and PTO tubes and retains the original 6BA6's for both. I
>confirmed the receiver stability by varying the line voltage + and - several
>volts with a variac. When tuned in to an AM broadcast station with the BFO
>turned on I could not detect any change in pitch when varying the line
>voltage several volts up and down to simulate line-voltage fluctuations. 73
>Todd Roberts WD4NGG.

I have read positive things about this modification. It will also reduce heat generation. Todd's good experience with frequency stability vs line voltage fluctuation reinforces the contention of some that current regulation provided by the ballastube is not really necessary. Moving those few wires around (in my opinion an insignificantly minor mod) may make some of the purists cringe. Replacing the BallasTube with solid state current regulator has also been discussed. A while back Dr. Jerry designed an AC current regulator using a full wave bridge wrapped around an LM317 configured as a DC current regulator, providing a clipped sine wave. I did a computer analysis of his circuit showing a +1.5%, -2.5% variation in its 300 mA RMS current over a +- 15% line variation. As far as regulator-induced noise is concerned, filtering would help but I am not sure that this is necessary. First in line after the 3TF7 is the BFO tube. The regulator's noise contribution here would probably be small compared to the fairly high signal level. Second in line is the PTO tube and the already present brute force filtering in PTO tube heater supply line would eliminate any noise at this point. Chuck Rippel's regulator-based ballast repacement module's noise filtering certainly doesn't hurt though. Chuck is a very thorough sort who likes to have all the bases covered (his excellent R-390A restoration workmanship reflects this). Another solid state regulator approach is to half wave rectify the 25.2VAC, filter and apply to a 3 terminal regulator configured as a 300 mA DC regulator. PTO and BFO tube heaters then operate on DC. Dr. Jerry was not in favor of this method as it places an unbalanced load on power transformer and in his opinion increases core saturation and heating. I believe that the imbalance is small compared to the total transformer load and probably wouldn't make much difference. The high current peaks (which cause core saturation) caused by charging the filter cap on each positive peak could be reduced by adding a resistor in series with the rectifier diode. This also would reduce filter cap voltage and dissipation in the regulator. By rough calculation I figure somewhere between 6 and 10 ohms with 1000 uF for a filter.

A few weeks back Francesco from Italy posted a message about his non-operational R-390A. I corresponded privately with him and he found the problem to be the BallasTube. I mentioned various options to him and this set me to thinking about these aforementioned aspects. For me, resurrection of this intriguing (previously) "dead horse" thread could not have come at a
better time! Have a happy holiday and may Santa bring each of you a sleighload of 3TF7's!

Date: Mon, 23 Dec 2002 14:40:22 -0800
From: "David Wise" <David_Wise@Phoenix.com>

Subject: [R-390] 3DW7: A 3TF7 Tubester

For the past six months I have been working on a solid-state ballast the size of a 3TF7, and I think I've done it. It's a two-terminal device; plug it in and go, no modifications whatsoever. It runs cool and regulates great. If ten people promise to buy them, I'll lay out the PC board and build them.

Date: Mon, 23 Dec 2002 15:05:25 -0800
From: Craig McCartney <craigmc@pacbell.net>
Subject: RE: [R-390] 3DW7: A 3TF7 Tubester

Your idea is very attractive. It would help in making a decision to buy if the approximate cost were known.

Subject: RE: [R-390] 3DW7: A 3TF7 Tubester
Date: Mon, 23 Dec 2002 15:38:16 -0800
From: "David Wise" <David_Wise@Phoenix.com>

This started out as a private reply to Richard McClung, and then also to Craig McCartney. To avoid the feeling that I'm sending N copies of a form letter, I decided to just post my reply. If you're not following this thread, delete it and go on. * * *

I wanted to wait until I had a prototype instead of a breadboard, but the recrudescence of the ballast tube thread seemed like a call. I'm proud of my work. AFAIK, nobody else has tried this, and I feel I have achieved some real innovations. I will never recoup more than a tiny fraction of the engineering time; it was a labor of love. But I still want token compensation. I also don't want to undercut Chuck Rippel. He sells a unit for IIRC around $100. I'd like $150. Think it over and get back to me. To minimize expenses, I will not lay out a circuit board until I have a bunch of confirmed sales. I arbitrarily picked ten. For now, I have a breadboard, and a hand-wired actual-size prototype of an earlier, all-analog design. Take your time, I'm still waiting for a couple of critical components that will let me do a full-scale test. Right now I'm using substitutes which can't take the full voltage range. My VFO changes 5Hz from 17VAC to 26VAC. I haven't measured it, but I believe this is less than B+ or AGC-induced variations. I've never made a product on my own before, this is scary. I hope I can make it look as good as it works.

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Mon, 23 Dec 2002 20:30:56 -0600 (CST)
Subject: Re: [R-390] Ballastubes (was inrush current limiters)

>RMS voltage and current are what define heating power in a waveform (DC"waveform"

That's what I thought, but all the references I could find searching last night only talked about average.

>One of my references lists RMS value of a half wave rectified sinewave to be half the PEAK >value.

I finally found a reference that agrees with this.

>The half wave rectified RMS value: (35.6)(.5)=17.8 VRMS.

I knew there was a reason this idea still bothered me....

>A 12AU7 will not work as it draws 150 mA when configured for 12 volts.

Thought so, but I was focused in on the other area.

>Replacing the BallasTube with solid state current regulator has also been.....

This is exactly one of the ideas I was kicking around, since I have a drawer full of 317Ts.

>As far as regulator-induced noise is concerned, filtering would help .....

Manufacturer's recommended filter/bypass caps are always necessary, IMHO. I remember the time a CBer brought me a home-built 12v power supply that would spike to >18 volts when he unkeyed his radio. The solution was to get out the data book and install the caps for the 317T that National Semi said shouldbe there for stability and transient response. There was also the blurb in QST years ago from the ham who tossed a bunch of bypass caps at the regulators and zeners in, IIRC, a TR7 and IC551 and saw a noticable improvement in the noise floor.

>Another solid state regulator approach is to half wave rectify the 25.2VAC,
>filter and apply to a 3 terminal regulator configured as a 300 mA DC regulator.

The same without filtering should give a clipped half-sine wave as above. Since we start out with an RMS of 17.8 volts, there should be enough headroom. Another variation I've been thinking about.

>I believe that the imbalance is small compared to the total transformer load
>and probably wouldn't make much difference.

I tend to agree.

>Have a happy holiday and may Santa bring each of you a sleighload of 3TF7's!

Maybe I should shut up until I actually get my radio up and running. Or at least find out if my 3TF7 is good...

Date: Mon, 23 Dec 2002 19:18:09 -0800 (PST)
From: Bryan Stephens <bryanste@yahoo.com>
Subject: Re: [R-390] Ballastubes (was inrush current limiters)

I am offering NOS 3TF7s for $25/ea+ship (limit 1 pls), and NOS 26Z5Ws for $16/ea +ship (limit 2 pls). Other JAN tubes and BA-related items available. Respond to me directly if interested. Thanks.

From: "Matt Parkinson" <mparkinson1@socal.rr.com>
Date: Mon, 23 Dec 2002 20:55:20 -0800
Subject: [R-390] R-390 ballast tube

Well we are selling 3TF7s for 35.00+500 shipping . Why would you want to pay 100.00 or even up to 200.00 for a solid state device when you can have the original part for a lot less in fact you can buy at least three or more and still be cheaper in the long run and will take of your needs longer than your life. If you are really having trouble blowing them out then stick a inrush limiter in your AC line to hold your AC voltage down till warm up. I have 15 R-390A's and 2 of them I have had over 10 years without a failure of this ballast tube while the other are not running all the time. This tube has not left the planet like so many have been brain washed into believing there are a lot of these ballast tubes around and I have been offering these to the list not ebay as of yet. So keep your receivers original like it was intended in the first place. Your R-390 will like it and so will your R-391 and 390a receivers. Matt

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Date: Tue, 24 Dec 2002 10:55:45 -0600
Subject: Re: [R-390] R-390 ballast tube
From: blw <ba.williams@charter.net>

A jumper wire across pins 2 and 7 is much cheaper than $40 for one of those tubes, or the lifetime supply being suggested. 12BA6s are probably the most common tube ever made, and are about $2 new. Been running this for 9 years now on the original 12BA6's. $40 for a tube that isn't really needed is a perfect example of artificial inflation. I'll pass on the idea of spending $120 for a lifetime supply of 3TF7 tubes, and spend $6 on the 12BA6's instead. That should save me $114 per radio. I've got 2 R390A's already, so I'm saving $228. If I buy 2 more radios, I'll probably save enough on 3TF7s to get the 5th radio for free! Hey, I'm on to something good here! Buy 4 R390A's and get the 5th radio for free. My wife would relate to this.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Tue, 24 Dec 2002 15:01:48 -0500
Subject: [R-390] 3DW7: A 3TF7 Tubester

Runs cool and regulates great? Sounds like the ultimate ballastube replacement! I am envisioning a switching regulator or phase control type of arrangement possibly with controlled rise and fall times to minimize noise generation. All of this sophistication in a 3TF7-sized package-now that's an accomplishment!

From: "Cecil Acuff" <chacuff@cableone.net
Subject: Re: [R-390] Ballastubes (was inrush current limiters)
Date: Mon, 23 Dec 2002 21:58:34 -0600

Here is how I remember it from my school days....RMS = Peak V x 0.707 An AC waveform is a Peak to Peak waveform. Moving equal amounts above and below Zero. (in this case). You arrived at peak value by half wave rectifying the Peak to Peak sine wave. You now multiply that value by .707 to get the RMS value. To go from RMS back to Peak you multiply by 1.414 and then double that to get Peak to Peak values. I verified that in a radio engineering handbook. (it's been a while since

I used this stuff too).

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Tue, 24 Dec 2002 16:03:58 -0500
Subject: [R-390] Re: BallasTubes (was inrush current limiters)

> >As far as regulator-induced noise is concerned, filtering would help but I
> >am not sure that this is necessary.

Jim Shorney wrote:....recommended filter/bypass caps are always necessary,.....

The maufacturer-recommended filter/bypass caps go without saying! Three terminal regulators can make good oscillators without them. For LM317 certain values of output capacitance will cause excessive ringing: a too-close cousin of oscillation. I believe the evil values lie within 500-5000pF. This range is swamped out by the recommended value. Additional filtering beyond that needed for stability may not be necessary, but wouldn't hurt.
>
> >Another solid state regulator approach is to half wave rectify the 25.2VAC,
> >filter and apply to a 3 terminal regulator configured as a 300 mA DC->>regulator.

Interesting method I hadn't thought of. Dr. Jerry's clipped sinewave circuit regulates on only part of the waveform; when instantaneous value drops low enough, regulator saturates. This requires a peak current of about 360 mA to achieve 300 mA RMS. Dr. Jerry verified this value with a fair amount of effort, and my computer simulation agreed. With the clipped half-sine wave circuit, that peak would have to be somewhat greater for the same RMS, so more fiddling about with true RMS current measurement techniques (can sometimes be a real pain) would be required for verification. This would make for another interesting computer simulation. These circuits would generate considerable heat; the advent of the coveted cool-running 3DW7 Tubester makes all of our regulator musings sound trivial (sigh).

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Tue, 24 Dec 2002 15:06:57 -0600 (CST)
Subject: Re: [R-390] Ballastubes (was inrush current limiters)

>.....multiply that value by .707 to get the RMS value. To go from RMS back to Peak you multiply by 1.414 and then double that to get Peak to Peak values.

That doesn't apply to the output of a half-wave rectifier. It only applies to a pure sinewave or full-wave rectified sine wave (allowing for diode voltage drop if you're dealing with low voltages). As Drew pointed out, the RMS value of a half-wave rectified sine wave is 0.5*peak.

Subject: RE: [R-390] 3DW7: A 3TF7 Tubester
Date: Tue, 24 Dec 2002 13:25:06 -0800
From: "David Wise" <David_Wise@Phoenix.com>

If it isn't the ultimate, it's certainly as far as I can take it. For me, it's a tour de force. As soon as I considered the "tubester" form factor, I knew that DC regulation was out.

With a grounded supply and load, half-wave rectification is necessary, doubling the required reservoir capacitance. You also need a ground. While it would be possible to contact the shield's bayonet base, I found this distasteful. The DC choices are (1) linear, and (2) high-frequency switching. In either case, the reservoir cap eats up 75% of the available space, leaving not enough for the brains and RF filter (switching) or the heat sink (linear). If the input to your pass device is other than DC, you must measure true-RMS. Those "clipped sinewave" designs won't work without it. Another idea is a saturable reactor. It's simple but way too big. My first try used a forward phase-controlled triac, with a light bulb and photocell as RMS sensor. I synchronized the control to the sine wave, using an exponential ramp circuit of my own invention. (At least, I haven't seen it anywhere else.) This was marginally usable, but the light bulb kept drifting. Eventually I gave up on it and found an RMS converter IC. This worked great, but my suspicions about RF noise were confirmed. I changed to reverse phase control with controlled fall time. This doesn't put any detectable noise into the receiver, but the parts count is high. Even so, I was able to squeeze! it into the available circuit board space to confirm it could be done. That was months ago, when I first considered announcing the 3DW7. At that point it would have been an analog design.

Dissatisfied with the density, I took the digital leap and breadboarded up a microcontroller. After months of "interesting" evenings debugging, I got the program working really well. It uses power mosfets switched at zero-cross to stay quiet, adjusts to voltage changes in one half-cycle without overshoot, and (like its analog predecessor) powers itself when not conducting, making it a two-terminal device. It factors its own power usage into the computed load current. It senses overloads and short-circuits, so quickly that no fusing is required. I don't have the facilities to test it, but I think it will regulate ugly-shaped, frequency-varying waveforms like what you get from a generator or inverter. It needs neither ground nor shield. The main heat source is the current sense resistor. It has recessed Up and Down buttons on top for calibrating between 270mA and 320mA, and stores the setting in eeprom.

I'm figuring on a transparent plastic envelope. No I will not blow glass :-) And sorry, it doesn't glow, takes too much power. This design could be adapted to a variety of voltages and currents.

Subject: RE: [R-390] Ballastubes (was inrush current limiters)
Date: Tue, 24 Dec 2002 13:28:13 -0800
From: "David Wise" <David_Wise@Phoenix.com>

The problem with using a '317 to clip the sinewave is that the only part of the wave that's regulated is the clipped region. The "shoulders" are not regulated. BTDT. If you regulate anything other than DC, you must regulate RMS, not average, not peak. The optimum 317 design requires a ground, not for the regulator but for the filter cap. Half-wave rectify, filter, and current-regulate the resulting DC. A series resistor softens the inrush and takes on some of the 317's heat burden. This is the minimum parts-count regulated solution and it's an excellent, quiet regulator, but it puts out a heck of a lot of heat, more in fact than the 3TF7.

From: "john w. king" <jbkking@bellsouth.net>
Subject: Re: [R-390] R-390 ballast tube

Date: Tue, 24 Dec 2002 15:18:31 -0600

I can buy NOS 3TF7 tubes for $20.00 as I did at Shelby Hamfest from a tube dealer who was there. Why would anyone want to pay $40.00?

From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: Re: [R-390] Ballastubes (was inrush current limiters)
Date: Tue, 24 Dec 2002 16:37:23 -0500

>An AC waveform is a Peak to Peak waveform.....

Half wave will posess the same (neglecting diode drop) peak value as the symmetrical sinewave whence it came, but a half sinewave is not the same waveform as a full sinewave.

>You now multiply that value by .707 to get the RMS value.....

This applies to a full sine wave, but not a half sine wave. Yes, the RMS value of a sine wave is .707 times its peak value. However, the RMS value of a half sinewave is 0.5 times its peak value.

From: "Bill Smith" <billsmith@ispwest.com>
Subject: Re: [R-390] Ballastubes (was inrush current limiters)
Date: Tue, 24 Dec 2002 13:55:22 -0800

Haven't tried it yet, but seems simple enough: Why not made a 300ma current source (zener, two resistors, transistor, or your improvement) and hook it up to the +/- terminals of a bridge rectifier. Hook the AC terminals of the bridge rectifier to pins 2 and 7 of the ballast. The current source always sees DC, and the circuit works in the AC line of the filament string.

Subject: RE: [R-390] Ballastubes (was inrush current limiters)
Date: Tue, 24 Dec 2002 14:31:50 -0800
From: "David Wise" <David_Wise@Phoenix.com>

Please forgive me, I'm still at work, and irritable. Some of you have not been convinced by arguments. One demonstration is worth a thousand speculations. It's a simple circuit. Please, just put it together and try it. Report the FAILURE back to us so we can drive a stake through it.

Date: Tue, 24 Dec 2002 23:36:37 +0100
From: Heinz und Hannelore Breuer <hbreuer@debitel.net>
Subject: Re: [R-390] Ballastubes (was inrush current limiters)

Hi, could somebody please give me the mathematical expression for a half sinewave. I don't get it that the RMS value of a half sinewave should be 0.5 of the peak value. As I understand it we use a diode to cut off one halfwave (i.e. the negative). So all we have is a positive halfwave in the first half period and nothing in the second half period. At 60 Hz that is a positive halfwave in the first 8.33 ms and nothing at all in the second 8.33 ms. To get a RMS value of 0.5 the waveform must

be a squarewave and not a sinus. Take a piece of paper and draw it up. What I am missing here?

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Tue, 24 Dec 2002 17:46:51 -0500
Subject: [R-390] BallasTubes (was inrush current limiters)

Thank you for the intriguing synopsis on the operation and iterations of the 3DW7. Putting in the microcontroller and writing the program is certainly a labor of love! My repect goes out to all of those intrepid souls who painstakingly unsnarl software. By his own admission, Dr. Jerry's design (bridge rectumfier wrapped around LM317) does not have as good current regulation as its parent regulator chip and my computer simulation confirmed this. My simulation showed a +1.5%, -2.5% variation in RMS current output over a +-15% line voltage change. This is still better than non-regulated schemes and may be good enough for some uses. It appears that the varying unregulated "shoulders" of the clipped current waveform are traversed in a reasonably (it seems) short time and contribute only a small portion of the total current. Under the conditions of a nice sinusoidal input voltage confined to the aforementioned range, and the constant load of tube heaters, clipping the current peaks might be considered a workable approximation of true RMS current regulation. Dr. Jerry's description of his trials and tribulations mention extensive testing using a variety of RMS current measuring methods, some of which actually agreed with one another. Your 3DW7Tubester makes all this seem academic. How about including an orange LED in the 3DW7 to simulate that warm filament glow :-)

From: Llgpt@aol.com
Date: Tue, 24 Dec 2002 18:15:25 EST
Subject: Re: [R-390] Ballastubes (was inrush current limiters)

I've been imbibing of the Christmas spirit and should probably keep my mouth shut, but here we go..... This is the deadest horse that has ever been beat.....it makes not one whit if you use a resistor, diode, 12BA6, 12BH7A, 12BY7, or Chuck Rippels solid state regulator. You will still be able to hear that damn hetrodyne from Pitcairn Island!!

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] BallasTubes (was inrush current limiters)
Date: Tue, 24 Dec 2002 18:14:57 -0500

How about an orange Xmas tree bulb altogether? What's the DC resistance of a 7 watt unit? OK, maybe it won't work, but they are in season. (and real cheap day after tomorrow)

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Tue, 24 Dec 2002 17:57:13 -0600 (CST)
Subject: Re: [R-390] Ballastubes (was inrush current limiters)

That's along the line I was thinking. As wonderful as Dave's little gizmo sounds, and I *do* wish him the best of luck with it, I don't plan on buying one. I'm just brainstorming for ideas that I can brew up with parts on hand in the event my ballast

tube is bad and my buddy Steve doesn't give me a spare for free... :-) Yeah, I'm a tightwad, and I'm not one of those purists who has to have everything look original; I don't mind wiring something in if it is a good solution. I'm sorry if this made anyone irritable, I've enjoyed the discussion and learned a thing or two. So what if it's a dead horse? At least I'm having fun! I hope the rest of you are, too.

From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Ballastubes (was inrush current limiters)
Date: Tue, 24 Dec 2002 19:43:32 -0600

I agree with you Drew.....a half wave rectified sine wave has the same peak value as a the original sine wave....but not the same peak to peak value. The peak value of a sine wave is half it's peak to peak value. You ended up with the peak value by stripping off the top half of the wave form with the half wave rectifier. So you have satisfied the first part of the formula...you divided by 2. Now you multiply by .707 and you have RMS. The formula in my books say to arrive at the RMS value of a sine wave you divide it's Peak to Peak value by 2 to arrive at Peak value then multiply that Peak value by 0.707 and you have RMS. I agree the 0.5 value is probably for a square wave. Go to google and search on Root Mean Squared....go to the last link listed if I remember correctly and it covers it pretty well.

From: "Jim Shorney" <jshorney@inebraska.com>
Date: Tue, 24 Dec 2002 20:05:53 -0600 (CST)
Subject: Re: [R-390] Ballastubes (was inrush current limiters)

The output of a half-wave rectifier is not a sine wave - it is a pulse waveform with a peak-to-peak value of .5 (one half) the peak-to-peak value of the input sine wave. The .707 formula does not apply to pulse waveforms, or any harmonically distorted sine wave for that matter. See: http://www.wodonga.tafe.edu.au/eemo/ne178/tut2_3.htm
About the middle of the page you will see the graphic for half-wave. RMS of a half-wave pulse is .5, average is .318, of peak.

>The formula in my books say to arrive at the RMS value of a sine wave you
>divide it's Peak to Peak value by 2 to arrive at Peak value then multiply
>that Peak value by .707 and you have RMS.

This is only true if you are talking about a pure sine wave with no harmonic distortion or modulation. It does not apply to square, triangle, pulse, audio, modulated RF or baseband, or any combination of the above. When thinking of the output of a half-wave rectifier, we are definitely not thinking of anything close to a pure sine wave. I'm with Drew on this one.

From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Ballastubes (was inrush current limiters)
Date: Tue, 24 Dec 2002 20:32:01 -0600

I agree with you....not that that ever really mattered! Good site Jim! I guess I was trying to get you the correct RMS value before you rectified it wasn't I! I was also simplifying things by thinking dividing by 2 in the formula and rectifying the sinewave

was the same...but the .707 formula doesn't ignore the energy in the other half of the sinewave just because we divided the full sinewave by 2. All this aside, we still didn't solve the ballast tube problem did we! I think the bottom line is that you should use what works best for you! If you don't mind buying the original 3TF7..it's probably the best solution. If not there are several good alternate solutions! Which is great because we can keep these great radio's going into the future. I guess in 50 years the focus might be on trying to find a "cheap" fix for those darned $50 PTO tubes or such!

From: "Tom Bridgers" <tarheel6@msn.com>
Date: Tue, 24 Dec 2002 21:41:18 -0500
Subject: [R-390] . Re: Ballastubes (was inrush current limiters)

So.... is it now agreed that using a diode in a half-wave circuit yields the necessary nominal 12 volts needed for the 6BA6 VFO and BFO filaments in series? That seems to be the conclusion from Cecil's posting and his formula's: Diode half-wave circuit = ((25 volts input x 1.404 peak)/2)x.707 = 12.4 volts with 25 volts input

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From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Fri, 27 Dec 2002 01:50:54 -0500
Subject: [R-390] RMS power and voltage (was BallasTubes...)

RMS POWER in a square wave is directly proportional to duty cycle and proportional to the square of peak voltage or current. RMS VOLTAGE (or current) in a zero-referenced square wave of peak voltage Vp (or Ip as applicable) and duty cycle d is given by: VRMS=((Vp^2)*d)^.5 (math formulas can be cumbersome in ASCII). Thus, a 50% duty cycle square wave would have an RMS voltage of .707 times Vp and an RMS current of .707 time Ip.. A half wave rectified sine wave has an RMS voltage value of half its peak voltage. A half wave rectified sine wave has an RMS POWER value of .5 times RMS power of the whole sine wave.

Resistance of 2 seriesed 6BA6 heaters is 12.6V/300mA or 42 ohms

With a whole sine wave of 12.6 VRMS applied to a 42-ohm load, RMS power= (12.6^2) /42 or 3.78 watts. With a whole sine wave of 25.2 VRMS applied to a 42-ohm load, RMS power=$(25.^2)$ /42 or 15.12 watts. Half wave rectify the 25.2 VRMS, apply it to a 42 ohm load, RMS power=.5*15.12 or 7.56 watts.

Double the voltage, power goes up 4 times. Half wave rectify, the power goes down to half. 4 times one half equals twice the original power. Those 6BA6 heaters glow brighter for a reason! In actuality, as they get brighter, their resistance increases so the power increase is less than 2 times, but power is still higher than when they were powered by 12.6 VRMS. Yes, your R-390A will still hear faint flea flatulence from Fiji, but life of those 2 6BA6's will be reduced. In past postings I should have been more specific that the RMS values to which I was referring were for voltage or current, as opposed to power. Sorry for any confusion I caused.

Subject: RE: [R-390] Ballastubes (was inrush current limiters)
Date: Fri, 27 Dec 2002 14:45:57 -0800

From: "David Wise" <David_Wise@Phoenix.com>

Here's IMO the simplest regulator that's also really good.

Parts list: 5ohm 10W resistor. 10ohm 10W resistor.
2.2K 1/4W resistor. 2.7K 1/4W resistor.
1K pot. 3000uF/50V cap.
Silicon rectifier. LM317 on heat sink.

Vin goes to 5ohm resistor.
5ohm resistor goes to anode of rectifier.
Cathode of rectifier goes to cap and LM317 IN terminal.
Other end of cap goes to ground.
LM317 OUT terminal goes to 10ohm resistor and 2.2K resistor.
2.2K resistor goes to LM317 ADJ terminal and 2.7K resistor.
2.7K resistor goes to 1K variable resistor.
1K variable resistor and 10ohm resistor go to Vout.

This will adjust from 280mA to 335mA. It has four big components, three of which are also hot, and it requires a ground. This was my first step on the road to the 3DW7.

How's it work? The rectifier and cap give you DC. The 5ohm resistor softens the charging peak and takes on some of the heat load. The LM317 will do anything in its power to maintain 1.25V from OUT to ADJ. This puts 1.25V across 2.2K for 0.57mA, which also flows through the 2.7K resistor. (The LM317's current out the ADJ pin is negligible.) 0.57mA * (2.2K + 2.7K) =3D is 2.78V .

The LM317 will do anything to make that 2.78V happen. In this case it punches 278mA through the 10ohm resistor. If you increase the 2.7K resistor to 3.7K, the voltage is 3.35V instead of 2.78V for 335mA out. I can't remember what range of AC input voltage this will work over, but it's at least 25.2 +/- 5% .

Subject: RE: [R-390] BallasTubes (was inrush current limiters)
Date: Fri, 27 Dec 2002 14:49:38 -0800
From: "David Wise" <David_Wise@Phoenix.com>

Does not! It glows all the time. If yours does not, then it is not a 3TF7. The iron wire is strung up and down in vertical segments arrayed around the periphery of the imaginary cylinder formed by two mica washers. Some segments will glow, others not. How many, depends on the voltage. As it rises, more will glow. If it's all dark, it's out of regulation on the low side. If it's all lit, it's out of regulation on the high side.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Sun, 29 Dec 2002 18:15:46 -0500
Subject: [R-390] Ballatube regulator simulations

I ran a computer simulation of a couple of different BallasTube replacement circuits. These are of the recently discussed "clipped sinewave" variety. No filter capacitors are used (beyond the small caps recommended for LM317 stability). The LM317 in each case sees raw unfiltered DC straight from the dead horse's, er, rectifier's mouth.

They are not true RMS current regulators but for some situations might provide a reasonable approximation. I found the results to be interesting and maybe you will find them to be boring.

Circuit Descriptions:

Regulator circuit #1: This circuit was designed, built, and tested by Dr.Gerald Johnson and reported on the R-390A list a while back. It consists of full wave bridge rectifier wrapped around LM317 configured as DC current regulator. Current sense resistor for LM317 may be preset for I=347 mA using a quiet DC source of about 6 volts at AC terminals of bridge rectifier. Rectifier AC terminals are then disconnected from DC source and connected to BallasTube socket pins 2 and 7. This should yield RMS heater current as specified at "Line Nominal" conditions. Because LM317's reference voltage may lie between 1.2 and 1.3 volts, current sense resistor value can range from 3.46 to 3.75 ohms. Tube heaters see a clipped AC sine wave.

Regulator circuit #2: This circuit was recently proposed by Jim Shorney and as far as I know has not been tested. Circuit consists of half wave rectifier feeding LM317 configured as DC current regulator. Current sense resistor for LM317 may be preset for I=523 mA using DC source as for circuit #1 above. Rectifier is fed from ballasTube socket pin 2 (Vsec) and regulated DC output fed to tube heaters at BallasTube socket pin 7. Current sense resistor for LM317 can range from 2.29 to 2.49 ohms. Tube heaters see pulsating half wave rectified DC with clipped peaks.

Simulation Conditions:

1.Ihtr is RMS current through seriesed 6BA6 PTO and BFO tube heaters. Total resistance is assumed to be 42 ohms hot.

2.Vsec is RMS AC voltage from transformer secondary winding at BallasTube pin 2.

3.Dev is Ihtr deviation in percent from Ihtr specified at Line Nominal conditions.

4.Pd reg is LM317 regulator power dissipation in watts.

5.For Startup, line voltage and Vsec are as specified for Line Nominal conditions and initial heater total resistance is assumed to be 5.4 ohms cold.

Simulation results for circuit #1:

Line Nominal:AC line=115, Vsec=25.2, Ihtr=300mA (adjusted), Pd reg=2.9w
Line-8.7%: AC line=105, Vsec=23.0, Ihtr=295mA, dev= -1.7%, Pd reg=2.3w
Line+8.7%: AC line=125, Vsec=27.4, Ihtr=304mA, dev= +1.3%, Pd reg=3.5w
Line-13%: AC line=100, Vsec=21.9, Ihtr=292mA, dev= -2.6%, Pd reg=2.0w
Line+13%: AC line=130, Vsec=28.5, Ihtr=306mA, dev= +2.0%, Pd reg=3.8w

Startup: Ihtr=330 mA

Simulation results for circuit #2:

Line Nominal:AC line=115VAC, Vsec=25.2, Ihtr=300mA (adjusted), Pd reg=1.2w
Line-8.7%: AC line=105, Vsec=23.0, Ihtr=291mA, dev= -2.9%, Pd reg=.8w
Line+8.7%: AC line=125, Vsec=27.4, Ihtr=307mA, dev= +2.3%, Pd reg=1.6w
Line-13%: AC line=100, Vsec=21.9, Ihtr=286mA, dev= -4.7%, Pd reg=.7w
Line+13%: AC line=130, Vsec=28.5, Ihtr=310mA, dev= +3.3%, Pd reg=1.8w

Startup: Ihtr=352 mA

Notes and Musings:
1. Precision regulators these ain't! The 3TF7 BallasTube does better with its specification of +-1% over a much wider line voltage range than shown in these simulations. An LM317 operated with sufficient headroom from a filtered DC source does far better still. The sophisticated 3DW7 Tubester with its microprocessor control is reputed to be excellent. However, circuits #1 and #2 do considerably better than no regulator at all.

2. Some like it hot! In order of least to most heat generation would be the cool running 3DW7, then circuit #2, 3TF7, circuit #1, filtered DC operated LM317. From a standpoint of simple regulator heatsinking, circuit #2 might be attractive.

3. It has been argued that current regulation for the PTO and BFO tube heaters is not really necessary for the type of operation that most of our R-39x see. There are several schemes which eliminate the 3TF7 current regulator and supply unregulated PTO and BFO heater power. Proponents of these schemes claim that frequency stability is still excellent. More data on frequency variation vs PTO/BFO heater current variation would help to resolve doubt in a given usage situation. If one were to classify stability with unregulated heater power as "quite good", perhaps circuit #1 or #2 could upgrade the classification to "very good" or "excellent". Schemes offering still better regulation might only provide improvements past the point of diminishing returns. For some users, however, anything less than the best obtainable would be unacceptable.

4.If you want original performance, use an original part! Put those 3TF7's to work.

5.Note that cold startup current is a bit higher than current when heaters have warmed up. Compare the values above to the 2.3 amps a cold 6BA6 would draw from a supply without current regulation. Current limiting action reduces heater inrush current and resultant heater stress. This might help prolong tube life.

6. Posting of these results helps prove that even a "dead horse" can still make a pile of manure! As such, these ramblings should be taken as just that: a product of my "fertile" imagination. Use these ideas at your own risk. My liability is limited to the saying of a requiem for deceased 6BA6's.

7.For my R-390A, I prefer and use the "Two 12BA6's and a paperclip" method for its utter simplicity and because I'm lazy. Maybe someday I'll test circuits #1 and #2 to satisfy my curiosity.

Neither 6BA6's nor electrolytic filter caps were harmed during the running of these simulations.

From: TheFirebottle@aol.com
Date: Mon, 12 May 2003 21:29:35 EDT
Subject: [R-390] Best ballast tube resistor

Should I use a 39 or 40 ohm resistor to replace my bad ballast tube? 1%, 5% or 10% and what wattage? Someone told me that if I use a resistor, my R-390A would not work properly. What should I do?

Date: Mon, 12 May 2003 21:40:18 -0400
From: "rbethman@comcast.net" <rbethman@comcast.net>
Subject: Re: [R-390] Best ballast tube resistor

I have no idea if it is the "best". I purchased my '67 EAC with a 50 ohm 10W in place of R-510. It is inserted across pins 2 & 7. I have removed it and replacxed it with a 3TF7 and can see or detect NO DIFFERENCE. My 3TF7 has a fairly small segment that glows. The frequency stability is as good as any R-390A that I've had the fortune to use.

From: "Jim Miller" <jamesmiller20@worldnet.att.net>
Subject: Re: [R-390] Best ballast tube resistor
Date: Mon, 12 May 2003 21:53:11 -0400

I drilled a 1/4 inch hole in my front panel to the right of the VU meter and installed a 15W wirewound pot. I am able to adjust the pot for optimum operation of the oscillator tubes. Since the changing filament voltage does cause a slight frequency shift, this can also double as a vernier tuning capability. I am now working on calibrating the dial in Hz offset. You must be very careful to avoid turning the pot to zero however, as it will fry the oscillator tube filaments. I am thinking of using a sheet metal screw as a safety stop for this purpose.

Date: Mon, 12 May 2003 23:10:48 -0700 (PDT)
From: Rodney Bunt <rodney_bunt@yahoo.com>
Subject: Re: [R-390] Best ballast tube resistor

Put a fixed resistor in the chain, so when the pot is at ZERO you still have the "40 Ohms" in series with the fillament.

From: "Bill Smith" <billsmith@ispwest.com>
Date: Mon, 12 May 2003 23:45:54 -0700
Subject: [R-390] RE: Best ballast tube resistor

(1) Remove the VFO tube, V701 (5749/6BA6W) and the BFO tube, V501 (5749/6BA6W). The VFO tube is underneath, in the PTO assembly, and the BFO tube on the IF chassis, behind the Line Meter switch.

(2) Replace each with 12BA6 tubes.

(3) Using a small piece of solid wire, make a wire jumper and install it (plug it in) between pins 2 and 7 of the ballast tube socket. No disassembly, soldering or other modifications are necessary.

From: <Tarheel6@msn.com>
Subject: Re: [R-390] RE: Best ballast tube resistor
Date: Tue, 13 May 2003 08:51:42 -0400

Bill's plan is fine, except for one thing in my experience. The piece of wire that bridges pins 2 and 7 needs to be insulated up to the points where it inserts into the pins. Why? Because in my case the wire was not rigid enough to stay firmly in place and it leaned (or was bent inadvertently by me) against the tube socket shield. A nasty short to ground resulted. So I use a piece of insulated wire. My 2 cents worth; YMMV.

From: DJED1@aol.com
Date: Tue, 13 May 2003 20:35:27 EDT
Subject: Re: [R-390] Best ballast tube resistor

Been using a resistor for 25 years, and it works fine. I'm planning on using the 3TF7 to fund my 401K when I retire.

Date: Fri, 16 May 2003 10:38:09 -0400
From: "Gregory W. Moore" <gwmoore@moorefelines.com>
Subject: [R-390] Radium dials and 3AT7 'unubtanium" ballast tube--query for the group

Forgive me if I bring up a subject (Ballast Tube replacement with solid state components) for probably in excess of 10 to the 6th power (LOL, I couldn't figure out how to do superscript in a Netscape web browser), but it does seem as if this is rather a touchy subject, and many modifications have been proposed to retrofit R390/A's with other methods for B+ control, etc. Ok, Query (Flaming, comments, mobs with burning torches parading in front of my house are welcome LOL). Now, here's my proposal:

<snip>

(B) OK, nuff about luminous dials, lets talk about the supreme of supremes in the class of unobtainum. I think that we have pretty much in agreement that the 3FT7 ballast tube has gone the way of all other good things.. I propose that since there seem to be one heck of a lot of Boatanchrs/R-390 and R-390A enthusiasts out there, I have been wondering if since there are both saftety and clout in numbers, that our group en masse could approach a manufacturer,
be it either here in the good old US of A or more promising, a firm in Russia (Svetlana) to produce this tube line again. Admittedly, it wouldnt be a billion piece run, but the technology is already in existance, as are the manufacturing lines, and since the Russian companies are already MAKING hollow state components, I wouldn't feel that the tooling for both blowing the envelope, and inserting the proper gas for the filler, as well as producing the specialized filaments wouldn't be a reinventing the wheel proposition. The only pitfalls I can see is (A.) setup costs which I believe we could collectively write off our taxes, and (B.) Dealing with the bureucracy as regards to the size of the run... (C.) At any rate, the patent for those

puppies has run out, so the manufacture would be in the public domain If you in the group concur, I would be willing to take over a preliminary engineering study oft the feasability of doing so. In addition, any other tubes that have become "unobtainum" could be handlled in the same fashion. The machines already exist, the basic tooling already exists, if not for the exact tube, at least it would be in the ball park.. Incidentally, as long as the tube fits, and works as designed, the cosmetics of the exterior don't amount to a hill of beans. The only requirement which I would require is the ability of tubes to fit an IERC tube shield, so the rig would LOOK original. If anyone has comments, queries, other business, feel free to email me off list or on list, and let's kick this around a while and see if the idea meets the reality test. I would much rather find out problems first, than discover the alligator pits later on.. Your suggestions and criticisms are welcome, FIRE AWAY 73 de ZGreg WA3IVX / NNN0BVN PA

Date: Sat, 17 May 2003 06:52:47 -0500
From: Dave Merrill <r390a@rcn.com>
Subject: Re: [R-390] Radium dials and 3AT7 'unubtanium" ballast tube--query for the group

Amperite lists the 3TF7 as 'still available' - http://www.amperite.com/ballastp.htm

However, if you check prices with their distributors (Newark and Richardson for example), they are $100+! Makes SSN price of $45 seem like a bargain. BTW, the Amperite page shows 3TF7, 3TF7A, 3TF7B and 3TF7/H - what's the difference? Amperite had only general ballast tube info on their site,no specs for individual parts.

From: "Francesco Ledda" <frledda@attbi.com>
Subject: RE: [R-390] Radium dials and 3AT7 'unubtanium" ballast tube--query for the group
Date: Sat, 17 May 2003 10:42:59 -0500

SSN is never a bargain.....

From: "Scott Seickel" <polaraligned@earthlink.net>
Subject: Re: [R-390] Radium dials and 3AT7 'unubtanium" ballast tube--query for the group
Date: Mon, 19 May 2003 20:22:28 -0400

I don't know what all the hub bub is about the 3TF7 ballast. They are quite readily obtainable for $25 NOS. This isn't unreasonable considering a sharp 390A will sell for $600+ on e-pay. Look what new tires for your car cost you. And for those of you that think you can't get a replacement for $25, there is a nice fellow on this list selling them (NOS) for that amount. There also was one, NOS again, that had no reserve on e-pay and and closed at $25 with no bidders just a couple of days ago.

From: "Phil Atchley" <k06bb@elite.net>
Date: Mon, 14 Jul 2003 23:05:41 -0000
Subject: [R-390] My 'new' '67 EAC is now "on line" 8^) Ballast Tube question.

<snip> BALLAST TUBE QUESTION: In all the R-390A's that I've had previously (that

still had the ballast tube) I seem to recall the filament having just a dull glow in only a small part of the filament. This one glows fairly brightly over nearly the entire length of the filament and makes me feel uneasy in that I'm afraid it's nearing the end of its lifespan (seems I recall reading that was an indicator). No, my line Voltage is under 120 VAC, especially this time of day with everybodies A/C running. Do I have cause for concern? Perhaps I should start looking for a 12BH7 tube (I did the 12BH7 mod while recapping the IF strip).

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] My 'new' '67 EAC is now "on line" 8^) Ballast Tube question.
Date: Mon, 14 Jul 2003 19:37:14 -0400

<snip> My experience is that they don't glow much after power-up. The ballast may be good but you may have excessive current draw. Since you replaced nearly everything else that could affect that, I strongly suggest you check the two tubes involved -- especially the one in the PTO. Yes -- lightning (element/filament shorting) does strike twice, (Phil found the previous PTO
tube shorted). Two possible reasons, offhand -- continued bumping/moving of the PTO as you were adjusting the linearity and/or the replacement tube may have come from the same lot with a latent defect.

Now that things are settled in, test those tubes again in the tester. Normally it's not best practice to leave them in the tester too long, but let them sit and tap as you go through the shorts test. Another possibility -- something in the wiring harness. Maybe you should measure the current draw with the ballast in place. Do others agree about the bright ballast situation?

Date: Mon, 14 Jul 2003 17:23:28 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] My 'new' '67 EAC is now "on line" 8^) Ballast Tube question.

I agree on the ballast tube, normal function is to come on bright at first then go dim so only a few places are lighted. Not sure what your problem is though too much current draw sounds right.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Tue, 15 Jul 2003 13:48:53 -0400
Subject: [R-390] Bright BallasTube

>Do others agree about the bright ballast situation?

It also is possible that heater strands in PTO or BFO 6BA6 could be shorted to one another and not to cathode. You might check voltage at PTO and BFO tube heaters while in the radio. Since it is unlikely that this type of short would occur in both tubes (Murphy's law notwithstanding) it would show as unequal voltage division between tubes. Make sure that BallasTube is really a 3TF7 and that PTO and BFO tubes are really 6BA6's (hey, maybe someone stuck 3BA6's in there, the 600 mA current specification would really light up that 3TF7).

Date: Wed, 16 Jul 2003 01:31:14 -0400

From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] My 'new' '67 EAC is now "on line" 8^) Ballast Tube question.

Experience has shown that the filament of the ballast tube SHOULD only partly glow when all is well. The symptoms you describe SHOULD mean that the circuit that it regulates is drawing too much current. Either one of the tubes has some form of a short, or something else is causing excessive current draw. It's probably going to be painful to track down, but will be worth it in the long run. As mentioned in an earlier post, if the PTO tube came from the same lot, it could be a bad lot. Try swapping the two tubes that R510 regulates from another R-390A. If the ballast tube goes down in brightness, then one or both of them are problem children. IF NOT, then something else is awry. Perhaps a bad or flaky ground. These radios are notorious for this with the MFP coating

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From: "Phil Atchley" <k06bb@elite.net>
Subject: RE: [R-390] My 'new' '67 EAC is now "on line" 8^) Ballast Tube question.
Date: Wed, 16 Jul 2003 19:31:23 -0000

Well, to reassure myself and others who have expressed concern I borrowed some tubes from another receiver here (my homebrewed longwave beacon set) and subbed both the PTO and BFO tubes at the same time (and yes, they are 6BA6's, not 3BA6's !). No change, the ballast glows the same. I've just come to the conclusion that this one may be drawing close to the end of its lifespan. I can't find it in my archives, but I KNOW I read somewhere in the past that is an indicator that either the ballast tube filament is getting "thin" (worn out) OR that possibly the inert gas has leaked out of it around the seals. I also tightened up the ground screws on the applicable tubes, though I would suspect that a loose one would open up the filament line or at least present a high impedance that would actually REDUCE current rather than increase it.

From: "Bob Tetrault" <r.tetrault@comcast.net>
Subject: RE: [R-390] My 'new' '67 EAC is now "on line" 8^) Ballast Tube question.
Date: Wed, 16 Jul 2003 13:39:35 -0700

Methinks you are right about the loss of gas as probable cause. Mine failed through old age but not loss of gas. When first powered up most of it would glow but some places were brighter than the rest. Those places remained glowing after inrush. Those places were visibly marginal (thinner) when inspected with a loupe.

From: "Barry Hauser" <barry@hausernet.com>
Subject: Re: [R-390] My 'new' '67 EAC is now "on line" 8^) Ballast Tube question.
Date: Wed, 16 Jul 2003 17:40:55 -0400

Well, Phil, you may have another project on your hands .... time to re-string and recharge that ballast tube. There are several ways of cutting the glass open, but making all those tight curlycues in the iron wire is tough. Then you have to carefully drape it over the insulators and spot weld the ends to the pins. Use a torch to re-fuse the envelope back together, open the nib, apply vacuum then quickly infuse the hydtrogen and seal it with a torch somehow -- without exploding the hydrogen. Then check DC resistance, and if it's too far off, start over again. Yessss -- I'm joking. Just

an extended application of the Cosmos rehab thing.

Anybody know:

1. Is the performance degraded when the ballast tube starts to glow brighter or show hot/thin spots?

2. How long before total failure?

It would seem unwise to invest in used 3TF7's, unless observed in operation. Someone (Hank?) is offering NOS 3TF7's at a (relatively) reasonable price, so you might want to have one in reserve. If you don't want to make that investment, I'd suggest the power resistor option -- have one handy as you can just stuff the leads into the tube socket at a moment's notice. If you
subsequently want to convert to 12 volt tubes or whatever, you're not tossing anything expensive. (I know once you get into DXing and monitoring mode, you don't want to be down long -- even though you have that VR-5000 as backup.)

From: "Phil Atchley" <k06bb@elite.net>
Date: Thu, 17 Jul 2003 04:41:19 -0000
Subject: [R-390] A0_Ballast_Tube_question.?

Bingo! You hit the nail on the head. I just took the screws out of the front panel (again) and took a peek at the Ballast tube. IT IS a 3TF4! I didn't even think about the possibility that it had the wrong tube in it. I rechecked the Voltage across the output of the ballast, going to the BFO and VFO and see 11.5 Volts tonight (think I had just over 12 when I checked before).

>Check that you've got the right ballast in there also. I experimented with
>a 3TF4 when I didn't have a 3TF7. It functioned, but it lit up all over- I expect it
>would not have lasted too long. Ed

From: "Kenneth G. Gordon" <keng@moscow.com>
Date: Wed, 16 Jul 2003 22:21:29 -0700
Subject: [R-390] 3TF7 and other ballast tubes...

I recently sent an e-mail to Amperite, the makers of the 3TF7 and asked if that tube, the 4H4C and the 1HT4 were still available and how much they wanted for new ones. Both the 3TF7 and 4H4C (used in some models of National HRO receivers) were still available, and although the 1HT4 was not, its replacement, the 1HTF4 was. They want $107.00 EACH for them. Gee...

From: "Barry Hauser" <barry@hausernet.com>
Date: Thu, 17 Jul 2003 09:56:08 -0400
Subject: [R-390] Ballast_Tube_question

The last time it came up, I recall that word was that the 3TF4 was not a good sub -- resistance is something like double or triple that of the 3TF7 and would not be long-lasting. However, in some contacts here and there I came across someone who has used them and says "no problem". What about this?:

What if you put a resistor in parallel with a 3TF4 of the right value to get the filament voltage up a notch and take some of the current off the ballast tube to reduce glow and increase life? Would there still be some ballast action with the combination? Might be a bit tricky to install alongside the tube. The resistor probably should not be inside the module chassis.

Any thoughts on this?

Date: Thu, 17 Jul 2003 10:06:00 -0500
From: Dave Merrill <r390a@rcn.com>
Subject: [R-390] 3TF7 vs 3TF4

There is a good discussion of the 3TF7 vs 3TF4 in the 'pearls'
http://www.r-390a.net/Pearls/ballast-tube.pdf

From: "Bryan Stephens" <mail08458@pop.net>
Subject: RE: [R-390] 3TF7 and other ballast tubes...
Date: Thu, 17 Jul 2003 10:54:48 -0400

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: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Thu, 17 Jul 2003 16:27:46 -0400
Subject: [R-390] Re: BallasTube Question

The 3TF7 is specified for 290-330mA over a range of 8.6 to 16.6v, the 3TF4 regulates at 280-320mA over a range of 4.3 to 8.3v. Outside voltage range the current range is not specified. I'd say that your ballast tube is on its way out, but if it isn't hurting the 6BA6's, what the hey.

Subject: RE: [R-390] Re: BallasTube Question
Date: Thu, 17 Jul 2003 13:47:56 -0700
From: "David Wise" <David_Wise@Phoenix.com>

If it's fully lit, it's not regulating. If you don't mind a clumsy adaptor or an incompatible mod to the IF deck, supplement the 3TF4 with a 22-ohm 5W series resistor.

From: Llgpt1@aol.com
Date: Fri, 18 Jul 2003 09:06:30 EDT
Subject: [R-390] Tube Class 101 for 3TF7 substitutions

Since Phil ran across a 3TF4 in his R390A recently, I thought this "oldie"from the archives would still be relevant. Les Locklear

>From: Llgpt@aol.com
>Date: Thu, 13 Apr 2000 18:39:42 EDT
>Subject: [R-390] Tube Class 101 for 3TF7 substitutions
>To the group, Concerning the replacement of the 3TF7 with the 3TF4.
>1. ballast tubes have two ratings, a voltage range where current regulation takes place, and the regulated voltage.
3TF7 8.6 - 16.6 volts 200 - 300 milliamps
3TF4 4.3 - 8.3 volts 280 - 320 milliamps.
>2. If you substitute a 3TF4, it will be operated beyond its recommended operating voltage rating. and the two filaments it regulates will operate beyond their recommended or maximum voltage ratings.
>3. Sure it will work, but rather than replacing a 3TF7 with an improper tube sub one of the resistor or other mods. Just my 3 cents worth.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: RE: [R-390] Re: BallasTube Question
Date: Sun, 20 Jul 2003 22:04:48 -0400

That would allow us to use a good resource we couldn't before. Another way to accomplish the same result (brace yourself) would be to add a diode in series with the 3TF4. With the half wave rectification a voltage of 17.8VRMS would be presented to the series connection of ballast and 12.6 volts worth of heaters, leaving 5.2 volts for the 3TF4. That is certainly within the 3TF4's regulation range of 4.3 to 8.3 volts. If one doesn't mind some loss of regulation headroom (who runs an R-390A at 100VAC anyway?) Dave's suggestion could be used to extend the life of the 3TF7. Up to about 13 ohms could be used. Such a scheme was recommended by National for NC-300 et. al. to extend the life of that troublesome 4H4C BallasTube. David Wise did not mention the most elegant BallaSolution of all: the 3DW7 tubester he developed. It plugs right in and fits entirely within the tube shield. It is a true 2 terminal device which will regulate down to about 18v input. It dissipates almost no power, relying instead on zero crossing phase control via a sophisticated microcontroller/MOSFET implementation.

From: "Forrest Myers" <femyers@attglobal.net>
Date: Mon, 21 Jul 2003 11:14:11 -0400
Subject: [R-390] Ballast tube

After reading some posts on how much a ballast tube should glow in an R390a, I decided to check mine. Took off the top cover and tube shield and could not see any glow at all. The radio was turned on and working. Felt the tube and it was very hot, as

expected. I looked closely at the tube and was not able to read the markings on it. Removed it and still couldn't read the markings on it. I don't know if it is the correct ballast tube or not but it does not glow, even in the dark. Anyone out there had the same experience or have any ideas on the subject?

Date: Mon, 21 Jul 2003 09:51:56 -0700
Subject: Re: [R-390] Ballast tube
From: ronald j deeter <k6fsb@juno.com>

Yours is working just fine. upon pwr up it'll glow till the other 2 tube filaments catch up then die down to a no glow or just barely perceptible glow in the dark.

Date: Mon, 21 Jul 2003 11:31:21 -0700 (PDT)
From: Joe Foley <redmenaced@yahoo.com>
Subject: Re: [R-390] Ballast tube

The only glow should be at the very ends of the wire, and may not be much of a glow at that.

Subject: RE: RE: [R-390] Re: BallasTube Question
Date: Wed, 23 Jul 2003 10:05:02 -0700
From: "David Wise" <David_Wise@Phoenix.com>

Good point on the diode, Drew. Even though I've mentioned it in the past, I didn't think of it this time. And thanks for the plug. I figured that aside from you and a couple of others, no-one was interested. I probably priced it too high. I decided some time ago to reduce it, but I'm busy with other stuff. I will not have time to lay out the board until next year, and I don't want to create demand I can't fill. Plus, I'm still playing around with the design. I think I can work in a low-current orange LED to simulate that olde-tyme glow. It won't just be cosmetic - it will blink at various rates to indicate anomalies. I have it coded into the program but have not had time to try it out. Re 3TF7 etc brightness: I'll say it again. At nominal voltage and current, it should be about half lit and half dark. If it ain't lit, it ain't regulating. At least, not well.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Thu, 31 Jul 2003 14:01:27 -0400
Subject: [R-390] Bottom 200Kc Dead

<snip> it would not receive anything from X.200kc down. T.....

As Dave Wise (he truly is) pointed out, your PTO may have Field Change 7 installed. That changes the value of the screen resistor with the intent of reducing radiated signal. Low(er) screen voltage may cause the problem you described. Someone else had the same problem a while back. The cause turned out to be low PTO tube heater voltage caused by a defective BallasTube. Replacement of the 6BA6 was the temporary solution. Verify correct heater voltage at PTO tube with tube in socket. Those BallasTubes can fail in ways other than going open, and some were out of spec to begin with.

From: "Phil Atchley" <k06bb@elite.net>

Date: Sat, 2 Aug 2003 04:55:08 -0000
Subject: [R-390] Correct Ballast makes a difference 8^)

Today the "correct" (3TF7) ballast arrived for my '67 EAC and the set is happily perking along with it installed. After installing it a visual checked showed that it had only just a couple very small spots glowing, same as I'd expect to see in a properly working ballast. The one that came in the set (3TF4) was glowing a nice cherry red along the entire length of it's filament. In checking the tuning of the set, it doesn't appear to have made any difference in overall performance or calibration. That is about as I expected as the voltage applied to the BFO/PTO was about 11.5 Volts, not all that low for two tubes in series. (I didn't check to see what it is now). Now, back to DXing with the set.

Date: Sat, 02 Aug 2003 08:37:20 -0400
From: "Ray V." <w2ec@attglobal.net>
Subject: Re: [R-390] Correct Ballast makes a difference 8^)

Phil, hold onto the 3TF4, it is used in the Collins KWS-1 SSB transmitter and I'm sure someone with a KWS-1 may have a need for it at some point.

From: "Steve Hobensack" <stevehobensack@hotmail.com>
Date: Mon, 04 Aug 2003 15:22:01 -0400
Subject: [R-390] 3tf4 mod

Here is neat little mod that will let you use either a 3tf7 or a 3tf4 and is reversible. Above the IF deck mount a 25 ohm 5 watt resistor using a terminal strip. Wire the resistor to pins 2&3 on the ballast tube socket below deck. Short/solder together pins 7&8 on the ballast tube socket. Carefully cut off pin 9 of a 3tf4 ballast tube. Being careless here might crack the glass. Install the 3tf4 with the cut-off pin directly over the keyway (one space removed from normal seating). The 3tf4 will now engage the new resistor in the circuit. If you happen upon a 3tf7, simply install it normally. Remember to always plug the 3tf4 in the odd way, otherwise you will burn it out. A few weeks ago I saw a posting where a diode could be used in series with the 3tf4. Anyone tried it?

Date: Mon, 08 Dec 2003 15:09:24 -0500
From: Gord Hayward <ghayward@uoguelph.ca>
Subject: [R-390] Capehart questions

The ballast mod can be one of three forms, a 12V tube, a resistor or a jumper with the 2 6BA6 tubes replaced with 12BA6 tubes. I did the latter with a wire jumper in the 3TF7 socket. No harm to the set and it works well. Cleaning is tedious, but has to be done.

From: "Drew Papanek" <drewmaster813@hotmail.com>
Date: Wed, 24 Dec 2003 16:30:09 -0500
Subject: [R-390] BallaSeason's Greetings!

In the spirit of Ronnie's ballastless but functioning R-390A and of the ballastraffic coursing through this list at this time last year I offer the following Christmas wishes:

May Santa Claus bring each of you a big bag containing the following:

1. An inexpensive Chinese knock-off of the 3TF7 (I don't know of any) so you can pop that in your radio and save the "lifetime supply" of NOS you bought last year for speculative investment purposes.

2. Two 12BA6 and a gold paperclip. Now demand for that tube can rise, supply can shrink and prices soar,befuddling owners everywhere of All-American Fives when they try to obtain their favorite IF tube.

3. A bit of wire and the "damn the originality" attitude to run the formerly ballasted tubes directly from the 6 volt line. You can then save the 25.2v for more important things, like the PTO oven. Remove the PTO inner can and replace with a can of Pop 'n Fresh dough. Turn on '390x and listen to the deafening silence for a while. Open PTO and enjoy fresh baked cookies.

4. Two 3BA6 and a piece of wire to wrap around pins from one tube to another above chassis. A goofy no solder required combination of 2. and 3. above.

5a. Two short pieces of wire and a 12BH7. You can sell the 12BH7 to your friendly neighborhood audiophool thereby funding about 1/3 the cost of a genuine NOS 3TF7.

5b. Same as 3a. except for 12BY7. You'll then have your "designated driver" for the holidays.

6a. A 42 ohm 5 watt resistor.

6b. Make that a 20 watt so your fingers don't get burned.

7a. A simple silicon diode and a liking for controversy. You can remove the #328 dialamps and the Veederoot will still be illuminated by the brilliant glow from the PTO and VFO tubes. 6BA6's of the world unite! You have nothing to lose but your filaments!

7b. A 20 ohm resistor to stick in series with the diode and make those 2 tubes blend back in with the crowd.

8a. LM317, bridge rectifier, resistor and a 0.1uF disc cap. You can do Dr. Jerry proud by building his ready-designed AC regulator solution. He did the hard work, you can put the true rms meter away.

8b. As 8a. but swap the bridge for a single diode. You will provide validation to Jim Shorney (and to me with my silly computer simulations) of Jim's pulsating DC ballast regulator concept. Jim and I will rest easier.

8c. Like 8a&b but add a big electrolytic, big heatsink, and power resistors as suggested by Dave Wise. Along with your quiet well regulated DC current source you can increase the entropy of the unviverse at a slightly faster rate whilst heating

up the innards of your radio.

9. Chuck's RFI filtered ballast box. You can make a Rippel as you cruise the airWaves.

10. One of Dave Wise's sophisticated digital 3DW7 ballasTubesters he developed in a quest to quell the hellacious high heat of 8c. above. Rumor has it that he was approached by a couple of men in black who obtained a sample. It is purported that the R-390 they installed it in is now so drift-free that they use it to verify the stability of WWV.

You could also put the name "Mullard" on it and sell for big bucks to an audiophool as a 3 volt version of their favorite 12 volt 12AU7/AX7 frankentriode. What I truly wish for all here is a new year of easy, carefree existence devoid of the unnecessary "ballast" that loads down so many of our lives. BallaSeason's Greetings to all! Drew

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Date: Wed, 2 Jun 2004 14:10:24 -0400
From: "Mikek" <cosmo224@execpc.com>
Subject: [R-390] Solid State Ballast 'quirks'?

I have a Collins 390a that has a solid state ballast replacement that I got as part of the restoration. Sometimes, while listening, the station will suddenly 'go away' and just have static. I noticed some of what appears to be 60 cycle hum in the audio. The Tuning and BFO does nil but the AF section is still working and selecting the various filters has the noticeable 'audio' so I wonder if the 'ballast' cut off. I power off the radio and let it sit and sometimes the set comes back for a while then goes dead. Other times, I let the radio sit overnight and the next day all is good - SO, I know this is an intermittent - should I zero in on the solid state ballast first - I suspected that unit since the only thing that seems to go away is the tuning/bfo - any one seen this before?? Any other places to look while troubleshooting?

Date: Wed, 02 Jun 2004 19:35:42 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Solid State Ballast 'quirks'?

Just about any component can be intermittent. The ballast should be pretty easy to check based on weather the filaments light up or not. If I was going to bet on the cause it would be a loose connection early on the IF strip or at the tail end of the RF chassis. The key clue being that you still have static when the signal goes away. If the intermittent is late in the IF strip then the radio just goes quiet. That does not rule out the conversion oscillators, but it includes a few more parts ... If you have a copy of a manual (there are several on the net) they have some pretty good voltage at a point troubleshooting data in them. It's good to have a VTVM to do the measuring with. If you don't have one already they are a pretty darn cheap these days. If you use a DVM then you may have to adjust some of the numbers a bit. Another good thing to get a hold of if you don't have them already is a set of tube extenders, it makes things a lot easier to measure. You should be able to get the extenders for $20 and the VTVM for $30 if you are in a hurry or quite a bit less if you shop around.

Date: Fri, 04 Jun 2004 18:29:33 -0400

From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] Re: Solid State Ballast 'quirks'?

(snip...)... should I zero in on the solid state ballast first -.....

If the ballast is causing trouble you will see that the BFO tube (V505) and the PTO tube (V701) will go dark. If those tube heaters are dark, it is also possible that one of those tubes' heaters is thermally intermittent . Either of those tubes could be swapped into another 6BA6 socket (IF stage); failure to light (perhaps after waiting for the radio to quit) would indicate a defective tube. Similarly, if during testing neither of those tubes goes dark in another location (and tubes taken from the IF sockets and installed at V505 and V701 do go dark), suspect the ballast. Replacements for the ballastube are myriad and controversy-generating. For a wealth of information on the topic, go to r-390a.net Click on references, Pearls of Wisdom.

Date: Wed, 30 Jun 2004 11:52:34 -0400
From: "Walter Schulz" <k3oqf@localnet.com>
Subject: [R-390] Help, Looking for Ballast Tube

Does anybody know where I can find Ballast tubes for my R-390A/URR? Sure would appreciate any advice on this. Thanks.Walter

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Date: Wed, 30 Jun 2004 11:41:07 -0700 (PDT)
From: "KC8OPP Roger S." <kc8opp@yahoo.com>
Subject: Re: [R-390] Help, Looking for Ballast Tube

Here is something I have done to 2 of the 390's I have and seems to work FB, and a bit cheaper than a ballast tube. Here is the link and the text about the 3TF7 sub.
http://www.r-390a.us/R-390A_Modifications.htm

3TF7 Substitution Mod: (optional, recommended) Add jumpers on RT510 between pin 7 and pin 5, and between pin 2 and pin 4. This allows you to later substitute a 12BH7A tube in place of your 3TF7 if (when) it ever fails. (HSN issue 10, pages 1&2 or HSN reprints, page 1)

Date: Wed, 30 Jun 2004 15:14:16 -0500
From: "K3PID" <k3pid@comcast.net>
Subject: Re: [R-390] Help, Looking for Ballast Tube

I bought a couple from "Michael C. Marx" <sndtubes@vacuumtubes.com> for $7 ea. drop him a note, I'll bet he has more.

Date: Wed, 30 Jun 2004 17:56:38 -0500
From: "Don and Diana Cunningham" <wb5hak@sirinet.net>
Subject: Re: [R-390] Help, Looking for Ballast Tube

Has more, Ron, but the $7 has become $35!!! Mods look better allll the time.

Date: Thu, 01 Jul 2004 11:57:20 -0400
From: Roy Morgan <roy.morgan@nist.gov>

Subject: Re: [R-390] Help, Looking for Ballast Tube

The below mod is fine, but if you put the jumpers **on the 12BH7** (and mark it well) then the radio is not changed at all.

Date: Thu, 01 Jul 2004 13:04:43 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] Ballastubes

You've by now seen the high price quotations for the 3TF7 ballastube, making modifications to replace that tube attractive. I suggest you go to r-390a.net. Click on references, Pearls of Wisdom. There you will find a wealth of information (and controversy!) regarding that R-390x topic and others, all gleaned from this forum over the years. Thanks go to Wei-i Li for his untiring compilation efforts!

I personally like and use the "Two 12BA6 and a paperclip" mod whereby the 6BA6's used in PTO and BFO are replaced with 12BA6's and then the ballastube socket is jumpered out (a piece of paperclip works well). The mod is extremely simple, inherently reversible, and dissipates less heat than the various modifications or even the stock configuration. One mod mentioned is Dr. Jerry's simple AC current regulator. I can e-mail you the schematic and notes.

Date: Thu, 01 Jul 2004 14:44:49 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Ballastubes

A caution on the paperclip thing ... I have recently found that some chrome paper clips are not exactly conductive out of the box. Apparently they're covered with some other kind of silvery finish or chromed then clear coated. I'm in the habit of using jumbo paper clips to make temporary test connections as they are of a convenient diameter. Came across this recently. Thought the radio was dead -- nope -- defective paper clip. Check first with an ohmmeter. I found some could be scraped and then made the connections. Just don't assume zero ohms -- or infinity either.

Date: Thu, 01 Jul 2004 15:08:50 -0400
From: Rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Ballastubes

Probably a LOT wiser to simply use bare copper solid wire. Don't know what resistance properties in the varied chrome processes. I've been chewing over doing this and saving my ballast tubes for whenever they (The R-390As AND I) finally leave THIS QTH.

Date: Thu, 1 Jul 2004 12:29:14 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] Ballastubes

This was enough to drive me out of hiding. I'll email to anyone who asks, a PostScript printout file of the schematic for a reverse phase control analog prototype of the 3DW7 that I built a while ago before going digital*. If you've got good eyes,

you can squeeze it into a "tubester" form factor, it dissipates only about half a watt. Just be sure to use conductive paper clips for the "pins", heh.

Date: Fri, 2 Jul 2004 11:29:46 -0400
From: "Walter Schulz" <k3oqf@localnet.com>
Subject: [R-390] Re: R-390 Digest, Vol 3, Issue 2

Thanks for the good information. Would appreciate the info on the AC current regulator when you have a chance to Email it to me. Thanks again for all the help.

Date: Fri, 2 Jul 2004 16:17:07 -0400
From: "Forrest Myers" <femyers01@bellsouth.net>
Subject: [R-390] Ballast Tubes

Came into the shack and found my r-390a dead. A quick check found the ballast tube was shot. I've seen a lot going by on ballast tubes these past few days but am interested in getting a real ballast tube, if I can afford it, back into the radio. Anyone have a source for a 3TF7? If I must, I'll put in a mod to get around the 3TF7 but would rather not.

Date: Fri, 02 Jul 2004 19:24:22 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Ballast Tubes

From what's been said here they are still available for something in the $30 to $60 range. Not quite a price that would encourage me to grab a couple dozen. One modification that has not been mentioned as part of this thread on ballast tubes is probably the oldest of the batch. Grab a plug that looks like a tube base and wire a resistor to it. The value needs to be right to get the filaments to run right but that's about all there is to it. It pulls no more power than the ballast tube and it's a totally reversible mod. When the bottom drops out of the ballast tube market you can plug one of those two dollar ballast tubes in there and nobody will ever know what you did. Somehow I doubt that ballast tubes will get cheap again unless there is a Chinese factory we know nothing about making them by the ton. They are not terribly high tech so it is a possibility. There may be a long forgotten warehouse in South East Asia with a few hundred thousand of them sitting on the shelves - stranger things have happened. If it was my radio I think I would do one of the re-wire mods to eliminate the beast. The filaments would be un-regulated but there would be less heat and no additional stuff inside the cabinet. The function of the ballast tube in the radio is questionable. With modern wall voltages the original ballast is running at best on the edge and at worst over the edge of it's ratings. It's not doing a real good job of stabilizing the filament voltages on a radio plugged into 120 to 125 VAC. Fortunately for all of us the filament voltage has a pretty small impact on the tubes in the radio. It's my belief that the problem comes in on the low voltage end of the equation. If you try a radio on 100 VAC then the ballast is probably a good idea. Don't see much of that coming out of the wall outlets around here ...

Date: Fri, 2 Jul 2004 18:02:57 -0600
From: "Kenneth" <w7itc@hotmail.com>
Subject: Re: [R-390] Help, Looking for Ballast Tube

12BH7A tube in place of your 3TF7 I did this mod' several years ago and My 1967 EAC R390A serial # 5911 and it has worked with out a hitch since that day.

Date: Fri, 02 Jul 2004 20:43:17 -0400
From: Jim Brannigan <jbrannig@optonline.net>
Subject: Re: [R-390] Ballast Tubes

My first radio was a Hallicrafters SX-77A AC/DC SW receiver. I was enthralled with short wave listening One day it died..... as a 12 year old kid I had no idea how to fix it and no test equipment.....I was devastated... The next family gathering I grabbed a non-ham EE uncle and pleaded with him to fix the radio.... He figured out that the portion of the ballast tube that controlled the filaments was blown. From the schematic he calculated the current requirements of the tube filaments and from there the value of the necessary dropping resistor. (This took several hours and it wasn't 'till years later that I figured out what he was doing) We went to the local "radio store" (remember them), and purchased the correct value resistor. Since I did not have a soldering iron, the pigtails were simply twisted around the correct pins of the ballast tube. That was in 1962. The resistor is still there and it still works.....

Date: Fri, 2 Jul 2004 21:49:16 -0400
From: "Chuck Ochs" <jmerritt2@capecod.net>
Subject: Re: [R-390] Ballast Tubes

One must keep in mind that the R-390 was a "general purpose" receiver, which saw extensive shipboard use by the Navy during it's heyday. Power aboard ships tends to be anything but stable. I know. I was a shipboard electrician on an LST during that nasty little war back in the sixties. We had these radios on board, as did nearly every other ship in the Navy at that time. Using a ballast tube in the oscillator filament circuits was, at the time, a clever way to maintain stability during all those periods where the line voltage sagged from operating such heavy electrical loads as gun turrets. The regulation of ships generators of the period was very slow by today's standards. IMHO, there is little (probably NO) need for this regulation scheme given a radio running on modern "shore power". A few years ago, the ballast on my VERY early R-390 died, and I simply replaced it with a resistor. I did not notice any change in operation whatsoever. It has been running this way for several years now.

Date: Fri, 02 Jul 2004 22:06:01 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Ballast Tubes

One thing you bring up that I should have mentioned. I have a couple of radios that are running resistors and they seem to all work every bit as well as the ones with ballast tubes in them.

Date: Fri, 02 Jul 2004 22:32:12 -0400
From: Rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Ballast Tubes

I bought my '67 EAC (R-390A) from an SK (WC3K) some three to four years ago. In

lieu of a ballast tube, it had the resistor in its place. I brought it home, plugged it in, turned it on. It still is running, and running just fine.

Date: Sat, 3 Jul 2004 00:27:34 -0500
From: "Don and Diana Cunningham" <wb5hak@sirinet.net>
Subject: Re: [R-390] Ballast Tubes

Would you guys share the value and size of the resistor you used for this "replacement ballast"?? Save the rest of us calculating it, since yours obviously works well.

Date: Sat, 03 Jul 2004 08:52:52 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Ballast Tubes

I've read most all the posts over the years, but still don't know. The general word -- consistent with Chuck's account -- is that the ballast tube was needed for military and naval installations where power sags were common and extreme. I've monitored the power line voltages here. Basic voltage levels run on the high side -- about 126 -- lower on average during the summer, when brownouts can drive it down to as low as 95 something. Due to cycling AC, electric dryers, refrigerators, etc. I see a fluctuation of about 3-4 volts regularly on a fairly rapid basis -- on the order of seconds. The meter will read 125 for a few seconds, drop to 123 for a second or two, pop back up, etc and that will continue. Is this the type of fluctuation/sag that the ballast tube would dampen out? As the 6BA6 filaments are resistive heaters, don't they have some damping characteristics of their own? There may also be some latency and damping in the transformer, any capacitors, etc. Would there even be a fluctuation in the heat output in those two tubes without benefit of a ballast? Either way, under what circumstances does a ballast tube smoothen things out? With all the past threads, I don't recall ever reading anything on this.

Date: Sat, 03 Jul 2004 10:14:48 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Ballast Tubes

There is mention of the ballast tube in the Collins reports on the radio. They did not seem to feel it was a major part of the radio. The report more or less says it's unclear weather it was needed or not. If your line voltage goes down to 95 volts then the tube will help. However the rest of the radio may not be doing very well at 95 volts. The ballast was set up for about a 110 volt nominal line voltage and regulation over a +/- 5 to +/- 10% range. It seems to work fairly well from 105 to about 115 VAC. Past that it starts to fall off in regulation. I doubt it will do much for a 122 to 125 volt change. Since it's a thermal part it will do it's thing on the order of seconds. The tube works about the same way. Very fast changes will not affect things but sags that last for > 10 seconds are an issue.

The only significant effect on the tube from the filament voltage is a small variation in transductance when the tube cools off. I suppose the geometry may change when the tube cools and thus the capacitances but if they do it's not a documented effect. Since oscillators limit cycle based on gain the frequency of an oscillator will change

a bit when the gain changes. A receiving tube with the filament up to temperature has such a small variation in transductance that the change even in a VFO should be nearly impossible to detect. The B+ change may on the rest of the stuff in the radio probably does more to move things around as long as the filaments are up to temperature.

Bottom line - ballast tubes are an optional part ...

Date: Sat, 3 Jul 2004 12:09:18 -0500
From: "Ed Berbari" <eberbari@indy.rr.com>
Subject: Re: [R-390] Ballast Tubes

What value of resistor and wattage?

Date: Sat, 3 Jul 2004 13:30:27 -0400
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: [R-390] Ballast Tubes - Resistor

According to my RCA Tube Manual a 6BA6 is rated 6.3 V at 300 mA, so 2 tubes in series 12.6 V at 600 mA. Supply voltage is 25.2 V so you want to drop 12.6 V with 600 mA of current: 12.6/0.6 = 21 ohms 21x0.36 = 7.6 watts

A resistor (21 ohms at 10 watts would seem right)
(the math is wrong...ed.)

Date: Sat, 03 Jul 2004 14:03:41 -0400
From: Rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Ballast Tubes - Resistor

I've pulled the resistor in my R-390A.
It is a Sprague "KOOLOHM", 50 ohm 10W.
It goes between pins 2 and 7

Date: Sat, 3 Jul 2004 14:05:38 -0400
From: "Dave Maples" <dsmaples@comcast.net>
Subject: RE: [R-390] Ballast Tubes - Resistor

All: Just a minute. Two 6BA6s in series will draw 12.6 V at 300 ma, not 600 ma. If the supply voltage is 25.2 volts, then:

Resistor value = (voltage to drop) / current through resistor
Resistor value = 12.6 / 0.3 = 42 ohms
Best fit: 47 ohms // 390 ohms (comes out to 41.945 ohms)
Power through resistors = E**2 / R

(12.6 * 12.6) / 47 = 3.37 watts
(12.6 * 12.6) / 390 = 0.407 watts

A 47-ohm, 5 watt resistor in parallel with a 390-ohm, 5 watt resistor should do the trick.

Date: Sat, 3 Jul 2004 14:09:25 -0400
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: [R-390] Ballast Tubes - Resistor

It has been correctly pointed out that there is an error in my calculations. The total current if the 2 tubes in series is only 300 mA. So the value of the resistor should be doubled to 42 ohms and wattage rating cut in half to 5 watts. See what happens when the memory starts to go!

Date: Sat, 03 Jul 2004 15:03:53 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Ballast Tubes

> From: Bob Camp <ham@cq.nu>
> Date: July 3, 2004 10:03:42 AM EDT
> To: Schluensen <schluensen@freenet.de>
>
> The resistor value does not change for 230 volt versus 115 volt
> operation. The transformer strapping on the primary takes care of this
> variation.
>
> If you have line voltage that is significantly different than the US
> normal 120 / 240 volts AC then there may be differences in the
> resistor value. The same might be true for a 50 Hz system compared to
> a 60 Hz system. Most of us over here have no direct with these radios
> operated off of 50 Hz.
>
> I have several radios that came to me with resistors instead of
> ballast tubes. No two radios have the same resistor in them. They all
> seem to work just fine. As far as I can tell people just grabbed what
> ever was in their junk box when the ballast tube went out.
>
> Here's the basic math on the resistor:
>
> The transformer winding is set up for 25.2 VAC with 115 volts input
> *and* with the ovens turned on. We don't use the ovens any more. The
> net result is that the 25.2 VAC is more like 26.9 VAC.
>
> Two tubes are in series with the ballast, V505 and V701. They are both
> 6BA6W tubes with 6 volt filaments. Most data books show the correct
> voltage and current for the filament as 6.3 volts and 300 ma.
>
> If we just take the center values then we need 26.9 - (6.3 + 6.3) =
> 14.3 volts on the tube. If we want 300 ma at that point then 14.3 /
> 0.3 = 47.667 ohms. That's not a real common value.
>
> Obviously a 47 ohm resistor is a standard value and it should work
> just fine. A 51 ohm resistor would drop the voltage a bit and will
> give you a bit more tube life. A 56 ohm resistor is probably pushing

> things a little, but should work with normal tubes. If you want to
> experiment a little then you can probably go up to 62 or 68 ohms and
> still have things work pretty well. I would not recommend going below
> the 47 ohm number for experimentation. Going that way will work well
> but it will shorten the tube life significantly.
>
> The radios I have are set up with a 47 ohm, a 56 ohm, and one with an
> unknown value. At least that's what I remember from the last time I
> looked at them .... I also seem to remember a radio with a 39 ohm
> resistor in it at a hamfest. Not my radio so I have no idea if it worked at all.
>
> The 47 ohm resistor will dissipate 5 watts when the tubes are warmed
> up. It will run quite a bit more than this for the brief period that
> the tubes are warming up. Normal practice on a resistor is to use one
> that will dissipate 2X the running power. This gets you up to the 10W region.
>
> On page 921 of the US DIgikey catalog they have ALSR-10 power
> resistors listed. A reasonable part number seems to be ALSR10-51-ND
> for the 51 ohms or ALSR10-47-ND for the 47 ohms. Both are $1.69 making
> them a lot less expensive than a ballast tube. Both are rated to
> handle the turn on power in the tubes. They should be a part that will
> last forever. They are $0.13 more expensive than the 5 watt parts that
> would be running at maximum power.
>
> A lot of people make resistors and a lot of people sell resistors. My
> only connection with Huntingtion resistors is that I had dinner in the
> town they are in once. I use Digikey for small parts since they are
> willing to sell you small quantities via credit card. They also seem
> to have a catalog in German ....
>
> Mounting the resistors is the next challenge. SInce the resistor
> replaces the ballast the modules will still be interchangeable between
> radios. The only thing to be careful about is plugging a ballast tube
> into a radio with a resistor. No matter how you do it the resistor
> needs to go between pins 2 and 7 on the tube socket. There are a few
> other possibilities like tying into pin 4 on V505 but I would
> recommend sticking with the ballast tube socket.
>
> I have two radios that have the resistor soldered into top side of the
> tube socket (uggg ...). A second radio has the resistor on a metal
> plug that fits in the tube socket. I have not investigated the room
> under the chassis for mounting the resistor in a more rational
> fashion. If you mount the resistor under the chassis you probably
> should do something on the top side to make it plain that a ballast
> tube no longer belongs in the socket. Strange things can happen when
> you are putting your radio back together at 4AM ...
>
> So now we'll see if I got any of that right ....
>
>>

>> do you know where I can find more Info about the "3TF7 to resistor" -
>> modification??? (socket pins, resistor value for 230Volts AC ...)
>>
>>> From what's been said here they are still available for something in
>>> the $30 to $60 range. Not quite a price that would encourage me to
>>> grab a couple dozen.
>>>
>>> One modification that has not been mentioned as part of this thread
>>> on ballast tubes is probably the oldest of the batch. Grab a plug that
>>> looks like a tube base and wire a resistor to it. The value needs to
>>> be right to get the filaments to run right but that's about all there is
>>> to it. It pulls no more power than the ballast tube and it's a
>>> totally reversible mod. When the bottom drops out of the ballast tube
>>>market you can plug one of those two dollar ballast tubes in there and
>>> nobody will ever know what you did. <snip>

Date: Sat, 03 Jul 2004 15:58:50 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Ballast Tubes - Resistor

Looks like anything between 47 and about 56 ohms will work just fine. Ten watts or larger should last forever. I finally posted the whole mess to the correct mailing list a few minutes ago. I'm not sure what the Teletype guys made of a big long string of stuff about R-390 resistors. Gotta watch the keyboard a bit more closely in the future ....

Date: Sat, 3 Jul 2004 21:42:11 EDT
From: Llgpt@aol.com
Subject: [R-390] Ballast Tube Thread

Oh for the good old days when this thread would trigger an onslaught of e-mails that would jam any server. It appears that the deadest horse that has ever been beat has once again been revived for all the new subscribers and those that have forgotten this dreaded thread. But, gone are the posters of the past, the beehive kickers, the nay sayers and witches who use solid state devices in place of the beloved 3TF7 which is now approaching record prices. Everyone who has replaced this ballast tube can still hear that heterodyne from Pitcairn Island or the flea farting in Fiji, but the legends live on. Where has everyone gone to? Hopefully, not the great listening post in the
sky.....

Les Locklear Monitoring from The Gulf of Mexico

Hammarlund HQ-120X Harris RF-505A (R-5075/GRR)
R-390/URR Ten Tec RX-350D
Alpha Delta Sloper Various Longwires
Monitoring since '57

Date: Sat, 3 Jul 2004 21:48:27 -0400
From: "JamesMiller" <jmiller1706@cfl.rr.com>

Subject: [R-390] Ballast Tubes in Shipment

One or two 390a's I have bought in the past arrived with bad ballast tubes. But they were presumably working before shipment. The only reason I can think of is excessive vibration and breakage of the flimsy filament during shipment. Solution? Before shipping a 390, remove the ballast tube and wrap in soft foam and in a separate box inside the shipping carton.

Date: Sun, 04 Jul 2004 05:30:52 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] Ballast Tubes in Shipment

Yes ... there have been reports of that happening from time to time and when I've had '390's shipped to me, I've asked that the 3TF7 be removed, bubble-wrapped and stuffed in somewhere. Way, way back, someone posted that their ballast tubes would seem to last forever, but a failure, when it occurred, tended to be after the receiver was moved around -- onto the bench or whatever. Others have sort of dismissed all that.

What's curious is that the last model series of the Zenith Tranoceanic tube portables (600 series) and the military version of the 500 series (R-520) all have 50A1 ballast tubes. The construction of the tube is the same -- a 9-pin envelope with a long iron filament strung around almost "nonchalantly" over the mica disks, like a poorly decorated Christmas tree. These are portable, luggage style radios with no shockmounting whatsoever. There were numerous clones and also mil portable gear with ballasts -- and some tube testers. So -- I dunno. If they were prone to vibration damage, would the mfr's go with them in portable gear? Not sure, but I doubt ballast tubes were ever cheap relatively. Nowadays, it's a horse race as to which would cost you more -- a 50A1 vs 3TF7. Of course, those T/O's also have the very pricey 1L6.

As for vibration/shock hot vs. cold -- the T/O's are battery portables, so might very well be in motion while running -- and included the famous removable "wavemagnet" with suction cups so you could attach it to the train or car window while traveling. I suspect failure-proneness may have to do with aging through use -- filament becomes more brittle with more heating and cooling cycles?

Date: Sun, 04 Jul 2004 10:44:43 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Ballast Tubes in Shipment

Battery powered gear is *very* different than line powered stuff. I used to run "portable" FM stuff that ran on batteries. It was amazing to me that the filament D cells would die as fast as they did. The voltage starts out at 1.5 volts but does not stay there for long. It gets down to about a volt fairly quickly. Without *something* to stabilize the oscillator tubes you would need the Energizer bunny and an 18 wheeler to keep your portable radio up and running.Since you always were on the verge of nuking the filament batteries most of the little 1.25 volt tubes didn't have as much margin built into the emissions side of their design. It would be very interesting to see if we can come up with some real transductance versus filament voltage data on

some of these tubes. I actually had do do a lab on it back in High School physics (tubes had just been invented ....) . For some odd reason I seem to have misplaced that log book ....

Since we're dragging everybody back into this .... Chuck Rippel had some stuff on the performance of an real ballast tube up on his site for a while. If it's still there I can't find it with a quick look. The net result of what he found was that the ballast tube was not all that great a regulator in the first place. It was far better than nothing at all but it still wasn't great.

As best anybody can figure the ballast tubes are built by selecting a pretty darn small diameter wire and balancing it against a weird back fill gas mix at partial vacuum levels. Given how much fun it is to get a batch of number 51 wire done up I suspect that on occasion they might have used number 50 or 48 instead. When they did that the extra wire had to go somewhere. Net result was the odd wire running all over the place construction. One very simple explanation for the parts getting fragile would be simple evaporation of the metal from hot spots. It's not a very elegant explanation but it has to happen to some extent. Flexing as the wire heats up and cools down can't help much either. There may be some change in the wire with time but if there is it's not very obvious. A final possibility would be air getting into the poor little thing. With no gettering the oxygen would head straight for the iron wire. Looking at about 90% of the sutf sitting out in the yard here suggests that Iron reacts with oxygen in a predictable way. Bottom line - they used ballast tubes in the portables because they had to. The shock and vibration issues were secondary ....

Date: Sun, 4 Jul 2004 10:47:29 EDT
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] Ballast Tubes

I think this has been said in the past. It is a bit more work in the beginning but I have had very good results by re-wiring the filament line in the I.F. deck to run the BFO and PTO tubes in parallel with the 6.3VAC filament line. This does away with using a resistor and saves the heat being dissipated. If you want to keep the original look of the radio just plug in a dead 3TF7 in the socket and leave it there. No one will know the difference unless they touch the tube and find it is cold. All I know is one time I used a variac and varied the 115 VAC line voltage +/- 10 volts with and without the ballast tube - with the BFO turned on - I couldn't hear any change in the beat note with the receiver tuned to an AM BC station.

Date: Sun, 04 Jul 2004 11:07:45 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Ballast Tubes

If you have a single radio, or can re-wire all your radios to match this works pretty darn well. The problem comes in when you have multiple radios with multiple mods on them. Getting one set of ballast tube mods mixed up with another set can result in unpredictable results

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Date: Sun, 4 Jul 2004 11:11:55 -0400
From: "JamesMiller" <jmiller1706@cfl.rr.com>

Subject: Re: [R-390] Ballast Tube Thread

>From page 15 section 4.2.2.1 AC Power Units of Final Engineering Report on Radio Receivers
R-389 and R-390 Sept. 15, 1953: http://www.r-390a.net/faq-eng-r3.pdf

"The filament regulation circuit for the oscillator filaments should also be covered here although this ballast tube is mounted on the IF unit. Considerable work was done with Amperite Corp. in designing this special ballast tube which feeds a constant 300 mils to the two 6 volt 300 mil oscillator tubes used in the VFO and BFO. These three tubes are connected in series across the 26 volt filament supply. The ballast tube (3TF7) operates on a current of 290 to 330 mA and holds this current within ±10 mA for input voltage variations of ±15%. This reduced the 15% variation to approximately 3%. There is some question if a filament regulator is necessary in these receivers since the oscillators are very good even without regulation. However, since the stability was a big factor in this design and since the factor of tube aging was not known, the regulator was included."

Date: Sun, 04 Jul 2004 11:14:53 -0400
From: Rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Ballast Tube Thread

'll play whatever role you wish pursuant in keeping this alive! I don't get "sucked" into anything! I JUMP in with my eyes open wide. To make sure it is "on-topic", My 50 ohm has after about 8 or so years of use in lieu of the INFAMOUS 3TF7, has drifted to 51 ohms in value.

Date: Mon, 05 Jul 2004 04:36:45 +0000
From: jonandvalerieoldenburg@att.net (Jon Oldenburg)
Subject: Re: [R-390] Ballast Tubes in Shipment

I had 2 failures here on the 3TF7 ballast, one shortly after shipping & the second on a radio that had been in a rack for years. The original 1953 performance reports basically stated it was an overkill in using the ballast regulator but in designing the radio for worst posible condition senairos it was left in. The 1953 Design Report is great reading to give insite to the eveolution of the R-390-URR into the R-390A. In my opinion use the tube if you have it, or insert the resistor. Any other mod should be well documented, but of course once you're gone so is the documentation. I believe Noland's documentation of high hour 27/7/365 operation would suport the theory of thermal shock failure. This is evident to most of us as the failure of a household light bulb, how many fail on power-up verses in use failure? Just remember that use of standby on modern line voltages increases filament voltage so unless you use regulated power to your rack (I used a 2-KW SOLA regulator for a number of years 115volts +- 2% untill my wife got sick of the noise) just shut it down completely or go the 24/7 method.

---Date: Mon, 05 Jul 2004 10:45:40 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Ballast Tube Thread

In defense of what they did it is pretty obvious that these radios got used on supply voltages that went well below 100 volts for significant periods of time. In that case the ballast tube would have done a lot of good. It is very interesting that they pulled a number of other things out of the radio "based on cost considerations" but still had the very expensive ballast in there. The main things they talk about failing against the original specification are the ultimate selectivity and audio numbers. It seems that the audio specification was changed (or at least reinterpreted) late in the program. They seem to have just plain missed the selectivity though. Given the ballast tube's location swapping it out for another IF can should have been a possibility. Sure would be nice to have the meeting notes from the monthly program reviews. I'll bet they had a *lot* of fun trying to work all this stuff out.

Date: Mon, 5 Jul 2004 20:53:43 -0400
From: "JamesMiller" <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] Ballast Tube Thread

History of Amperite company began with Ballast Tubes 1922---Amperite Business Incorporated in New York City, NY by Samuel Ruttenberg- produced cartridge-type Automatic Adjusting Resistors(ballast current-regulators) for tube-operated AC/DC radio sets 1930(circa)---Amperite Began making hermetically-sealed ballast regulators in vacuum tube form with helium and hydrogen gas...

http://www.amperite.com/DesktopDefault.aspx?tabid=10

Date: Mon, 05 Jul 2004 21:09:48 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: Lutefisk and The Ballast Tube Thread - on topic - Haa! - Take that

I'm not real sure we know what the process was that they used to manufacture the ballast tubes. It's pretty obvious that precision wire placement and careful insulator assembly were not part of the process. We obviously have the skills to figure out the wire length, wire gauge, and wire composition they used. No way are you going to convince me that anything closer than a 10% accuracy is needed in ether wire length or diameter. If we send out a tube or two for a residual gas analysis we'll know what the gas mix they used was. The only other variable would be pressure. My guess is that they did a very normal bake out with a vacuum pump on the tubulation. Once the thing is clean on the vac ion gauge you fire up the wire with a constant current source. Then you back fill the tube to the point that the voltage on it drops to a specified value. More or less it's a thermistor vacuum gauge in reverse. Once it's stable with a given gas level you can sweep it to check it's regulation. If it passes you seal it off. If the process is really that simple - why the high cost for these darn things? They never have been cheap. The process can't have been as extensive as a normal vacuum tube. If we have the skills to figure out the details then anybody in the tube business could have. Again - why should these cost so darn much ....

Date: Mon, 05 Jul 2004 21:17:50 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: Ballast Tube Thread - on topic - Haa Haa - take that again ...

So if a ballast tube is so important to making a stable radio that you can't even

replace it with a herring then answer me this: we have the R-390A's dwarf midget child the R-392. The 392 is designed to be a mobile version of the 390. It runs directly off a jeep alternator. Last time I checked an alternator output it wandered around quite a bit depending on the speed of the motor. Both radios were supposed to do the same FSK stuff at roughly the same stability. The R-390A did it at a line voltage of say +/- 10%. The 392 did it at a supply between 22 and 32 volts. So why no ballast tube in the 392 ???? If one was needed that's the radio that should have gotten it. It didn't even get a herring ....

Date: Wed, 07 Jul 2004 20:25:28 -0400
From: Bob Camp <ham@cq.nu>
Subject: [R-390] VFO / BFO with no ballast.

I have radios with both setups (ballast and no ballast). I can see absolutely no difference between the two as far as stability.

Date: Wed, 7 Jul 2004 21:56:26 -0400
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>
Subject: Re: [R-390] A few SP-600 questions

I generally agree, but there is one mod suggested by Kleronomos that should be avoided. He suggests putting in a current regulator in the filament supply for the RF desk. The idea is to stabilize the power to the VFO tube filament to improve frequency stability. That is a laudable goal, but doing it with a current regulator to a bunch of tubes that are wired in parallel is asking for trouble. If one of the tubes filaments goes open, the current regulator will pump 4 tubes worth of filament current into the remaining 3 tubes. The voltage across the filaments will go up accordingly. Bad idea. Kiss off four tubes just because one died. If you want to regulate the filament of the VFO, you should put in a voltage regulator - not a current regulator. Unless, of course, you also plan to rewire the filaments so they are no longer in parallel. The reason the ballast tube in the R-390A works is because the tubes it regulates are in series - not in parallel.

Date: Wed, 7 Jul 2004 20:58:58 -0500
From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] VFO / BFO with no ballast.

Now to get a decent freq counter that I can synch to my GPS standard and check the drift with and without. Not sure it is worth the trouble though, I doubt if I can find any difference. Be neat the lock the crystal oscillators in the thing to the 10 mhz standard though.. hmmm. But, Bob and group, I've notice no discernable differences with jumpers and 12BA6's or with a resistor. I think the main thing is that the ballast was indeed designed to compensate for the variety of mains voltages the radio was likely to encounter in the field and with reasonably stable home AC power, it is not likely to be of much use.

Date: Fri, 9 Jul 2004 17:57:56 -0500
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] An ON TOPIC ballast replacement question

A while back someone had come up with a ballast replacement that used a bridge and instead of a simple transistor arrangement it used a voltage regulator? Anyone have a recollection of that design or did it get mentioned and lost in the past weekend's clam bake?

---From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] An ON TOPIC ballast replacement question

Ok, here's the "bridge" version of the ballast tube replacement: You wire up a normal four diode full wave bridge rectifier to the two ballast tube pins (2 and 7 as I recall). The "ac" pins on the rectifier go to these pins. On the "dc" side of the rectifier you put a 47 uf capacitor (to keep the regulator stable) and a nice normal three terminal regulator. Five, 3.3 and 1.25 volt regulators all seem to have been used at one timer or another. Another capacitor, also a couple uf goes on the regulator output (also for stability).

Finally you put a load resistor on the regulator output that will pull 300 ma at what ever voltage your regulator puts out. Since the load resistor is on the constant voltage side of the regulator it will always see the same voltage and thus always pull the same current.

The net result is a solid state DC constant current sink hooked up to do AC.

The down side is that the AC current flows in pulses rather than as a continous current. Thus you get RFI. You can play with the value of the 47 uf capacitor to make the pulses wider. The lower the value of the capacitor the wider the pulses and the more ripple at the input to the regulator. You have to stop dropping the value of the capacitor when the ripple gets so great that the regulator drops out.

No matter how slick you get with the value of the capacitor you will still have pulsing current, it's only a matter of how much you get. Also remember that a proper AC current waveform goes from zero to 1.414 times the RMS current during each half cycle. This little gizmo would be perfectly happy if the current was a square wave at the RMS value....

All that said the circuit does work. If you have significant amounts of time when your line voltage swings from 95 volts up to 130 volts then I would strongly recommend you use something as ballast ....

Date: Sat, 10 Jul 2004 19:17:17 -0400
From: Rbethman <rbethman@comcast.net>
Subject: [R-390] Another ballast tube replacement

While digging around the proverbial "junque" box, I stumbled across something from MANY years ago. It MAY prove to make another replacement for ballast tubes. This particular item is an SO-239 connector with a GE-47 bulb soldered in. It also has a red flexible translucent tip. These were sold approx 20+ yrs ago as <cringe> CB dummy loads. If this took the 4 watt carrier AND the modulation, AND provided a 50 ohm load, THEN a #47 soldered with wires one then inserted into pin 2 the other into 7, it SHOULD replace the ballast tube. NO RFI.

Date: Sun, 11 Jul 2004 07:55:33 -0400
From: "Steve Hobensack" <stevehobensack@hotmail.com>
Subject: RE: [R-390] Another ballast tube replacement

I think it was a PR16 flashlight bulb.

Date: Sun, 05 Sep 2004 21:54:28 -0500
From: Mahlon Haunschild <mahlonhaunschild@cox.net>
Subject: [R-390] TJ311M01 sighting at Shelby

At Shelby this weekend a tube-head in the flea market forced me to purchase a pair of TJ311M01s from him for $5 the pair (yes, that's right, $5). As most of us know, the TJ311M01 is essentially the same as the 3TF7. Just wanted to note here that these particular examples were made by Victoreen in 3/56, so it seems that there were other sources/production lots made other than Amperite in 1978 (as one source has noted). Just so you know.

Date: Sun, 5 Sep 2004 23:03:34 EDT
From: Llgpt@aol.com
Subject: Re: [R-390] TJ311M01 sighting at Shelby

Just hoping they work.....of course if they don't, silicon will.

Date: Sun, 05 Sep 2004 22:35:10 -0500
From: bw <ba.williams@charter.net>
Subject: Re: [R-390] TJ311M01 sighting at Shelby

If not, wire and a 12BA7 works well. You can skip the witchcraft part too.

Date: Mon, 06 Sep 2004 16:19:03 -0500
From: Mahlon Haunschild <mahlonhaunschild@cox.net>
Subject: Re: [R-390] TJ311M01 sighting at Shelby

3Z6925-19.3 1 EACH RESISTOR, CURRENT REGULATING
TJ311Mo1 (NOTE: yes, that's a little "owe" not a "zero") 11412-P-54-59 (51)
MFG BY VICTOREEN INST.CO. DATE PKD : 3/56

Apparently this was a US Army contract; the tubes are lettered "US ARMY" as well. I'm guessing here, but it seems to me that the usage of the little "owe" was to denote a "zero" whereas an upper case "owe" would denote an actual "owe". Cold DC resistance: 12.4 / 12.6 ohms

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Date: Mon, 06 Sep 2004 20:00:15 -0500
From: Mahlon Haunschild <mahlonhaunschild@cox.net>
Subject: Re: [R-390] TJ311M01 sighting at Shelby

Forgot to mention: Rubber-stamped on another side of the boxes is what appears to be the FSN: 5905-502-4840

Date: Fri, 24 Sep 2004 08:36:01 -0500
From: "Dallas Lankford" <dallas@bayou.com>
Subject: [R-390] 3TF7 Substitutes

The standard 3TF7 substitutes,

(1) using a 42 or 43 ohm 10 watt resistor in place of the 3TF7, and

(2) using an appropriate tube, like a 12BY7A, with a 12.6 volt filament in place of the 3TF7 are both acceptable substitutes.

Using a 10 MHz rubidium standard I determined, somewhat to my surprise, that the power resistor is generally a more stable substitute than a 12BY7A. Recently while examining the long term frequency stability of one of my R-390A's with the BFO turned ON (for SSB, ECSS, or CW) using a rubidium standard, I found that the 3TF7 does not do a very good job of stabilizing the BFO and PTO frequencies when the AC line is varied. A change of only 2 or 3 VAC in the line voltage (I used a VARIAC to vary the AC input voltage to the R-390A) causes a substantial (4 or 5 or 6 Hz or more) departure from zero beat. Next, I removed the 3TF7, inserted a 9 pin tube test extender into the 3TF7 socket, and powered the BFO and PTO filaments with an external regulated 12 VDC supply (12 VDC was found to give almost exactly 300 mA filament current). With this arrangement, no change in zero beat was observed as the AC line voltage was varied from 120 VAC nominal down to 100 VAC and back up to 120 VAC. WOW. Whoever designed the original BFO and PTO filament stabilizition circuit was on the right track. They just used the wrong method to stabilize it. Current regulation is the wrong approach; voltage regulation is the correct approach.

Rather than rewire the 3TF7 socket, I opted to make the mod "plug-in" in so far as it was possible. I cut the metal flange off a miniature 9 pin ceramic tube socket, pushed 9 pieces of #18 tinned solid copper wire in each receptacle, soldered them, cut off the ends to the appropriaste length for a 9 pin tube, deburred and polished the tips, drilled out the cylindrical center piece of metal and removed it. I ground off most of the head of a 6-32 brass screw of the appropriate length and attached an inch long (or somewhat longer) insulated spacer, and mounted an insulated standoff on the threaded end. This provided me with a home made tube socket extender on which I could build most of a 12 VDC regulator. There is a nut on the front of the IF deck where I added a ground lug. I ran a diode from the #2 pin lug of the adapter to the standoff, and a 1000 mF 50 volt electrolytic from the standoff to the ground lug. The ground tab of a 3 pin 12 volt 1 amp regulator was attached to the RF deck corner nearest the IF deck using one of the green screws that hold the oscillator deck to the RF deck plate; the regulator pins stick up above the top edge of the RF deck plate. The input and output pins of the regulator were bypassed to the ground pin with 0.1 mF 50 volt capacitors, and the regulator ground pin was wired to the added ground lug on the IF deck. An insulated wire from the standoff to the regulator input pin and an insulated wire from the regulator output pin to lug 7 of the plug-in adapter completed the modification. Well almost... three (3) complete wraps around the lugs of the home made adapter with Scotch Glass Cloth Electrical Tape and heat shrink tubing on the standoff protected the plug-in adapter from shorts. This mod is not

100% plug-in because to remove it you have to (1) remove the nut on the front of the IF deck to remove the ground lug, and (2) remove the green screw on the RF deck to remove the 3 pin regulator.

I have now had the mod running continuously for about 48 hours. No problems were expected and no problems have been experienced. Not only does this mod give you improved frequency stability for ECSS, SSB, and CW, it should also provide a permanent solution for the 3TF7 replacement problem. There is still some very slow frequency drift, as much as 1 Hz per hour, sometimes more. I currently do not know the cause of this drift.

Date: Fri, 24 Sep 2004 12:29:17 -0500
From: mikea <mikea@mikea.ath.cx>
Subject: Re: [R-390] 3TF7 Substitutes

Thanks _very_ much for your research results. I have had the benefit of your expertise for some years now, and think it is appropriate to give you your due in public. I feel some construction coming on.

Date: Fri, 24 Sep 2004 12:44:35 -0500
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Fw: [R-390] 3TF7 Substitutes

>I have already spotted a few typos in my postring, which I believe will be obvious to those >who read it. I meant to include that I used a 1N4003 diode, >200 PIV and 1 amp.

I presume a 100 PIV 1 amp diode would be fine. I just happened to have 1N4003's on hand.

>Also, be sure to mount the 3 pin regulator to the RF deck plate (unless you >want to drill a hole in the IF deck and mount it there). .....

I don't know how large a heat sink the regulator actually needs, but the RF deck front plate is surely much more than enough.

Date: Fri, 24 Sep 2004 13:09:48 -0500
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] 3TF7 Substitutes

No, I have not seen a spec on frequency shift vs. line voltage change. If you find it, I would like to see a copy. For a stock R-390A and the usual applications exceptional stability is not necessary, just as my BFO vernier fine tuning mod is not rerally necessary. But if you like your SSB to sound like AM, then the fine tuning mod is a step in the right direction. And the remaining step (there may be a 3rd if I can figure out where this slow +/- 1 Hz or so drift is coming from) is the 3TF7 replacement with a 12 VDC regulator. Then when your AC or 50 amp
electric CH kicks in, the SSB tone (or CWS tone) won't change. And when the fellow you are listening to drifts off 5 or 6 Hz, you will know it is him, and not because your house line voltage drifted off several volts. For ECSS (which hams seldom use, but

which is a mainstay of AM DXers), staying on frequency is important for obtaining the best recovered audio from difficult DX. As for spookland, there is no telling what they are up to. But it wouldn't surprise me if they didn't still have some rooms full of R-390A's.

> 10,000 thanks for publishing your results. Those are exactly the types of experimentation and subsequent analysis that help the hobby. (That is, as opposed to some witchcraft that somebody thought appropriate, seemed to work for him, but was fundamentally wrong all the time. We see enough of those.) I think I ran across a spec for the R-390A as built by Hammarlund (thus EAC) where they quoted 30 Hz or so shift in received frequency when the line voltage varied from 90 volts up to 120 volts. I'll see if I can find that spec and pass it on. You may already have seen this spec yourself. But except for really critical applications (I don't know, maybe 16 multiplexed TTY channels) in the 1950's, even 30 Hz shift shouldn't be too much of a bother. But then in some Black application of the radios, I could be way off base.

Date: Fri, 24 Sep 2004 13:29:40 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] 3TF7 Substitutes

If you're in the mood for construction and would prefer to make *no modifications whatsoever* to your radio, you might consider the 3DW7A, which I designed a while back. Thanks again to Roy Morgan for massaging the picture into a portable format. I tried to post it here, but the listserv rejected the .jpg attachment. Contact me off-list and I'll email it to you. The single-source items (the MOSFETs and the RMS converter IC) are available at DigiKey. Everything else is generic. It's a cool-running two-pin module, although you'll need a magnifying glass and tweezers to cram it into the "tubester" form factor like I did. Maybe I ought to post a photo of the completed unit to prove it can be done. By the way, I'm still working on the 3DW7D, which does the same job digitally at about 1/2 the parts count. Somebody asked for a LED to simulate the olde-tyme glow, and I got carried away. Soon (but that means < 5 years :)

Date: Fri, 24 Sep 2004 16:25:20 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] 3TF7 Substitutes

There are any number of complex ways to solve the 3TF7 issue but we should not be short sighted and forget about any noise that might be generated by the solution. Linear regulator circuits work great but are quite noisy. The new fangled sand box radios suffer from many problems associated with noise generated by devices internal to the radio...fortunately the 390 series doesn't have that problem....that's one of the things that makes it such a stand out performer.

Date: Fri, 24 Sep 2004 14:51:56 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] 3TF7 Substitutes

Right. (I presume you mean "switching regulator circuits", not linear.) By the way I did a linear regulator too. It worked fine but I didn't like the extra stuff cluttering up the

view.

I once put a Sangean ATS-803A at maximum gain right next to the 3DW7A when it was still a breadboard, and with certain antenna orientations I could hear a little bit of hash around 150-300kHz. I don't hear any noise in the R-390A itself, at any frequency. My circuit uses reverse phase control at 120Hz, which is much quieter than anything one can do with the kind of switcher you're probably thinking of. The MOSFET pass elements are on at zero cross, and softly turn off part way through the waveform. I'm not arguing that my circuit is simple, far from it. Some would call it an obsession gone wrong. But to my knowledge it's the only good regulator that is also 100% nonintrusive. You don't so much as have to loosen a screw, you just plug it in like a 3TF7 and it plays.

Date: Fri, 24 Sep 2004 17:01:06 -0500
From: "Dallas Lankford" <dallas@bayou.com>
Subject: Re: [R-390] 3TF7 Substitutes

Uhhh... I guess I need to look at my mod again and try to figure out where it is invasive. I must have missed something. But you can get all my parts, except the miniature 9 pin tube socket, at Radio Shack. I think that outweighs any invasiveness (which I can't seem to find anyway).

Date: Fri, 24 Sep 2004 20:08:37 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] 3TF7 Substitutes

The crystals in the crystal oscillator deck probably have a 0.25 to 0.5 ppm per degree C temperature coefficient when the radio is at normal room temperature. On the 10 MHz band the second crystal oscillator is running at 13 MHz. A one hertz drift on a 10 MHz signal would equate to roughly 0.08 ppm of drift on the second crystal oscillator. That would equate to something in the range of a degree C change every three to six hours. That's not a bad temperature change for a room with good temperature control.

Date: Sat, 25 Sep 2004 10:40:27 +1000
From: "Bernie Nicholson" <vk2abn@batemansbay.com>
Subject: [R-390] 3tf7

I still maintain that shorting out the conections for the 3TF7 and replacing the BFO &VFO with 12BA6 tubes is the simplest way to go and the placing of the 3TF7 socket is just right for a 12AU7 double triode product detector ,I use mine all the time on SSB and after half an hour drift is no problem

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Date: Fri, 24 Sep 2004 18:24:41 -0700
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] 3tf7

Let us get down to the nitty gritty. I have over 40 R-39XX and have never had a 3TF7 failure. I have heard of "VERY" few failures. How many TECHS out there that really worked on the units can verify that this is a real. HOW ABOUT SOME PROOF IN THE

PUDDING AS THE OLD SAYING GOES. Some people hype this to sell upgrades and mods. As Nolan Said he had some running 24/7 for over 7 years with no failures. WHO IS TOOTING WHOSE HORN. I have sold over 100 NIBOS 3TF7's and nobody has ordered one other than as a spare or some bought several maybe to speculate on later. It is amazing that these fine units worked all over the world in had to various power conditions without the use of variacs, inrush limiters and with and with out black tube shields, in racks and racks and running 24/7. If you do not get the point then call ET in one of his calls home. HOW MANY PEOPLE OUT THERE CAN TRULY VERIFY A 3TF7 FAILURE. as i slide off of my soap box and my .002 worth.

Date: Fri, 24 Sep 2004 21:24:08 -0500
From: mikea <mikea@mikea.ath.cx>
Subject: Re: [R-390] 3tf7

Here's _one_. My R-390, after about 15 months continuous power-on, went deaf, and investigation revealed an open 3TF7. I cannibalized one from the EAC R-390A, and the R-390 came back to life.

Date: Fri, 24 Sep 2004 22:45:16 -0400
From: "Ray, W2EC" <w2ec@attglobal.net>
Subject: Re: [R-390] 3tf7

I've only had 3 personal R-390A's and one R-391. I've had one failure in a R-390A while it was in service in my home shack, one of my R-390A's had an open 3TF7 on arrival and a second R-390A arrived minus the 3TF7, reason unknown. I wasn't keeping track so I don't know which one of my three R-390A's the failure occured in, the one I received with a good 3TF7, the one I relaced the 3TF7 in or the one I had to put the 3TF7 in since it was missing one at the start.

Date: Fri, 24 Sep 2004 19:59:59 -0700
From: Greg Mengell <gregorymengell@comcast.net>
Subject: Re: [R-390] 3tf7

I have had four 3TF7 failures since 1973. Two were in radios purchased and transported by motor frieght. Four in thirty-plus years isn`t so bad. Hey, Hank, what would you want for a couple more? I tend to agree with Hank. These radios were built to work under very severe conditions and to work 24/7. Both the R390A and R390 were /are superbly designed radio recievers.

Date: Fri, 24 Sep 2004 23:34:21 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] 3tf7

A total of three failures out of less than 15 radios.

1) Radio I got on the "E" place and it came with a resistor where the 3TF7 used to be.

2) Hamfest acquisition. It was working when bought and was dead when I got it home.

3) Fair radio was the source. It arrived with a dead ballast tube. I have stood there and watched Fair check out R-390's. I am *very* sure it did not leave Lima with a dead ballast tube. Just for the record there was no problem getting the part replaced.

Obviously I did not see the first one fail. I can only draw the conclusion that it failed. Maybe that one does not count. The other two have an obvious common element. The R390 got bounced all over New England with a used ballast tube in it. I suspect that is not a real good thing to do to a 20 or 30 year old ballast tube. To your point. I have never seen one fail in a radio that was operating normally. Assuming they survive transport they seem to be fairly reliable.

Date: Sat, 25 Sep 2004 00:19:29 EDT
From: Radiograveyard@aol.com
Subject: [R-390] RE 3TF7

I have to agree with Hank when I bought the 134 from the government all were missing the 5814s many 6C4s and other tubes BUT most had the 3TF7s still in the sets and all were good no bad ones. Like they say if it ain't broke don't fix it. I personally have had one failure last year in my 67 EAC everyday user.

Date: Sat, 25 Sep 2004 09:57:25 -0700 (PDT)
From: "Richard M. MC Clung" <wa6knw@sbcglobal.net>
Subject: [R-390] RE 3TF7

The ballast failures that I observed During 21 years of militaryservice:

R-390 and R-390A Failures:
Mobile: 4 that I can remember.
Transportable: 3
Fixed Station: None.
R-392 Failures:
Mobile: 6 that I can remember. and one R-392 of my collection while using the RCVR.

Date: Sat, 25 Sep 2004 15:11:10 -0500
From: "Francesco Ledda" <frledda@comcast.net>
Subject: RE: [R-390] RE 3TF7

I have two 392s, and none of them have 3TF7s.

Date: Sun, 26 Sep 2004 11:12:02 +1000
From: "Bernie Nicholson" <vk2abn@batemansbay.com>
Subject: [R-390] 3TF7 s

I have 3 receivers (390A) and in 25 years I have had two 3TF7 tubes that have gontogod

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Date: Sun, 26 Sep 2004 01:02:16 -0700 (PDT)
From: "Richard M. MC Clung" <wa6knw@sbcglobal.net>
Subject: RE: [R-390] RE 3TF7

The reference to the ballast failures in the R-392 that I made earlier should actually reference to the similar series filament circuit of the PTO / BFO in the R-392. The is, of course, no ballast in series with these filaments. But they will open due to voltage spikes caused when the primary DC power is running over 28VDC and the RCVR is powered up or when the vehicle is started to charge batteries or when switching from vehicular to generator power. Sorry for any confusion. It was my age addled brain causing it.

Date: Sun, 26 Sep 2004 16:26:34 -0400
From: "John B." <john@gumlog.net>
Subject: Re: [R-390] 3TF7

I've owned one R-390, one R-1247/GRC-129 and one R-390-A and have only experienced one radio failure that was related to the current regulator.

The R-390 did not have a 3TF7 installed when I bought it in 1976. In order to get it running, I temporarily put a 43 ohm, 5w resistor in the 3TF7 socket and when I foolishly sold it in 1981, it went to the new owner with the resistor still installed.

The R-1247 developed an intermittent frying noise that turned out to be a 5749 with an intermittent short. Further investigation revealed that the current regulator had been replaced incorrectly with a 3HTF4, which left the two 5749s to divide about 18v.

No wonder the tube had problems. Replaced all three, the 5749s and the wrong regulator for a 3TF7 that receiver has been playing well with occasional service from 1981 through today.

The R-390A, a Motorola, 14 Ph 56 contract had a TJ311M01 installed when I got the receiver in the spring of 1982, and is still working fine as my chair-side monitor receiver in our den.

I'm like you, I believe most of the 3TF7 failures are man made or by extreme vibration of a well used 3TF7 during shipment.

Date: Wed, 29 Sep 2004 20:49:31 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] On 3TF7's...

On the topic of the 3TF7 ballastube, Dallas Lankford wrote: (snipped)

>...I found that the 3TF7 does not do a very good job of stabilizing the
>BFO and PTO frequencies when the AC line is varied.

There are other failure modes for the 3TF7 other than just going "open". I have one which "regulates" at 350 mA; another list member reported having one at around 240 mA (the spec is 300mA). The degree of regulation probably is degraded with that type of failure. It could be that Dallas' 3TF7 has that defect.

Dallas continued:

>Whoever designed the original BFO and PTO filament stabilization circuit
>was on the right track. They just used the wrong method to stabilize it.
>Current regulation is the wrong approach; voltage regulation is the correct
>approach.

A good 3TF7 is specified to hold current constant within +-1% over the voltage range. Perhaps that performance is not adequate for the ultimate in PTO/BFO frequency stability. Either current regulation or voltage regulation would accomplish the same desired result in terms of frequency stabilization. The designers used current regulation because that was far simpler to implement with the technology of the era. Their current regulators weren't as good as those we can inexpensively build today. Current regulation has an added benefit in that it eliminates inrush current surge on startup. That high current (a bit over 2 amps for a 6BA6) causes a brief heater hot spot which eventually burns open. Tube heaters are generally designed to reduce that effect, but it still remains to some extent. (Extreme example: I have a few Bugle Boy 12AX7's the lowest part of whose heaters flashes brilliant white on startup). A few current regulators using the LM317 have been described in this forum. One is Dr. Gerald Johnson's simple AC regulator. While his circuit does not get the best performance from the LM317, it is still quite good and much much better than a recalcitrant 3TF7. It dissipates no more power than the 3TF7 and places neither asymmetric load nor current spikes on the power transformer. Another is Dave Wise's LM317 DC circuit (not his phase control based "3DW7" designs). Its regulation is excellent and is adjustable from 270 mA to 330 mA IIRC, but it generates more heat than Jerry's circuit (I calculated something around 7 watts compared to the 3.8 watts of Jerry's design). With its half wave rectification it places an unbalanced load with high current peaks on the transformer. Dave incorporated series resistance to reduce those peaks somewhat. Dallas' voltage regulator circuit generates higher heat and without the aforementioned refinement used by Dave draws even higher current spikes in its unbalanced load from the transformer. Dallas' circuit is not adjustable and is simpler than Dave's. May I suggest yet another DC current regulator circuit? Connect 25.2 VAC from ballasocket to anode of diode (1N4002 and up suitable). Connect cathode to + side of 1000 uF 50V electrolytic capacitor. Ground - side of cap. Run DC thus formed from + of cap to input of LM317 (pin 3). Connect load at 3TF7 socket (the connection to the seriesed BFO and PTO tube heaters) to LM317 adjust terminal (pin 1). Connect a current sense resistor (4.166 ohms, 1 watt) from LM317 output terminal (pin 2) to the adjust terminal. A 4.0 ohm, 1% resistor will give nominally 313 mA - close enough to the desired 300 mA. For those who want to set the current exactly (given the LM317's Vref tolerance) use 5.0 ohms in parallel with 20 to 33 ohms. Add the obligatory short leaded, grounded .1 uF caps on LM317 input and output to quell LM317 oscillation/noise tendencies. Heatsink well. That circuit would have close DC current regulation, not be as readily adjustable as Dave's, be simpler than Dave's, more complex than Dallas' and have the same high input current spikes, unbalanced load, and excess heat as Dallas'.

Both the circuit I propose and Dallas' could be made to dissipate a little less heat and be a little less "spikey" by reducing the filter cap to 470 uF thereby allowing more ripple (not Chuck) at the regulator chip's input. That would have no noticeable effect on regulation.

While the current spikes and unbalanced load of half wave rectification with capacitive filtering will cause additional heating in the R-390x power transformer, I'm of the opinion that there would probably be no detriment given the transformer's conservative design and massive size. The transformer's existing load is symmetric and spike free, comprising resistive and full wave rectified choke input. The added half wave rectified load is small by comparison and hence would be "diluted".

On 3 terminal regulator noise Cecil Acuff wrote: (snipped)
>There are any number of complex ways to solve the 3TF7 issue but we should
>not be short sighted and forget about any noise that might be generated by
>the solution. Linear regulator circuits work great but are quite noisy.
>The new fangled sand box radios suffer from many problems associated with
>noise generated by devices internal to the radio...

I don't know how much of a problem that would be for an R-390x using a 3 terminal device for PTO/BFO tube heater regulation. The radios having that malady have operating bias voltages so regulated/adulterated. OTOH, heater power is not directly associated with the signal path, though there can still be some leakage. In the R-390x, encountered first after the tube heater regulator's output is the BFO tube heater. There and at the detector the signal level is high enough that 3 terminal regulator noise would be miniscule by comparison. Next in line is the PTO tube heater. That is fed through a brute-force LC noise filtering circuit included by the designers to keep PTO signal in and noise out; no trouble there. Any noise problem caused by the aforementioned heater usage of 3 terminal regulator would most likely be due to radiation from heater wiring inside the IF module. That would be dependent on existing lead dress and shielding. An inductor and another 0.1 uF capacitor could be connected to the regulator output to form a pi-section brute force filter thereby addressing any noise concerns.

Not all of us demand the ultimate in stability from our R-390x. On ballasubstitution, Jerry wrote a while back: (snipped)
>The purist restorationist will want to use ballast tubes until there are
>no more. The picky will want to go solid state regulation, and the AM
>listener probably will be super happy with a pair of 12BA6 and a jumper.
>Since the 12BA6 was the standard IF tube in 4 and 5 tube AC/DC radios using
>miniature tubes, there should be a million of them about or more.

A schematic of Jerry's AC current regulator and a component connection description of Dave's DC current regulator can be found under the "Ballast Tube" heading in Wei-i Li's brilliantly conceived "Pearls of Wisdom".

Go to r-390a.net . Select "References", "Pearls of Wisdom". There reside postings from this forum painstakingly distilled over the years. There is much enlightenment to be gleaned and amusement to be had by perusal of the lively and animated discourse over this most controversial of R-390x topics.

Date: Thu, 30 Sep 2004 19:28:55 -0400
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] On 3TF7's...

The main issue with the 3TF7 is that is is designed to regulate around a line voltage of about 108 VAC. With 122 VAC line power you are getting close to the "unregulated" end of the 3TF7's range. Since the 3TF7 works just like a tube filament it has the same inrush current issue as a tube. Other types of current regulation will take care of the tube inrush but a 3TF7 will not. It's not very clear exactly how important the inrush effect is on receiving tubes. As far as I can see tubes are pretty reliable as long as you don't vibrate them. That makes it a bit tough to quantify an improvement from inrush limiting. The whole issue of half wave rectification to run the tube filaments has as you mention been thrashed out at great length in the past. One idea that has not been tossed around is to lift the far end of the regulated filament string and then full wave rectify the AC. That would at least reduce the level of pulsation on the AC line. I have never
taken a look at the connectors involved to see if there are enough spares to make it something you could do.

Date: Mon, 04 Oct 2004 17:01:54 -0400
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] On 3TF7's...

>The main issue with the 3TF7 is that is is designed to regulate around a line voltage of about 108 VAC. With 122 VAC line power.... close to the "unregulated" end of the 3TF7's range.

The 3TF7's voltage range is 8.6 to 16.6 volts; at 122 VAC line the 3TF7 would see about 16v. One could insert resistance in series with the 3TF7 to reduce voltage and lengthen that tube's life. With 13 ohms in series the 3TF7 would see about 12v at 122 VAC line. If the line were to then drop to 110v the 3TF7 would see 8.6v; at any lower line voltage it would drop out of regulation. Most of us do not run our R-390x at less than 110VAC; series resistance might be a good option. National issued a service bulletin instructing NC-300/303 users to insert resistance in series with the radio's unreliable 4H4C ballastube; R-390x owners are hardly alone in dealing with ballasfailures.

>It's not very clear exactly how important the inrush effect is on receiving
>tubes. As far as I can see tubes are pretty reliable as long as you don't vibrate them. .....

Good point. How many of our tubes fail from open heaters? I find relatively few.

>.....One idea that has not been tossed around is to lift the far end of the regulated filament >string and then full wave rectify the AC.

The grounded far end is the PTO tube heater. That tube's hot side is filtered by an LC network.If the far end were lifted it would be necessary to add there another LC network to keep RF signals where they belong. It would probably be easier to full wave rectify (bridge) right at the secondary terminals of the power transformer and use pulsating DC for the whole radio's 25.2 VAC needs (don't forget to add a hash suppression cap across each of the bridge's diodes). A solid state ballast replacement module would then have a diode at the input to isolate the module's filter capacitance from the rest of the 25v circuits. The other circuits would otherwise

see about 35VDC filtered instead of the intended pulsating nominal 25VDC; the ovens (we all have those turned off, right?) would fry eggs and the antenna relay would pull in with a heated vengeance.

Date: Mon, 04 Oct 2004 15:12:04 -0700
From: Dan Arney <hankarn@pacbell.net>
Subject: Re: [R-390] On 3TF7's...

I asked how many people had an actual 3TF7 failure that they knew of. Out of all of the considerable replies that came in the total was under 100. One person lost 3 in one unit due to a power supply problem.

Date: Tue, 05 Oct 2004 14:20:02 -0400
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] On 3TF7's...

>The 3TF7's voltage range is 8.6 to 16.6 volts; at 122 VAC line the 3TF7 would see about 16v. >...13 ohms in series the 3TF7 would see about 12v at 122 VAC line. If the line were to then >drop to 110v the 3TF7 would see 8.6v; at any lower line voltage it would drop out of regulation.

Thanks for your sensible idea. I would add that the resistor will limit the inrush current to the ballast and the tubes, and presumably lengthen their lives. The ballast would "drop"out of regulation fairly quickly on the low voltage side, not just quit like solly state or even hollow state regulators can. On the upper side of the voltage range, the degradation in performance is less sudden. There used to be a web link for a graph of the ballast characteristics with explanation of how they work, but I cannot find it today.. the page was ballasts.htm If anyone finds that, please let me know. (I do have a copy of it here.)

>National issued a service bulletin instructing NC-300/303 users to insert resistance in series >with the radio's unreliable 4H4C ballastube; R-390x owners are hardly alone in dealing with >ballast tube failures.

Hammarlund issued a bulletin to use a 6V6 instead of the 4H4C in the HRO-60 and other radios. One reported reason was the increasing difficulty in finding the ballast tube.

> The whole issue of half wave rectification to run the tube filaments has
> as you mention been thrashed out at great length in the past. One idea
> that has not been tossed around is to lift the far end of the regulated
> filament string and then full wave rectify the AC....

While re-reading the article in HSN* on the VLF mod to the R-390A, I discovered a seldom-referred to Ballast replacement mod. (The 12 volt tubes with shorted ballast, and the 42 ohm 5 watt resistor mods are also mentioned.) It is basically a triac acting as both rectifier and voltage adjust device. It requires connection to only the two pins used by the ballast tube, and ground. The ac filament supply is rectified, filtered by a 3000 uF cap and sent on to the two regulated filaments. A 14 -15 volt zener and pot allow for adjusting the output voltage.

* "The R-390A on Longwave -- Cheaply" From Craig-Healy comes this article he originally wrote for "LOWDOWN"

Published in the predecessor to Hollow State News:
The R390 USERS GROUP A Newsletter for URR Users
Vol 1 No. 2 a tradition since March

(My copy of this issue is not dated, but it mentions to expect the next issue in September 1983. The publisher, T.J. Skip Arey, WB2C (G??), says they had 70 members at that time.)

Date: Sun, 14 Nov 2004 21:52:12 +0000
From: Charles B <ka4prf@us-it.net>
Subject: [R-390] 3TF7 resistor replacement

Can some one give me the specifics on how to replace the 3TF7 Ballast tube with a 42 OHM resistor? I am wondering where the resistor leads are placed in the tube pin holds etc. Any help would be appreciated.

Date: Sun, 14 Nov 2004 18:19:15 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] 3TF7 resistor replacement

The resistor goes between pins 2 and 7. Page 115 in the Y2K manual ..... There was a fairly extensive thread on this back a couple of months ago. You can probably find it in the archives. All of the plusses and minuses of the various ballast tube modifications were brought up. Best bet is if you have a plug that will go into the tube socket. That way you can replace the mod if you find a ballast tube later. Alternately you can solder the resistor to the tube socket pins under the IF module.

Date: Sun, 14 Nov 2004 19:03:41 -0800
From: "Bruce Hagen" <bhagen@msn.com>
Subject: [R-390] 3TF7

The Amperite TJ311M01 is suppose to be a direct sub for the 3TF7and is still available from some internet tube merchants.

Date: Sun, 14 Nov 2004 18:55:38 -0500
From: Bruce MacLellan <brumac@juno.com>
Subject: Re: [R-390] 3TF7 resistor replacement

I had a ballast fail on me last night. I replaced it with two 51 ohm resistors in parallel inserted into #2 and #7 socket positions, Use 2 watt or better. A bit of shrink tubing on the leads will keep them away from the socket shield mount. If you don't have carbon you can get MOV s in 3 and 5 watt values from Mouser. It works well for me.

Date: Sun, 14 Nov 2004 20:46:45 -0800
From: "Bruce Hagen" <bhagen@msn.com>
Subject: [R-390] 3TF7 info

The Amperite web page lists this as a type still available.

Date: Mon, 15 Nov 2004 13:18:02 -0500
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] RE: 3TF7 resistor replacement

>Alternately you can solder the resistor to the tube socket pins under the IF module.<snipped>

That is neat and unobtrusive, but will add almost 4 watts of heat under the IF module. Baked BFO, anyone?

>I had a ballast fail on me last night. I replaced it with two 51 ohm <snip>

Two 51 ohm resistors in parallel is about 25 ohms; that value is too low. The desired value is 42 ohms. A 47 ohm resistor will work. A sufficient power rating is 5 watts; a 10 watt unit would run cooler and be less of a tempation on which to burn your fingers Bruce wrote of "MOV's" from Mouser, I believe he meant "MOX" (metal oxide power resistor).

Methinks the simplest ballasubstitution to be swapping out the PTO and BFO tubes with 12BA6, then jumper out the ballasocket. No resistor required!

>I have heard from various experts that if one were to do this, when somebody >turns a light switch on in any part of the house, the receiver will change >frequencies. Can you confirm or deny this?

In this rushing-about-hither-and-thither busy busy busy age many of us just don't have sufficient time and energy to kick about a good ol' dead horse and play the controversies. <snip>

From: Llgpt@aol.com
Subject: Re: [R-390] RE: 3TF7 resistor replacement

That is a shame, because I have all the time in the world to use as I wish to debate the "deadest horse that has ever been beaten." Maybe more of you should take the time to smell the odor of burned dust on long dormant tubes and power transformers.....:-) Of all the various modifications, they ALL seem to work, some possibly better than others. I wouldn't waste the money on a nos or nib or even nice used 3TF7 as it isn't needed to ensure the proper performance of the receiver.

Date: Mon, 15 Nov 2004 14:25:41 -0800
From: "Bruce Hagen" <bhagen@msn.com>
Subject: [R-390] The ballast still

Yikes! The simple mod is change the two tubes to 12BA6's and jumper the ballast with a U made from a paper clip which is the David Medley way. Ten minutes and less than $5.00 and in ten minutes you can reverse it if you think it gives the audio too much bass.

Date: Mon, 15 Nov 2004 15:25:24 -0500
From: Rbethman <rbethman@comcast.net>
Subject: [R-390] The infamous or notorious Ballast Tube

The Equine Assault and Battery begins again! Sigh. First - I can't get to the Pearls. Second - We wnet through the serious technical discussions, THEN lapsed into one of OUR notorious wholly irreverent threads a little while back. A bit of advice - Once you've used a ballast tube, DON'T remotely contemplate moving the radio much at all! I firmly believe that the iron filament takes on a brittle tendency. When I have ever moved one after use, I ALWAYS remove it from the radio very carefully, and package it separately. The 47 ohm, or for that matter a 50 ohm, 5 or 10 watt resistor betweens pins 2 and 7 works VERY well. About three years running now, on 24/7 with no problems. When you futz around with paper clips, you DON'T know what plating was used. Better to use bare copper, or insulated copper wire with the ends tinned with solder. We've already gone down the path of kielbasa and OTHER ridiculous possible substitutes..... <G> Although I MUST admit this list has been VERY quiet of late.....

Date: Mon, 15 Nov 2004 16:03:37 -0500
From: Bruce MacLellan <brumac@juno.com>
Subject: Re: [R-390] RE: 3TF7 resistor replacement

Yep, I meant MOX, not MOV! and 2 resistors in parallel for 51 ohms turned into two 51 ohm resistors in parallel--- etc. Funny, I didn't have any trouble pouring the Famous Grouse into the glass! Guess I just got my murds wixed last night. Thanks, someone may have taken my advice to heart. Hope not.

Date: Mon, 15 Nov 2004 19:59:02 -0500
From: "Michael Murphy" <mjmurphy45@comcast.net>
Subject: Re: [R-390] The infamous or notorious Ballast Tube

Once you have used a ballast tube - you never go back.

Date: Mon, 15 Nov 2004 19:45:21 -0600
From: bw <ba.williams@charter.net>
Subject: Re: [R-390] The infamous or notorious Ballast Tube

Why even go thru the resistor hassles? Wire is easier. I have one with the ballast tube and its been transported in the back of my truck quite a few times. The filament has held up.

Date: Fri, 3 Dec 2004 15:02:58 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: [R-390] Ballist Tubes

I recently acquired a Boonton 250A RX meter. While it seems to be working properly, I have found a problem with the 6.3 V heater line. Boonton used a 6H-6 ballast tube to regulate the heaters in the bridge oscillator tubes and the mixer tube. The spec calls for 6.3 +/- 0.3 volts. I am measuring 8.3 V with two different AC

voltmeters. AC line spec is 105-125 V so I am OK
there. Can ballast tube fail in such a manner that it will still pass current but fail to regulate?

Date: Fri, 03 Dec 2004 17:02:11 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Ballist Tubes

>I recently acquired a Boonton 250A RX meter.

Good for you. It's a neat gadget. (I have at least one of them here.) You can see for yourself now whether or not carbon film resistors are inductive enough to matter. (Please let us know what you decide.. maybe you'll start another long, long thread on the topic.) BAMA has a manual for that thing. It is in dejavue format. See:<http://bama.edebris.com/manuals/boonton/250a>

> Boonton used a 6H-6 ballast tube

Make sure it really is a 6H-6 ballast tube (Glass with fine wire filament strung between the mica wafers), not a 6H6 duo diode tube (likely metal and short).

> The spec calls for 6.3 +/- 0.3 volts. I am measuring 8.3 V

Make sure BOTH of the tubes being regulated are lighted up. With one or more not present or filament open, the rest will get too much current.

>Can ballast tube fail in such a manner that it will still pass current but
>fail to regulate?

Probably. There are some things you can do:

1) Note that R-407 and R-401 are in parallel with the load. I strongly suspect these have risen high in value and are no longer doing their job. They get warm at lease, hot likely, were too small to begin with, and were carbon composition types most likely. They are in parallel with the regulated filaments to help the situation when one of the tubes is removed or opens, making sure that the ballast tube is dropping the amount of voltage within it's range, or at least not too far out of it's range.

2) If the ballast is operating past it's normal range, for example at too high a voltage drop, then add a resistor in series with it to bring the voltage drop down to the lower end of the range. You will note that there already is R-508 (0.55 ohms?) in series with the thing.. do check the value on that one.. Feel free to raise that value as high as you need to in order
to get the regulated tube voltage correct.

3) Try different tubes in the regulated spots - some industrial tubes draw more or less than the normal equivalents. The tubes specified are two 5718's. I was going to suggest that someone substituted normal tubes in their place, but these are subminiature ones and I was not able to locate easily any substitutes other than a CV number. It's not likely that you have a box of spares.. Make sure both tubes are

being heated up. (If the meter is working, then both oscillators are working.)

4) Put a 6SK7 (300 ma) in the ballast socket and see what happens. Actually, a duodiode 6H6 would do the same thing. Measure the actual transformer winding output.. the schematic says 13.5 volts. Here IS good use for a variac. Lower the line voltage till you do get 13.5 at the transformer winding/input to the ballast and see what is going on.

5) Put a big resistor in there instead of the ballast. (13.5-6.3)/.300 = 24 ohms. Measure the actual transformer output to see what resistor you need. It will dissipate 2.4 watts or more, so use a 5 watt unit or bigger. If your instrument measurements wander due to changing line voltage (that's why they used a ballast), get a voltage regulating transformer.

6) Get another ballast tube and try it out. This is listed last because you may have trouble finding spares. But ... Playthings of the Past has them for about $10 http://www.oldradioparts.com/2a2fl.txt

See http://www.amperite.com/Uploads/Ballasts.pdf for a description on how they work. Do not be encouraged when you find 6H-6 in the list of still-available tubes.. they want over a hundred dollars each for other types that are also listed (the 3TF7, for instance, according to R-390 list postings of the past.) <snip>

Date: Mon, 20 Dec 2004 11:18:37 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] atf4 ballast tube

The current delivered to the regulated tubes is likely to be wrong. Do test the voltage at the output of the ballast tube to find out. The ballast tube is likely to not last very long. It is being operated way above it's current design range. That's why it "glows a little more". You would be better off with a fixed resistor.

Date: Mon, 20 Dec 2004 11:39:20 -0500
From: "wglevy" <levyfiles@att.net>
Subject: Re: [R-390] atf4 ballast tube

Just out of interest what size resistor do the boys put into place of the 3TF7?

Date: Mon, 20 Dec 2004 18:09:21 -0500
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] 3TF4 Ballastube

>hello to everyone happy xmas. have just fitted ATF4 ballast tube in 390a
>and it seems to be working fine.it glows a little more than a ATF7. can
>anyone tell me will this give me any problems. many thanks brian

I believe you are referring to type 3TF4 and 3TF7 ballastubes. Both are specified to regulate current to 300 mA plus or minus a few tens of milliamps.

The 3TF7 regulates with a voltage drop of from 8.6 to 16.6 volts.

The 3TF4 regulates with a voltage drop of from 4.3 to 8.3 volts.

In the R-390x application the supply voltage for the PTO and BFO tubes is nominally 25.2 VAC. The two 6BA6 heaters fed with 300 mA drop 12.6 volts and the 3TF7 drops nominally 12.6 volts, operating somewhere in the center of its voltage range. When installed in the R390x the 3TF4 would operate outside of its specified voltage range; it would pass more than 300 mA and its life and the life of the PTO and BFO tubes would be reduced. I assume you are using the 3TF4 for lack of a 3TF7. Many other ballast substitution schemes abound. One entails jumpering the ballastube socket (a short piece of wire inserted into pin contacts 2 and 7) and then using 12BA6's to replace the PTO and BFO 6BA6's. Another is to replace the ballastube with a resistor of about 42 ohms, 5 watts. The possibilities are myriad. Wei-i Li helps all of us by distilling the information coursing through this forum into his highly enjoyable work, "Pearls of Wisdom". To receive these Pearls from Heaven, goto r-390a.net Click on "References", "Pearls of Wisdom", "Ballast Tube". Be amazed, be very amazed. I love the smell of Dead Horse in the Morning! It smells like.....Victory!

Date: Mon, 20 Dec 2004 20:21:12 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] Seeking Ballast Help

Not R-390 ballast help. Does anyone on the list know the value of a 6TF4 ballast? This particular ballast is in a WRR-2 receiver. And speaking of WRR-2's, does anyone on the list know where I can get an manual for a NON-A model. Mine is unsuffixed, the manuals out there seem to all be for the A and B models of WRR-2/ FRR-59. Not a lot of differences, but some - such as this ballast.

Date: Tue, 21 Dec 2004 01:54:27 -0700
From: "Kenneth Arthur Crips" <crips01@msn.com>
Subject: [R-390] ballast tubes

I notice according to Amperite website's section on Amperite Ballast tubes <http://www.amperite.com/Uploads/Ballasts.pdf (PDF) they still have the following ballast tubes in stock. 3TF7, 3TF7A, 3TF7B, 3TF7H. There was another site I have not re discovered which is devoted to the restoration of tube type guitar amp's. Many of these amp's used ballast tubes. One of the sites had the calculations for a substitution using an small incandescent light bulb and a resistor for the a ballast tube. I am still looking.....

Date: Tue, 21 Dec 2004 07:59:12 -0500
From: "Steve Hobensack" <stevehobensack@hotmail.com>
Subject: [R-390] 6tf4 Ballast

Tom, a rule of thumb for ballast tube nomenclature: The first number usually means the current in milliamps the ballast tube will hold. The number at the end usually indicates the "head voltage" required for regulation. As in the 6tf4 , it will hold 600 mills of current and you need at least 4 volts over and beyond the tube voltage for minimum holding of current. 4 volts is at the edge of hold , ideal voltage would be a few more volts above 4 volts more than tube filament voltage. This may be explained

at the amperite web page. I don't know the web address offhand.

Date: Tue, 21 Dec 2004 11:48:02 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] 6tf4 Ballast

>Tom, a rule of thumb for ballast tube nomenclature: The first number
>usually means the current in milliamps the ballast tube will hold.

In hundreds of milliamps

> ..This may be explained at the amperite web page. .....

I have a PDF version of the Amperite info on Ballasts and will email it to
anyone who wants it. The direct link to it is:
        <http://www.amperite.com/Uploads/Ballasts.pdf>
Note: do not be enthused if you find your favorite number in their list of ballast tubes still available. Some time ago a quote from them about the 3TF7 was in the order of $115.00 each with a minimum order of 50 or a hundred.

Date: Tue, 28 Dec 2004 05:31:10 -0600
From: Dave Merrill <r390a@rcn.com>
Subject: Re: [R-390] ballast tubes

Amperite lists them as available, but when you call a distributor they quote you over $100 per ballast.

Date: Tue, 28 Dec 2004 07:27:36 -0500
From: Rbethman <rbethman@comcast.net>
Subject: Re: [R-390] ballast tubes

Oh yes! One of the sources/distributors with a GRAND total of S-I-X (6) on hand, SAYS you can order up to 99999 of them. They are PRICED at $163.00 - - - E--A--C--H Think I'll stick with the 10W sand resistor backup when the last 3TF7 dies!

Date: Tue, 28 Dec 2004 04:55:22 -0800
From: "ELDIM" <eldim@att.net>
Subject: Re: [R-390] ballast tubes

You might be surprised that they're just about giving them away on your favorite e-Place.

Date: Tue, 28 Dec 2004 13:56:06 +0100
From: "Francesco Sartorello" <francesco.sartorello@virgilio.it>
Subject: Re: [R-390] ballast tubes

It is so effective and neat to use two 12BA6 instead, that I refuse to buy a 3TF7 at 3 USD, not to mention at 163 USD! Let the distributor keep them all six!

Date: Tue, 4 Jan 2005 16:41:25 -0700

From: "Kenneth Arthur Crips" <crips01@msn.com>
Subject: Re: [R-390] Autotuners

I have the RF/IF module out of my R390A checking to see why the BFO is failing and I was wondering I have the 12BH7A mod' in place for the 3TF7 and have read on this forum about jumpering the socket and installing 12BA6's in place of the 6BA6's in the BFO and PTO positions. Is this a better setup then what I have now?

Date: Tue, 4 Jan 2005 19:49:44 EST
From: DJED1@aol.com
Subject: Re: [R-390] Autotuners

I don't see why one choice should be better than the other. Both give up the regulation provided by the 3TF7, but most agree that it works well without it. Incidentally, the two oscillator tubes are 6BA6s, to be replaced by 12BA6s if you choose. I've been using a resistor for about 20 years now, but am saving two 3TF7s to cash in when i retire.

Date: Tue, 04 Jan 2005 20:44:41 -0500
From: Walter Wilson <wewilson@knology.net>
Subject: Re: [R-390] Autotuners

The 12BH7 mod jumpers pins 2&4 and 5&7 underneath the 3TF7 tube socket. It works very well if your ballast tube dies. I can't tell any difference. Just check continuity between these pins from the top with the tube pulled to see if you have it installed.See http://r-390a.us/R-390A_Modifications.htm for this and other modifications.

Date: Wed, 05 Jan 2005 18:48:12 -0500
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] Which Ballasubstitution? You decide.

On the subject of ballast substitutions: a question was raised by Kenneth. He inquired as to which of two methods is the better. Each has advantages and disadvantages:

1. 12BH7 modification: same heat production as 3TF7, needs another tube, keeps the stock 6BA6's, looks reasonably authentic. 12BH7, 12BY7, 12BV7 can be used and can have gas, shorts, and/or no emission so long as the heater is good. Using a defective tube as a power resistor gives you a sense of accomplishment; that you got something for nothing.

2. Two 12BA6 and a paperclip: about 3.8 watts less heat on the IF deck, needs other tubes, big empty socket. 12BA6 are easy to find. I did not use the traditional paperclip to jumper the ballasocket; instead I wrapped a fine wire around the two correct pins on the defunct 3TF7 and plugged it back into the socket. Except for missing the very faint glow of the 3TF7 now gone dark, looks original.

Make your choice (Remember also many other substitution schemes).

Date: Tue, 1 Feb 2005 23:24:43 -0000
From: "charles bolland" <ka4prf@peoplepc.com>
Subject: [R-390] Tubes new or used?

I was wondering about the 3TF7 ballast tubes. When I purchase a tube from a tube vendor or other source, will I ever receive a new tube or have all the existing tube been used at one time or another? My currecnt 3TF7 blew this morning. I have a spare, but I don't want it to die on me, so I saving it and using the resistor again. So, do you think I'd ever find an un-used 3TF7?

Date: Tue, 1 Feb 2005 19:12:12 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Tubes new or used?

There are brand spanking new 3TF7 tubes available from the manufacturer. But they are expensive! Not sure of the price but someone posted recently about it....I just don't remember. There are also what I would think are New Old Stock Military 3TF7's available from time to time on Ebay.

Saw one just the other day...may still be there.So the answer is yes....as a matter of fact you can purchase every tube in the R-390A new...they may be 20 years old but new..

Date: Tue, 01 Feb 2005 20:12:12 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Tubes new or used?

The 3TF7's are expensive but still available. It is not at all clear if they are necessary to the function of the radio. I would recommend using the resistor and not using the 3TF7. At some point an unused 3TF7 with it's box will be worth as much as the radio.

Date: Tue, 1 Feb 2005 22:35:42 -0600
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Tubes new or used?

There's New Old Stock, which may be 40 years old. IIRC, in one of our frequent ballast threads, it came out that the iron resistor in a ballast tube is cooled by hydrogen. Now, hydrogen, being the smallest atom, tends to escape from anything made of bigger atoms, which is everything including glass. So you need to be careful when you ask about "new" tubes. NOS isn't necessarily what you're looking for. Oh, and hydrogen makes iron brittle over time. Just to kick over the can, unless you run your receivers from poorly regulated field generators, you don't need a ballast tube. And you don't need the heaters unless you alternate between desert and polar regions with the same receiver. But if the set was aligned with ovens on, it needs to be re-aligned with them off. The calibrator oven needs to stay on.

Date: Wed, 2 Feb 2005 08:11:07 -0600
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Tubes new or used?

I guess I missed most of that past discussion...but I certainly wouldn't want any tube of mine to be full of Hydrogen. If the filament were to arc when it decided to open up I would expect an explosion. Sounds like the Hindenburg (spelling) all over again. Are you sure it was Hydrogen? Maybe Nitrogen... Just seems strange to me. Also if it escapes what does it leave behind? You are also saying that Ballast tubes have a shelf life.....anybody know how long that might be? Or maybe I have fallen off into a trap here.....hmmm

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Date: Wed, 02 Feb 2005 18:14:23 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Tubes new or used?

I agree that hydrogen is a bit unusual in a tube. I would have expected helium. In either case you probably don't have to worry much about an explosion. In order to explode you would need a bunch of oxygen in with the hydrogen. Apparently they did a back fill of the tube in order to adjust it's characteristics. I would not be surprised if it was a tube by tube process. Something in the process must have made these expensive to build. The nice thing about hydrogen or helium is that you don't have to use a lot of it to get good thermal conductivity. Those little atoms move heat really well. In any case - the ballast tread has been going on forever and ever. So far nobody has posted data showing the ballast tube makes the radio work any better. That includes the paragraph about the ballast tube in the original Collins project report on the radio. As long as you do a plug in resistor mod I don't see any reason why that's a bad thing. Wrap the ballast tube up real well and store it away on the shelf. If you ever want to sell the radio as a "100% real thing" then plug it back in.

Date: Wed, 2 Feb 2005 19:36:32 -0600
From: "Bill Hawkins" <bill@iaxs.net>
Subject: RE: [R-390] Tubes new or used?

Ah, but don't turn it on! Hydrogen is used to cool multi-megawatt power company generators. Less "air" resistance and better cooling. Lotta risk to using H2 but there must be a payoff. Then again, an invisible hydrogen fire is no worse than an invisible 2000 PSI steam leak. You know the leak is there because of the noise and the clouds of condensate. You look for it with a 2X4. When the 2X4 gets sliced through, you've found the leak.

Date: Wed, 02 Feb 2005 21:15:17 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] Tubes new or used?

Oddly enough you use helium for the same cooling in micro watt level precision quartz resonators. With them you look for a leak with a radiation sensor that finds a stuff at the few atoms level. Takes a long time to chop a 2X4 a few atoms at a time.

Date: Thu, 3 Feb 2005 02:24:34 -0000
From: "charles bolland" <ka4prf@peoplepc.com>
Subject: Re: [R-390] Tubes new or used?

I must remind myself in the future "don't ask about tubes". Too much information.

Tue, 08 Feb 2005 16:39:01 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] More Ballast Tube Noise

>Does anyone have information on what the difference is between a...
>3TF7 and the 3TF4 & 3TFV4?

That last one I don't know about but, the first number is the regulating current in tenths of an amp, the last number is the knee of the regulating voltage across the ballast.
So: 3TF7 300 ma current, regulates at 7 volts and upwards
3TF4: 300 ma current regulates at 4 volts and upwards.

If I had two 3TF4's, I'd put them in series to see what happens.

Date: Wed, 09 Feb 2005 18:37:31 -0500
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] More Ballast Tube Noise

I don't know that's such a great bargain. I have a couple of 3TF4's around, but never tried them. There is a document on the Amperite web site which includes the following:

"LIFE EXPECTANCY:
Average life if operated as recommended 2000 hrs.
If operated continuously at maximum voltage 1000 hrs.
If operated continuously at 80% maximum voltage 5000 hrs.
If filament is operated below glow point 5000 hrs. and up

In operation, the Amperite filament starts to glow at one point; as the voltage is increased, the glow spreads over the entire filament. Like incandescent lamps, turning the ballast tube on and off reduces its life, especially if operating near its maximum voltage."

So, there's quite a range -- and they recomment operating below the glow point. The differential is such that a $9 glowing 3TF4 might not compare well -- if you need 3 or more of them vs. a 3TF7. There are some other interesting things in that document, such as:

"GENERAL ADVANTAGES
. Light, compact. No moving parts
. Rugged, will stand vibration of 10G minimum
. Hermetically sealed; not affected by altitude or humidity changes
. Can be changed as easily as a radio tube
. Operates equally well on A.C. or D.C."

Hmmmmm.... hermetically sealed..... 10G's! ... a bargain at twice the price. Finally, that doc also says "It (the ballast tube) consists of a resistance wire with a positive

temperature coefficient of resistance, hermetically sealed in a bulb containing hydrogen or helium gas." So, apparently there are von Hindenburg and Non-von-Hindenburg renditions. You can read the whole thing at http://www.amperite.com/Uploads/Ballasts.pdf

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Thu, 10 Feb 2005 13:08:54 EST
From: Llgpt@aol.com
Subject: [R-390] A ballast tube primer/Tube Class 101 for beginners

I wrote this over five years ago. Since that time many newcomers have asked about replacements for the 3TF7. The 3TF4 seems to always come up as a replacement. Rather than beat the deadest horse that has ever been beaten into even tinier shreds, I offer this tid bit for those who know not of what they speak.....

1. Ballast tubes have two ratings, a voltage range where current regulation takes place and the regulated voltage.

   3TF7 8.6 - 16.6 volts, 200 - 300 milliamps

   3TF4 4.3 - 8.3 volts 280 - 320 milliamps

2. If you substitute a 3TF4, it will be operated far beyond its recommended operating voltage rating, and the two filaments it regulates will operate beyond their recommended or maximum voltage ratings.

3. Sure, it will work, but rather than replacing a 3TF7 with an improper tube, substitute one of the other modifications which all work quite well.

Date: Thu, 10 Feb 2005 15:44:53 -0500
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: [R-390] RE: More BallasTube Noise

The 3TF4 used in that way will operate above its upper voltage limit with attendant shortened life. One could insert resistance in series to reduce dissipation; the value would range from 15 ohms to 28 ohms. Dissipation would range from about a watt and a half to two and half watts. Alternatively, a diode could be inserted in series with the 3TF4.

The 25.2v secondary when half wave rectified would have an RMS value of 17.8v, 12.6V would be dropped by the 6BA6 heaters and the 3TF4 would see 5.2v.

The BallasTube can be dispensed with entirely. Substitution schemes abound. Goto r-390a.net click on References, Pearls of Wisdom, Ballast Tube. There you will find out more than you ever wanted to know

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Date: Sat, 12 Feb 2005 14:32:54 -0000
From: "charles bolland" <ka4prf@peoplepc.com>
Subject: [R-390] R-390A ballast replacement

Yesterday I went to the archives and found a circuit diagram for a ballast

replacement by K0CQ. It has as it's main componenet the LM317T. I was wondering if anyone built this circuit and if so, are they still using it in place of a ballast tube? Is it an improvement as stated in the building instructions? Other comments?

Date: Sat, 12 Feb 2005 14:56:41 -0000
From: "G4GJL" <g4gjl@btopenworld.com>
Subject: Re: [R-390] R-390A ballast replacement

I built it on Dr Jerry's advice. Easy to construct and fit in the available space, but no noticeable difference in performance. A good unit to build if you cannot get the original tube.

Date: Sat, 12 Feb 2005 11:19:10 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] R-390A ballast replacement

The only issue with the solid state ballast tube replacements are that the ones that are easy to build all rectify the filament voltage. With modern diodes this generates RFI on the filament circuit. Depending on how your particular radio is wired and bypassed this may be more or less of a problem to you. There are several postings in the archives about hum modulation on CW signals that tracked back to various mods that rectify the filament voltage. Simply put you are doing something that the original designers of the radio did not expect. Since they did not expect it the bypassing was not set up specifically to handle it.

If you want to get into the technical details here's more or less what is going on:

If you put in a full wave rectifier bridge (4 diodes) and then attach a resistor to the output of the bridge current will flow as long as the diodes in the bridge are forward biased. With normal diodes this happens somewhere in the 1 to 1.5 volt range. When you are below the turn on voltage no current is flowing.

Turning the current on and off, even at a 1 volt level generates noise. If you put a capacitor across the resistor then current only flows when the AC voltage is greater than the DC voltage on the capacitor plus the turn on voltage of the diodes. If the capacitor is charged to say 70% or the peak AC voltage then the current is flowing less than half the time. This generates even more switching noise since the current it turning on and off at a higher voltage. Now if you put a solid state gizmo on the capacitor you *may* even increase the turn on voltage a bit more.

More is not a good thing in this case. Bypassing and grounding and filtering is a possibility. Since the bypassing has to go to the ballast tube socket you will only be able to do just so well. The question is weather it's all worth it.

A fixed resistor soldered to a tube base works pretty darn well with normal line voltage variations. They also are very reliable. I have never heard of a wire wound resistor melting and taking out the wiring harness of an R-390. Of course I have not heard of any of the solid state mods doing that either ....

Date: Sun, 13 Feb 2005 12:54:41 EST

From: ToddRoberts2001@aol.com
Subject: Re: [R-390] The Penultimate R-390* Ballast Replacement

Most of the 3TF7 substitutes I have read about involve buildng something small enough to plug directly into the 3TF7 socket or on a nearby bracket. This comes with problems of heat dissipation or else installing unsightly brackets near the I.F. subchassis. Some of the recent ideas got me thinking - Why not build a small separate power supply module with a well-regulated/filtered and /bypassed 12.6 VDC output that could be placed next to the receiver and the only connection would be a small umbilical cable with a 9-pin plug that plugs directly into the 3TF7 socket? You could run the umbilical through the side of the R390A chassis thru one of the large holes and tuck the power supply and cord out of the way next to the receiver. This layout is similar to the way some audiophile preamps use a separate power-supply module with an umbilical. You could modify one or two pins of the 3TF7 socket with a jumper to ground to provide a ground return for the 12.6VDC so you wouldn't have to tie down a separate ground lead with a terminal and screw somewhere else on the chassis. When you plug in the umbilical it breaks the 25.2 VAC circuit and connects the 12.6VDC circuit and ground. The ground pins would have no effect on the original 3TF7 if you wanted to plug one back in. This way you could build a nice little husky separate regulated/filtered/bypassed 12.6 VDC power supply and not have to miniaturize it or compromize the performance. If you want to go back to a 3TF7 just unplug the DC supply 9 pin plug and put the 3TF7 back in. No unsightly permanent wires or brackets hanging off the I.F. subchassis. The regulated DC supply should give the ultimate in stability and pure DC on the filaments of the BFO/PTO tubes.

Date: Sun, 13 Feb 2005 13:28:21 -0800
From: "Bruce Hagen" <bhagen@msn.com>
Subject: Re: [R-390] The Penultimate R-390* Ballast Replacement

I find myself somewhat mystified with all of the ballast tube solutions. Most very clever and well thought out but were am I missing it? It seems to me that an inch or so of wire bent into a "U" shape for the ballast and then pulling two 6.3 volt tubes and replacing them with two readily available and cheap 12.6 volt tubes is the logical and easiest solution if you do not want to spend a few dollars and buy a 3TF7. Bruce

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Date: Sun, 13 Feb 2005 13:41:20 -0500
From: "John KA1XC" <tetrode@comcast.net>
Subject: Re: [R-390] The Penultimate R-390* Ballast Replacement

Sounds good Todd. The 12.6 VDC supply doesn't even need to be husky, for only a 300 ma load any of the common 78xx style 3 or 4 terminal regulators in the TO-220 packages would suffice, and even the best regulator would only need a 723 and a pass transistor. I wouldn't even bother with connecting the ground return to the ballast tube socket, just use any chassis ground connection on the back panel. I've read all kinds of over-worrying about electronic regulator "noise" or oscillations from voltage regulator IC's in radios, but it's really a non-issue. As long as you follow the bypassing suggestions in the app notes for the part, use good parts, and check things with a scope it'll be fine. Only *once* did I have a problem with a 3 term regulator inside an HF receiver. My TMC GPR-90 has a whole bunch of solid state

mods and has a +/- 12 VDC regulated supply under the chassis to run them. After I installed it I heard some 300 kHz carriers that I didn't hear before. It turned out to be one of the 3 terminal regulators oscillating (and I hadn't followed my own advice about checking it with a scope!) which happened to be a TI part. Took it out and installed a Motorola device in its place and it's been clean for years.

Date: Sun, 13 Feb 2005 14:03:10 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] The Penultimate R-390* Ballast Replacement

The tube swap process works fine as long as all of your radios have the same mod in them. The problem comes when you blindly swap modules between a ballast tube radio and a 12 volt filament radio.

Date: Sun, 13 Feb 2005 14:08:10 -0800
From: "Bruce Hagen" <bhagen@msn.com>
Subject: Re: [R-390] The Penultimate R-390* Ballast Replacement

Yes, that makes sense. Only own one 390 so not a problem for me.

Date: Sun, 13 Feb 2005 14:17:04 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] The Penultimate R-390* Ballast Replacement

I totally agree that if you are going to do something like this an external box that plugs in with no mods to the radio is the way to go. Chopping up the IF deck or the wiring harness simply is not worth it in this case.

The good old style 78xxx regulators are pretty well behaved. Some of the newer parts are not so forgiving. The older parts generally have NPN transistors in an emitter follower configuration. They are stable into almost anything you can tie to them.

The newer parts with the "ultra low drop out" features have PNP devices (or FET's) in a collector output configuration. This makes gives them a lot less stability than the good old parts. Both oscillation and broad band noise are common issues with the newer parts.

If you do go with a solid state filament supply be sure to consider the inrush current. A quick check with an ohm meter on a cold tube should give you a pretty good idea what to expect from that particular tube. Common wisdom (often wrong ...) is to provide 4 to 5X the running current for inrush. Your 300 ma supply would have to source 1.5 amps while the tubes warm up.

Current limit is one way to get around this. The two common options are constant current limiting and fold back limiting. A fold back limiter is not going to do any good in this situation. A constant current limiter actually increases the power dissipated in the regulator as it cuts back. Unless there is a big heat sink this generally either melts the device or puts it into thermal overload. If it goes into thermal overload you get the same problem as with the fold back limiter.

Twelve volt one or two amp supplies are not hard to find. They also won't set the bank roll back by much more than a nice dinner for the family.

This would all be a bit easier to evaluate if we had some real data (1.2 Hz per 1% change) from several radios on the impact of heater voltage on the stability of the radio. The boys at Collins didn't take any data that they found convincing when they designed the radio ....

Date: Sun, 13 Feb 2005 11:25:34 -0800
From: "Dan Merz" <djmerz@3-cities.com>
Subject: RE: [R-390] The Penultimate R-390* Ballast Replacement

Hi, since some appreciable fraction of the posts are tongue-in-cheek, it's hard to know what to make of this outboard solution. The resistor or wire jumper/tube substitution seems to be the choice I'd make if I didn't have a 3tf7. I've never tried either but it's hard to imagine that either wouldn't work to my complete satisfaction in light of others experience and results.
On the other hand, the outboard power supply might provide some advantage in some application..... so I look at it as a mental exercise now filed away and remembered with great respect. I'll await reports of the results,

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Date: Sun, 13 Feb 2005 14:34:23 EST
From: Llgpt@aol.com
Subject: Re: [R-390] R-390A ballast replacement

This has to be the "deadest horse that has ever been beaten," Just put a resistor in there and be done with a useless tube. Les

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Date: Sun, 13 Feb 2005 14:38:59 EST
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] The Penultimate R-390* Ballast Replacement

Thanks for the comments! I was thinking of something along the lines of a 12.6 VAC 1 or 2 amp filament transformer with a full-wave bridge bypassed with caps on each leg and a decent-size filter cap running into a 723 regulator (well bypassed) and a single 2N3055 pass transistor. The power supply output may sag for a second or 2 with the turn-on inrush current but that is fine
and self-limits the current at turn-on. Put the parts into a nice small aluminum mini-box or open chassis with perhaps a small heatsink and an umbilical cord and tuck away near the receiver. Would be a fun project to build! 73 Todd WD4NGG

Date: Sun, 13 Feb 2005 14:41:28 -0500
From: Bob Camp <ham@cq.nu>
Subject: Re: [R-390] R-390A ballast replacement

> Sounds like a good reason to add four more 26Z5W's

Actually using 26Z5's would be the perfect solution to the noise aspect of the problem. They are soft turn on devices and only cut in up in the 20+ volt range. They

are high resistance at that point so the current would be quite low. With no current to the ballast tube filament string you have no noise out of the radio. With the oscillators running at DC (no output) there is no drift what so ever. Obviously this is the ultimate ballast tube replacement scheme!

Date: Sun, 13 Feb 2005 15:59:04 -0500
From: "Drew Papanek" <drewmaster813@hotmail.com>
Subject: RE: [R-390] The Penultimate R-390* Ballast Replacement

>The good old style 78xxx regulators are pretty well behaved. Some of
>the newer parts are not so forgiving.

Of even greater benefit is that most of us have those older parts already lying around in the junk box :o)

>If you do go with a solid state filament supply be sure to consider the inrush current. A quick check with an ohm meter on a cold tube should give you a pretty good idea what to expect from that particular tube. Common wisdom (often wrong ...) is to provide 4 to 5X the running >current for inrush. Your 300 ma supply would have to source 1.5 amps while the tubes warm up. Current limit is one way to get around this. The two common options are constant current limiting and fold back limiting. A fold back limiter is not going to do any good in this situation. A constant current limiter actually increases the power dissipated in the regulator as it >cuts back. Unless there is a big heat sink this generally either melts the device or puts it into thermal overload. If it goes into thermal overload you get the same problem as with the fold back limiter.

The 78Mxx series of three terminal regulators could be used in a constant voltage configuration. those go into current limit at, IIRC, 500mA. They are protected,as are virtually all 3-terminal regulators, from damage due to thermal overload. Better still would be to not use voltage regulation at all but to use current regulation instead. The LM317 or 7805 are well suited to the task. Dave Wise built such a constant current supply (before his sophisticated 3DW7 analog and digital "tubesters").

[Dave Wise's text follows]
Here's IMO the simplest regulator that's also really good.

Parts list:

5ohm 10W resistor.	10ohm 10W resistor.
2.2K 1/4W resistor.	2.7K 1/4W resistor.
1K pot.	3000uF/50V cap.
Silicon rectifier.	LM317 on heat sink.

Vin goes to 5ohm resistor.
5ohm resistor goes to anode of rectifier.
Cathode of rectifier goes to cap and LM317 IN terminal.
Other end of cap goes to ground.
LM317 OUT terminal goes to 10ohm resistor and 2.2K resistor.
2.2K resistor goes to LM317 ADJ terminal and 2.7K resistor.
2.7K resistor goes to 1K variable resistor.

1K variable resistor and 10ohm resistor go to Vout.

This will adjust from 280mA to 335mA. It has four big components, three of which are also hot, and it requires a ground. This was my first step on the road to the 3DW7. How's it work? The rectifier and cap give you DC. The 5ohm resistor softens the charging peak and takes on some of the heat load. The LM317 will do anything in its power to maintain 1.25V from OUT to ADJ. This puts 1.25V across 2.2K for 0.57mA, which also flows through the 2.7K resistor. (The LM317's current out the ADJ pin is negligible.) 0.57mA * (2.2K + 2.7K) =3D is 2.78V. The LM317 will do anything to make that 2.78V happen. In this case it punches 278mA through the 10ohm resistor. If you increase the 2.7K resistor to 3.7K, the voltage is 3.35V instead of 2.78V for 335mA out. I can't remember what range of AC input voltage this will work over, but it's at least 25.2 +/- 5% [end Dave Wise's text]

Constant current regulation is advantageous because the PTO/BFO tube heaters never see more than their normal steady state (300 mA) current. Possible shortening of tube life because of inrush transients becomes a non-issue.
Dr. Jerry's device is a (fairly) constant current regulator. A 0.1 uF disc ceramic across each rectifier diode will address any diode switching noise concerns.

>Twelve volt one or two amp supplies are not hard to find. They also
>won't set the bank roll back by much more than a nice dinner for the
>family.

David Wise's circuit described above was intended to use the 25.2 VAC available at the ballaSocket. The diode, 5 ohm resistor, and electrolytic filter cap could be eliminated and the remainder of the circuit powered by a large wall wart. Those commonly used to power cheap inkjet computer printers would be ideal, being rated at around 18 VDC at about an amp. It would be well to connect a 0.1 uF disc cap across the regulators's "IN" and "ADJ" teminals to ensure stability.

>This would all be a bit easier to evaluate if we had some real data
>(1.2 Hz per 1% change) from several radios on the impact of heater
>voltage on the stability of the radio. The boys at Collins didn't take
>any data that they found convincing when they designed the radio ....

I believe some pertinent data appears in the "Pearls of Wisdom". at r-390a.net
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Date: Mon, 21 Feb 2005 21:16:29 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] One last ballast alternative - 12BH7, 12BY7

I don't remember the 12BH7/12BY7 being mentioned in the latest round of zombie* horse beating. I had forgotten all about it until I popped the top on a 390A over the weekend. Seems I had used a "bad" 12BY7 in one of my sets some years back, it still works fine. Is cheaper than a ballast - most of the time, especially if you have a few lying around. Filament current is 300 ma and this particular radio has worked fine with this "fix" for 8 years or so. Drift and
stability is comparable to my other receivers that use ballasts.

Date: Sun, 27 Feb 2005 00:54:56 -0000
From: "charles bolland" <ka4prf@peoplepc.com>
Subject: [R-390] Standy or Off?

I've burnt out a couple of Ballast tubes over the months and I am a little "gun" shy now. I don't want to wear out other tubes in my set, so I am wondering which will prolong the life of any tubes in my receiver best of the three following options?

1. Completely off when not in use - thinking about turning the set on and off all of the time.
2. Standby when not in use - thinking some tube still burning all of the time.
3. On when not in use - thinking all of the tubes are hot all of the time.

Any comments will be appreciated.

Date: Sat, 26 Feb 2005 20:05:12 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] Standy or Off?

Why use a ballast tube at all since it seems to be generally conceded that they don't do anything useful when operating from a household AC line? Replace it with a resistor or replace the 6BA6's with 12BA6's and use a jumper in the ballast tube socket; no irreversible modifications with comparable or better performance.

Date: Mon, 2 May 2005 21:47:03 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Variacs and solas: additional thoughts

Todd Roberts asks, can using a variac possibly extend the life of the 3TF7 ballast tube?

No not likely. The best thing you can do for the 3TF7 in the circuit is to leave the receiver on forever. (Well, 24 x 7 for six months at a time.) Next best thing is to buy a spare to replace the item when it reaches the end of its useful life.

Then there are alternate life styles,
A. use 2 12BA6's. One in the BFO and one in VFO with a jumper in 3TF7.

B. Use a resistor for 3TF7

C. Use a 12 volt 0.3 amp tube for a 3TF7. (12BH7, 12BV7, 12BY7, 12DQ7)

Spend more time listening to the radio and less time wondering if you can afford to listen to the radio. Cheers Roger KC6TRU

Date: Wed, 15 Jun 2005 05:36:07 -0500
From: "CLARENCE LOZANO" <JEEPER@netins.net>
Subject: [R-390] NEED HELP R-390'

Hello to all .how does a R-390 receive when ballast tube 3TF7 is weak or bad?

Date: Wed, 15 Jun 2005 07:15:15 -0400
From: "Lester.veenstra K1YCM" <lester.veenstra@intelsatgeneral.com>
Subject: {Spam?} Re: [R-390] NEED HELP R-390

Bad = No receive
Weak = receiver OK

Date: Wed, 15 Jun 2005 11:46:05 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: [R-390] NEED HELP R-390

> The PTO will not work.

I've pulled the (good) ballast tube from a working R-390A and I was surprised how long the PTO continued to "work": A few seconds after pulling the tube, the PTO begins to drift enough to be noticeable. For the first couple of seconds, I don't hear the PTO drift even when listening to CW. For ten or so seconds after that, the PTO drifts maybe a few hundred Hz but keeps on working. There's another few seconds where the PTO is drifting way way out from where it originally was oscillating. After about 15 seconds, finally the PTO stops oscillating and the radio goes quiet. My guess is that there is enough "gain margin" in the PTO design that even though loop gain drops dramatically as filament emission drops, still the oscillator keeps on running.

Date: Wed, 15 Jun 2005 11:07:06 -0500
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] NEED HELP R-390

I wonder what the output voltage on your PTO runs with the 3TF7 in place? Both of mine only put out a couple of volts, but I think they're supposed to generate about 7 volts. Apparently it takes very little injection signal to keep things going and even my 2 or 3 volt units provide plenty of signal. Not sure, though, how long the loop will continue after mine loses filament power. Perhaps I'll try that. Sadly, one of my 3TF7s died recently. I was aligning the IF and in the process of pulling the xfmr shields at the time and I think something shorted to the shield in the process. Yeah, I should've turned off the power when doing this, but I didn't think there would be a point that would touch anything. At any rate, the 3TF7 died when I heard the "buzz" while pulling the shield off of one of the transformers. Since the 3TF7 only regulates the two filaments, I'm not sure how this would have caused the 3TF7 to blow. Perhaps it was just its time to go? At any rate, it is now replaced with my trusty 47-ohm resistor bundle until I find another reasonable replacement. :(

Date: Wed, 15 Jun 2005 13:42:22 -0400
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] NEED HELP R-390

Why replace the ballast tube at all? Dallas Lankford's work showed that the ballast tube didn't do a very good job of stabilizing the PTO filament voltage anyway. The resistor or 12BA6 substitutions require no modifications and do just as good or better

job. Besides they cost less than the $20-$30 you have to pay for a new ballast tube. Unless a person is a fanatic about original condition, I don't see any reason to keep the ballast tube.

Date: Wed, 15 Jun 2005 13:38:46 -0500
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] NEED HELP R-390

That's what I was referring to as a "reasonable replacement." I'm thinking of modifying this one for 12BA6 operation. The only thing I don't like about this is it means there is a dependency between the IF and PTO modules. Not too bad and if the jumper is replaced with a 3TF7, it won't burn the filaments out so it's relatively "safe". I may try the 12BH7/12BY7 route too. I'm sort of planning on modifying the power supply for 12BW4s so this might be my "modded" radio

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Date: Wed, 15 Jun 2005 15:05:51 -0400
From: "Tim Shoppa" <tshoppa@wmata.com>
Subject: Re: <<<SPAM>: Re: [R-390] NEED HELP R-390

> I wonder what the output voltage on your PTO runs with the 3TF7 in place?
> Both of mine only put out a couple of volts, but I think they're supposed to
> generate about 7 volts.

I have about 5V P-P with the 3TF7 in place. I'll try putting in 12BA6's and taking out the 3TF7 and see if I notice anything different.

Date: Wed, 15 Jun 2005 19:12:37 -0400
From: Mark Huss <mhuss1@bellatlantic.net>
Subject: Re: [R-390] NEED HELP R-390

David is right. I repeated Dallas Lankford's work and found that the receiver PTO is much more stable with a 42 Ohm resistor than the origional 3TF7. Unless you have AC power that varies more than about 7 volts, use a 25 watt 42 ohm resistor. It generates some heat, but no more than the original 3TF7.

And if you have a fetish about drift of a few hertz, use a Voltage Regulator and a good heat-sink. You have to add a ground wire to the socket, but it was stable to the point that it was unmeasurable on my equipment.

I tried the 12BA6 with a 1 ohm resistor in series to measure current rush, and saw quite a spike in current on turn-on. Makes sense as filament resistance goes up as the filament heats up. Enough that I decided to stick with the resistor to keep the filament surge down. It helps, I noticed that the PTO takes about two seconds longer to come up than normal. If anybody is interested, I did the design work up to Breadboard for a plug-in Voltage Regulator. it is designed for 40Volt Peak input voltage and 80 degrees C. ambient at 20% overcurrent.

Date: Fri, 17 Jun 2005 19:58:47 -0400
From: "Jim Miller" <jmiller1706@cfl.rr.com>
Subject: Re: [R-390] R-390 BALLEST/HELP

One popular mod. is to substitute a 12BH7 tube in the ballast tube socket, with jumpers at pins 2-4 and 5-7 of that socket. The 12BH7 filament provides the voltage drop. The mod is simple and easily reversable, and you won't miss the 3TF7. By the way, you can still use a 3TF7 if you want to in place of the 12BH7. Here's an old thread on ballast tube and replacements:
http://209.35.120.129/Pearls/ballast-tube.pdf

Date: Fri, 17 Jun 2005 20:48:52 EDT
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] R-390 BALLEST/HELP

Simplest, easiest and safest is replace the 6BA6's with 12BA6's and add a jumper wire across the terminals used in the ballast tube socket.

Date: Tue, 11 Oct 2005 00:34:44 -0400
From: "Norman J McSweyn" <normn3ykf@stny.rr.com>
Subject: [R-390] 3tf7 replacement proceedure

I've been doing some reading on the 3TF7 replacment schemes. For the time being I think I'll use a 12BH7 in place of the 3TF7.All I have to do is move the wire on pin two to pin four and the wire on pin seven to pin five, right?

Date: Tue, 11 Oct 2005 07:24:37 -0400
From: Mark Huss <mhuss1@bellatlantic.net>
Subject: Re: [R-390] 3tf7 replacement proceedure

Lankford did some data collection on replacement options for the 3TF7. Turns out the most stable option is a simple 40-50 ohm, 10 watt wirewound resistor. Not only is it a bit more stable than the tube sub, but you get less rush current on turn-on. After doing a bunch of design work trying to come up with a solid state replacement, i just put the resistor in my R-390A with pins soldered to the leads. works fine for me.

Date: Tue, 11 Oct 2005 08:03:16 -0700
From: "Dan Merz" <djmerz@3-cities.com>
Subject: RE: [R-390] 3TF7 replacement proceedure

Norm, Hi, if I recall correctly, I just put jumpers between these pins (2 to 4 and 5 to 7) rather than moving the wires. That way, the 3tf7 could still be plugged in without changes if you, or a later person, wants to put the 3tf7 in for some reason, or doesn't know you made the mod. This puts ac heater voltage on the two grids of the 12bh7 but that affects nothing since you're just using the tube filament to drop the voltage I have the socket in my 390 hooked this way. Now I'll have to check my notes to confirm I did this. (added note: I just checked my set and that's the way I did it - works ok for about 6 months so far) Dan.

Date: Tue, 11 Oct 2005 15:42:18 -0400
From: "Norman J McSweyn" <normn3ykf@stny.rr.com>
Subject: Re: [R-390] 3tf7 replacement proceedure

Mark, I considered the 47 ohm 10 watt resistor. The problem is how to mount it. 1. Vertically in the tube socket secured how? 2. Underneath? Not a lot of space

between the bfo shaft and coupler. How did you do it?

Date: Tue, 11 Oct 2005 17:25:33 -0400 (EDT)
From: John Lawson <jpl15@panix.com>
Subject: Re: [R-390] 3tf7 replacement proceedure

I got my -A with a 'sandbar' resistor plugged by it's leads into the ballast socket. I was shipped about 2500 miles like that, has been worked on and moved several times since then - still standing there in the socket. I was trying to figure out all sorts of clever ways to make it "better" - but, as is oft repeated: "If it ain't broke..."

Date: Tue, 11 Oct 2005 17:40:50 -0400
From: "Norman J McSweyn" <normn3ykf@stny.rr.com>
Subject: Re: [R-390] 3tf7 replacement proceedure

Thanks all for the input. The resistor is an easy fix. Tonight is tube socket resistance checks for the radio with all modules in place. I love being on vacation.

Date: Tue, 11 Oct 2005 17:42:58 -0400
From: "Steve Hobensack" <stevehobensack@hotmail.com>
Subject: RE [R-390] 3tf7 replacement proceedure

You could probably leave the the wires the way they are on the 3TF7 tube socket and add two jumpers to encompass the filament of the new 12BH7. That way, if you ever come across a 3TF7 at a hamfest/radio fest at a decent price, you could just plug it in.

Date: Tue, 11 Oct 2005 20:50:43 -0400
From: Mark Huss <mhuss1@bellatlantic.net>
Subject: Re: [R-390] 3tf7 replacement proceedure

At first, I used 18 gauge solid wire, bent to fit to center the wirewound resistor vertically in the tube socket. Then, using high temperature epoxy, and the bad 3TF7 to make a mold, i made a solid plug-in base. Now it can't fall over and short something. Used Ohmite L12J47R 12 watt, or the L25J50R will do, too. This way if I ever get around to getting another 3TF7, I can just plug it in.

Date: Tue, 11 Oct 2005 21:29:37 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] 3tf7 replacement proceedure

If you have the 12BH7 base diagram from the back of a handbook you are OK.
I am running the modification in my R390A. Have been for 21 years.

Date: Mon, 05 Dec 2005 15:00:56 -0800
From: Dan Rae <danrae@verizon.net>
Subject: [R-390] R-390A Current Regulator Tube replacement?

One alternative I don't remember seeing for losing the hard to find ballast tube is to run the two oscillator tube filaments from the otherwise unused 12.6 Volt center tap on the power transformer. This involves adding one wire in the power supply (from

transformer pin 9, the centre tap, to the previously unused pin 9 on the connector J111), moving the filament feed to the IF strip from the present pin 1 inside plug P111 to pin 9 (in mine, it's the thinner of the two white / brown wires), and finally shorting out the current regulator pins 2 and 7 in the IF strip. And that's it.

This has some advantages over the methods using a resistor, it's cheap, retains the original tubes rather than replacing them with 12BA6's, but does not have the advantages of another form of current regulator, solid state, for example.

Anybody tried this before, or got any comments for or against?

Date: Mon, 5 Dec 2005 18:49:36 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] R-390A Current Regulator Tube replacement?

I guess I have to ask why?

Tests run by Dallas Lankford and published to this group showed the resistor substitution was just as effective as the ballast tube and maybe even better. I also think he stated that his test showed if you really wanted stability, the VFO and PTO should be run from a separate regulated DC supply. Either replacing the ballast tube with a resistor or replacing the 6BA6's with 12BA6's and the ballast tube with a short is effective and reversible with a few minutes work not involving circuit changes.

Date: Mon, 5 Dec 2005 19:25:00 -0500
From: roy.morgan@nist.gov
Subject: Re: [R-390] R-390A Current Regulator Tube replacement?

Is one end of the 26 volt winding grounded??? I am not sure without getting out the schematic.

> Anybody tried this before, or got any comments for or against?

No, I have not tried it. One comment is that it means the modules are now not interchangeable, at least to some extent.

Date: Tue, 6 Dec 2005 10:56:33 -0800
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] R-390A Current Regulator Tube replacement?

Roy: Yes, the 25V winding is grounded.

While Dan's mod can be done very neatly without a prohibitive amount of effort, I give a thumbs down because as Roy said, it makes the IF deck incompatible with the standard power supply module. Although the 12BA6 mod renders the IF and PTO incompatible with standard PTO's and IF's, they at least can be restored without removal/rewiring. If you aren't keen on regulating the heaters, I favor the 42 ohm resistor mod because it represents the absolute minimum effort to install and remove. Myself, I want to regulate them, and after a long hiatus I've resumed work on the 3DW7D 2.0 . Meanwhile, schematics of the 3DW7A are free for the asking, but only

a zealot like me would make the effort to squeeze it into a tubester format, and if you give up the format, there are easier regulators to build. None cooler though -- in either sense!

Date: Tue, 6 Dec 2005 13:13:44 -0600
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] R-390A Current Regulator Tube replacement?

I'll say this, you certainly have a "stick to it tiveness" that is admirable. If Hank Arney is ever looking for an somebody to pick the fly poop out of the pepper, you will get my recommendation..... Out of all the modifications that have ever been posted here or other places, none of them make a difference imho. resistors, diodes, tubes or the elaborate mod that Chuck Rippel does, which held the voltage to 6.2 volts for months on end seem to make a difference as to whether one can hear that heterodyne from Pitcairn Island.

Date: Sun, 25 Dec 2005 02:34:18 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: [R-390] More Ideas for the Y2.005K FAQ, etc

Some time ago someone -- was it Nolan? Someone put together a parts breakdown on Amperite Ballasts that showed the differences between a 3TF7, 3TF4, etc so folks could "decode" any mystery ballasts they might find out in the wild. Is that information still floating around somewhere? More info as it pops through the cobwebs. :-)

Date: Sun, 25 Dec 2005 13:06:17 EST
From: ToddRoberts2001@aol.com
Subject: Re: [R-390] More Ideas for the Y2.005K FAQ, etc

Tom - About all the information you could ever ask for about the Amperite Ballast tubes used in the R-390A are located in the R-390A Pearls Of Wisdom pages. Here is a recap of the info -

Amperite numbering system in general (not consistent!)
First Digit - regulated maintain current in tenths of an ampere
First Letter - envelope type
Second Letter - not sure, version perhaps?
Last digit - threshold voltage in volts?
Thus 3TF7 = 0.3 ampere regulated maintain current range, T6-1/2 bulb 9 pin miniature, 7 volts threshold voltage

According to Amperite specs the actual regulated voltage drop range is from 8.6-16.6 volts, so the 3TF7 will try to maintain a regulated current of 0.3 amps (300 milliamps) within a voltage drop range of 8.6-16.6 volts. The voltage drop across 2 6BA6's in series drawing 0.3 amps will be 12.6 volts and with a 25.2 volt filament circuit the required voltage drop across the 3TF7 will be also 12.6 volts, therefore the 3TF7 will be operating right in the middle of its voltage drop range for optimal regulation.

We all may want to keep in mind the R-390A Pearls Of Wisdom pages so we don't

needlessly repeat info that is already out there?

Date: Sun, 25 Dec 2005 12:29:08 -0600
From: Tom Norris <r390a@bellsouth.net>
Subject: Re: [R-390] More Ideas for the Y2.005K FAQ, etc

I had thought I'd looked there first. Hmmm. Thanks Todd!!!

Date: Sun, 25 Dec 2005 22:00:30 -0500
From: "Steve Hobensack" <stevehobensack@hotmail.com>
Subject: [R-390] Amperite Ballasts

As a rule of thumb, the first number is the operating current in hundreds of mills, the second number is the minimum value of head voltage needed for the low end of the regulation range. The 3TF7 runs at 300 mA, a minimum of 19 volts is needed to hold regulation in the R-390A BFO & PTO filament circuit.(6 + 6 + 7 = 19) The supply voltage in the R-390a is 26 volts. If the voltage drops below 19, the regulation ability goes below spec. I think Amperite has a web site and has a .pdf file on ballasts. Some of the older octal Amperites omit the letters and use only two numbers.

Date: Tue, 27 Dec 2005 18:47:38 -0600
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] Amperite Ballasts Info Needed again

I put up a ballast tube 101 several years ago, it is in the "Pearls" section here: http://www.r-390a.net/

Date: Wed, 28 Dec 2005 09:15:42 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Amperite Ballasts Info Needed again

Some info is on the Pearls of Wisdom site as mentioned in an earlier post.

Also, I recently found a four-page brochure by Amperex at:
http://www.bunkerofdoom.com/xfm/index.html
there is a four page pamphlet from Amperite on Ballast tubes:

http://www.bunkerofdoom.com/xfm/amperite/AMPR_AB51.html

(Click each of the four pages to get a bigger version of the image.)
NOTE: that site contains the biggest collection of transformer catalogs I have seen. NOT to be missed.

Date: Tue, 03 Jan 2006 15:26:16 -0800
From: "Kenneth G. Gordon" <kgordon@moscow.com>
Subject: [R-390] SS replacment for 3TF7 - back-to-back Zeners.

The RCA modification to the power supply in the SRR-11/12/13 receivers did away with the ballast tube which was being used to regulate the oscillator filament voltage,

and substituted a resistor and a pair of back-to-back Zeners. The output waveform is a clipped sine-wave and regulation is very good, the amount of clipping varying with input voltage to the Zeners.

Date: Tue, 3 Jan 2006 19:29:06 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] SS VR replacement for 3TF7

An idea back when was to just stuff a silicon diode rated at 1 amp and 100volts into pins 2 and 7 of the 3TF7 socket. This blocks the 25.2 volts 1/2 of the time. The net effect is 12.6 volts of DC. No 3.6 watts of heat to radiate. The transformer gets a 1/2 cycle rest. As long as you are poking stuff in the socket add a filter cap. We will get yada yada yada all week for my use of the S word. Yes, a regulator may offer better performance if the power line shifts. I live with real weather and when my lights blink, I do not set and wonder why my receiver is drifting off frequency. As I am not an OP trying to get a copy these days. When my receiver drifts I get the head sets off and look out my window. There is more to life than my receiver and I would like to continue to enjoy life. My QTH is not a bunker these days. Power line shift is my first clue to bad weather.

Tubes are getting costly. So some do not want to run them on DC filaments because some 1920 - 1950 text books suggest DC filaments tend to burn open at one end and thus give tubes a short life. We will likely toss the tube for noise before we burn its filaments open operating it on DC.

DC filaments with no filter are more noisy than AC filaments. This could be. But some filter caps would go a long ways. Maybe DC filaments are better for noise if the source is filtered. Any way the idea has been presented before. It does work. Is it better? I do not know. Is 31 flavors of ice cream enough? What flavor is best? Why have we not heard about this approach before? Read some of the other mail from today.

Date: Tue, 03 Jan 2006 20:40:27 -0500
From: shoppa_r390a@trailing-edge.com (Tim Shoppa)
Subject: Re: [R-390] SS VR replacement for 3TF7

Not exactly. Look up "RMS". Sqrt((25.2**2)/2) is not the same as Sqrt(12.6**2). Putting the diode in series gives you effectively 17.8V worth of heating (ignoring diode drop...) We've been through this at least three times before on the list in the past couple of years... Or did I again fall for the purposely-mistaken-fact-to-make-a-point? I'm always falling in that trap!

> I live with real weather and when my lights blink, ...

For fun, pull the ballast tube and count how many seconds until you start hearing the beat note drift. My ears may not be as sensitive as when I was young but it's many seconds until I hear the drift from zero filament current!

> Why have we not heard about this approach before?.....

I've seen it before many times over the past couple of years... again I think I fell for the trap!

Date: Tue, 3 Jan 2006 21:08:34 -0600
From: "Barry" <N4BUQ@aol.com>
Subject: Re: [R-390] SS VR replacement for 3TF7

So, using the VR this way, it functions as a half-wave rectifier and regulates the positive half-wave? Sorry, but I'm not that versed in SS VRs.

Date: Tue, 3 Jan 2006 21:30:30 -0600
From: "Barry" <N4BUQ@aol.com>
Subject: [R-390] Another ballast question

Some have suggested using a 12V tube's filament as a "ballast". I can't seem to locate a 12V tube, but I do have a dual 6V tube (a 6201). Measuring the filaments in series, the resistance is 15 ohms (7.5 ohms for each heater). If a 12V tube drops the same voltage as a 45-ohm (or approximately that value) resistor, then why does the filament only measure 15 ohms? Does the filament resistance increase as it heats? It would make sense as I *think* resistance increases with thermal activity, but not sure about that. Can someone enlighten me?

Date: Tue, 3 Jan 2006 23:51:43 -0500
From: roy.morgan@nist.gov
Subject: Re: [R-390] Another ballast question

> Some have suggested using a 12V tube's filament as a "ballast". I can't
> seem to locate a 12V tube, but I do have a dual 6V tube (a 6201).

If the rated current for the 6201 (run on 12 volts) is the same as the tubes in the PTO and Crystal Oscillator, then use it. (Sorry, I did not take time to look it up.)

> Measuring the filaments in series, the resistance is 15 ohms (7.5 ohms for each heater).

Don't DO that!

> If a 12V tube drops the same voltage as a 45-ohm (or approximately that
> value) resistor, then why does the filament only measure 15 ohms? Does the
> filament resistance increase as it heats?

YESSSS! From 2 to 5 times, depending on the tube. Regular incandescent lamps do the same thing. Measure a 100 watt lamp cold and figure the starting current at 120 volts. Halogen lamps run the filament at higher temperatures than normal everyday light bulbs, and likely have a greater increase in resistance. Large transmitting tubes had to be started on low filament current and ramped up very slowly, or the very large inrush current could destroy the filament.
It would make sense as I *think*

> resistance increases with thermal activity, but not sure about that.

You may now be sure.

Date: Wed, 4 Jan 2006 08:36:09 -0600
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] Another ballast question

It occurred to me after I wrote this that different 12V filaments run at different current ratings. Using a 12V tube whose filament current rating is the same of that of the two oscillator tubes combined in series is what is needed to work correctly. I typed before I thought it all out. Sorry. Just wondering why you say don't measure the DC resistance across the 12V filaments? My ohmmeter uses a 9V supply so there shouldn't be a problem doing this, right? Of course, 9VDC isn't the same as 9V RMS so some conversion must be made to ensure 9VDC isn't too much for 12V RMS, but this shouldn't be an overvoltage situation, should it?

Date: Wed, 04 Jan 2006 10:47:15 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Another ballast question

Ohmmeter circuits are quite simple usually. If this is an old style VOM, such as the Simpson 260, it works like this: The test leads, the meter, a range resistor and the battery are all in series. With the test leads shorted, the meter reads full scale, calibrated at zero ohms. If a resistor the same value as the range resistor is at the test leads, the thing reads half scale. So the current through the test leads depends on the range resistor - set by the ohms scale selected. The open circuit voltage might well be the 9 volt battery voltage, but will drop when the leads have a resistor connected to them. The current available (max with the leads shorted) depends on the range resistor selected. The range resistors are chosen depending on the sensitivity of the meter movement. In a Simpson 260, I think this is some 50 microamperes. The tubes you test will never light up. VTVM's and digital DMM's work on similar principles.

Date: Wed, 04 Jan 2006 19:18:11 -0800
From: John Kolb <jlkolb@jlkolb.cts.com>
Subject: Re: [R-390] Another ballast question

Modern DMM's will generally measure resistance by passing a constant current through the unknown R and measuring the voltage drop. Thus with a 1 mA current, a 0.250 V measurement would = 250 ohms. The max voltage presented is usually limited also to prevent turning on semi******* junctions. The diode test position allows a higher voltage so that the junction V drop can be measured. Thus the 9V battery is to danger,even to low voltage tubes (to get back towards on topic. :)

Date: Thu, 5 Jan 2006 12:27:52 +0200
From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: [R-390] PTO heaters

"Of course, 9VDC isn't the same as 9V RMS ....."

Yes, it is exactly the same! The definition of the RMS value is "That value of an alternating voltage (or current) which gives the same heating effect as a DC voltage (or current) of the same value" For a sine wave, which is what should be coming out of your wall socket or transformer, the RMS voltage is 0.707 of the peak value (For other wave shapes, this value is different) Even connecting your 9V battery directly across the valve heaters will probably do no harm as the small 9V battery will quickly run down trying to give 300mA!

Date: Thu, 05 Jan 2006 18:57:39 -0800
From: "Kenneth G. Gordon" <kgordon@moscow.com>
Subject: RE: [R-390] SS replacment for 3TF7 - back-to-back Zeners.

>David Wise wrote: There's regulation and then there's regulation.

Absolutely!

>The shunt clipper you describe below is good to, oh I don't know, maybe a >few percent, which is IIRC slightly inferior to a 3TF7 at the top of its game.

Could be, all right. I haven't compared them too closely. BTW, the ballast tube in the SRR-11 isn't a 3TF7, and I can't exactly remember which one it is either.

>Why? Let's say the supply voltage goes up. The zeners continue to lop off the >top of the sine wave, but the part they don't, lasts longer per cycle and >therefore delivers more power to the heaters.

Right. However, in this case, the SUPPLY voltage is 17 VAC.

>An exact answer requires integral calculus. When ballast tubes went out of the >mainstream of new instrument design, RCA judged the clipper "good enough" >for the SRR.

Yup, and it isn't all that stable, either, especially on the upper band which ncludes 32 Mhz.

> > There are heavy-duty approaches that can beat this by several orders
> of magnitude. Will you notice? Depends, probably not.

As you say, it depends. With the selectivity set at its narrowest, a little drift IS noticeable. In the case of the SRR-11 Zener regulator, I think it regulates well down on the more "linear" slope of the sine wave, not at the sharply curved top. None-the-less, it is pretty crude, IMHO. As I said above, the supply voltage is 17 VAC for a 6.3 VAC filament. In any case, I have not yet tested the regulation, but will when I can.

Date: Fri, 6 Jan 2006 09:40:30 -0600
From: "Barry" <n4buq@aol.com>
Subject: Re: [R-390] Another (perhaps) silly ballast question

I started this mod last night, but was too lazy to do it all the way. Instead, I soldered a jumper wire from the 12.6V center tap and plugged it into pin 7 of the ballast tube

socket. Naturally it worked fine. I plan to run it neatly into the plugs and sockets, but was just anxious to try this. One thing I found very interesting was what happens when disconnecting the jumper while the radio is running. The BFO fades rather rapidly (about 5 seconds or so), but the PTO continues to run for about 15 seconds. Naturally, when the BFO is warming up or dying out, the change in output signal is easily recognized, but after the BFO dies, it is difficult to tell if the PTO is drifting or not without a counter connected somewhere. I'm curious as to whether the stability issues reported by those who have performed tests with regulated filament lines vs. not regulated lines are more due to the PTO or the BFO?

Anyway, it looks like my search for a ballast tube now is moot. Using the 12.6V line just makes sense -- at least for me. In a way, I a bit surprised the engineers way-back-when didn't run this as an option. In the field, if the ballast were to go out, there wasn't anything to do except either find a resistor or wait for a replacement ballast. If they had run the 12V line to blank position on the ballast socket (unused pins are available on both plugs), if the ballast fails, the radio could have been temporarily restored to operational status with a paper clip. I realize each inch of wire amounted to extra cost and they were trying to save on costs where possible and maybe it just wasn't a critical enough of an issue at the time given the fact that ballast tubes were in plentiful supply. Also, ballast tubes seem to last indefinitely as long as they're not abused, so maybe they figured it wasn't an issue. Dunno. I'm just happy the transformer has a 12.6V tap!

Oh, by the way, there was some discussion as to a suitable resistor to use for the ballast (in case that's the route you go). I looked at my setup last night and I have four 180-ohm resistors in parallel yielding 45 ohms.

Just a tad closer to the actual value needed than the standard 47 ohm resistor and it allows using smaller wattage resistors to equally dissipate the heat. Mine happen to be higher wattage resistors (3-watts each, Ithink), but a bundle of four 2-watt resistors would be well over the required rating.

Date: Sun, 8 Jan 2006 22:05:27 -0600
From: "Barry" <N4BUQ@aol.com>
Subject: Re: [R-390] Another (perhaps) silly ballast question

I got part of this mod finished this evening. I ran a teflon-insulated, 20GA wire neatly from the IF deck plug to pin 5 of the ballast tube socket. At first I thought this wasn't going to work because the compartments are completely isolated from each other between where the plug is located and the tube base; however, there is a very tiny opening where the sheet metal was folded in just the right way to allow the wire to snake very neatly beside the AGC amp and AGC detectors, beside the BFO and on to the tube socket. I ran the wire from the center tap through the plug on the IF deck (even was able to snake the new wire inside the large boot where the rest of the wires go into the plug and inserted a jumper between pins 5 and 7. I works great. All I need to do is run the new wire through the plug on the PS. Kind of a pain when a resistor or appropriate tube will work, but I really wanted to do away with the unnecessary heat source.

Date: Sat, 25 Feb 2006 20:15:36 -0800 (PST)

From: Masters Andy <nu5o@yahoo.com>
Subject: [R-390] LM117K Mod and other issues

Good evening. I am working through a R-390A that I recently acquired on EBAY. It is an EAC '67 series. It came with the Kleronomos audio mod and provides excellent audio, especially on AM. It also has a pair of diodes across TB103 Term 10/13 and a wire going over to TB102/4. The power supply has been changed over to a pair of diodes with a 200 ohm dropping resistor. I have recapped the IF and AF sections and changed out the "out of tolerance" 2.2K resistors in the IF section. Tonight I added the current regulator mod from ER number 70, page 24 using a LM117K regulator. I ended up changing R2 from 4.3 ohms to 4 ohms to raise the actual voltage measured at pin 2 of the 3TF7 socket. Initially, with 4.3 ohms, I measured about 10.2 volts. With 4 ohms, I am measuring 12.1 volts. How close to 12.6 vdc do I need to be on the BFO/VFO tubes? Everything seems quite happy at 12.1 vdc and I am inclined to leave it there unless there is a good reason not to do so. The voltage stays solid as a rock with the AC input being varied from 105 to 128 VAC. I plan to add the Lankford full wave bridge AM detector next and I am also interested in adding the two 1N4148's to pin 2 V506A and Pin 1 V509. Does any one out there know of a reason NOT to do both of these mods?

Date: Sun, 26 Feb 2006 19:04:20 -0800 (PST)
From: "W. Li" <wli98122@yahoo.com>
Subject: Subject: [R-390] LM117K Mod and other issues

Nice work! Leave it at 12.1 volts to the BFO/VFO heaters. The Radiotron reference allows 10% variance on the heaters. They'll last longer at the slightly reduced levels.

Date: Sun, 23 Apr 2006 21:16:20 -0400
From: Barry Hauser <barry@hausernet.com>
Subject: Re: [R-390] 6C4-The Final Horse Beating?

Well there ... you've gone and done it. The fabled BallastHorse never dies, only goes into hibernation until it's time for the next roundup. Prehistoric in origin, they're something like a cross between a Clydesdale and a wooly mammoth, shaggy, gray with slight orange markings and stand several hands higher than a big dray horse on steriods. They would not deign to be fully domesticated -- never be caught pulling a beerwagon, but have been known to attack and consume the contents of same when their natural feed -- fermented marsh hay -- was in short supply. If you beat them, they'd just stay there, stare you down and maybe try to bite your head off a little. But, due to their size and weight they came in handy sometimes. If the water was running too fast on the river, you tied your barge up to one of 'em and they'd just refuse to move, and keep your watercraft from going away -- hence the name "ballasthorse".

Instead of drayage, their specialty was "stay-age". Nowadays at the mention of "ballast" or something like 3TF7 going out over the wires, the ghost of the BallastHorse merges with it's bones and the flesh grows and morphs back to life and rears up, whinnies and gallops off down the Interstate -- and attacks a Budweiser 18 wheeler. "Well, heck, that trailor was back there when I started out," says the trucker. "There was this really big horse though." See what you've gone and done. Now, ya' see I have an actual ballast tube question, as follows: They make a solid state

replacement for the 50A1 ballast used in the 600 series of Zenith Transoceanics and clones thereof. AES sells them for about $18, versus the $40 or so for an NOS 50A1, and nearly that much for a used one -- so they're in the same price and availabilty category as the 3TF7's. These plug-in replacements (also 9 pin) look like some heavy potted white plastic or maybe even ceramic.

Until a couple of days ago, I had assumed that they just contained a wirewound resistor. Someone who rebuilds and restores Transoceanics (for over 25 years now) assured me there was more to them -- couple of transistors and some other parts. He said that just a resistor wouldn't do well in the circuit, but I don't know. If that's so, then can similar plugin be made for the 3TF7 socket? Clopita, clopita, clopita, <snort>.. uh-oh.

Date: Mon, 24 Apr 2006 16:09:34 -0700
From: "David Wise" <David_Wise@Phoenix.com>
Subject: RE: [R-390] 6C4-The Final Horse Beating?
To: <r-390@mailman.qth.net>

That would be me. Twice. A few years ago I perfected the 3DW7A (proudly injecting my initials), which switches the incoming AC on and off in the manner of a high-priced reverse-phase-control dimmer to maintain constant RMS current as measured by a neat little chip from Linear Technologies.

That thing can be packed into a tubester - I did it - but it's not for the faint of heart. Looking to shrink the parts list, I worked up the 3DW7D (D for digital), which regulates constant RMS by passing or blocking individual AC cycles using an A/D-equipped microcontroller to calculate the RMS. I puttered with this, on and off, for another few years and just recently felt I had brought it to its peak. A few people asked for schematics, which I supplied off-list. I assembled the prototype on a bit of vectorboard and did not have to resort to 1/16W resistors. Works fine and has an LED on top that simulates the variable glow of a real 3TF7. It's not orange though, not efficient enough. Pity.

I don't have a Zenith T-O schematic in my head at the moment. If the low side of the 50A1 includes a filter cap, it might be possible to do a series switcher in a similar fashion. It would dissipate a bit more heat than my thing because of the higher voltage it has to drop for its internal power needs.

I don't think a linear-reg tubester could be done. The guy who told you a resistor wouldn't work was a perfectionist. (Yeah I know, pot, meet kettle. But Zenith used a resistor in more T-O's than the entire R-390A production.)

Date: Sat, 27 May 2006 08:07:27 -0500
From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] Re 26Z5 replacement

I have connected that 12.6V tap to the "low" side (pin 7) of the 3TF7 tube. Provided the voltage to your radio is fairly constant, it eliminates the need for the 3TF7.

Date: Mon, 04 Jun 2007 01:05:03 -0400

From: Scott Bauer <odyslim@comcast.net>
Subject: [R-390] Ballast Resistor, 3TF7

I have been going through my tube inventory and ran across an interesting ballast tube. I have only seen one of these before. With hope someone here might be able to help me identify it. I cant find a cross reference. It is made by Victoreen. Marked. 3Z6925-3.38 resistor, thermal. CRM 300-8 13602-PH-53 Motorola Inc Chicago, Ill. 1/56. The tube itself is marked 300-8 Victoreen
I am hoping it will cross over to a 3TF7. They are identical looking.

Date: Fri, 21 Sep 2007 20:13:39 -0500
From: "Barry" <n4buq@knology.net>
Subject: [R-390] Ballast Auction Warning

Just a warning: The eBay item number 230172418615 is advertised as a ballast tube for the R390A and it isn't. As far as I know, the 3TF4 is not an acceptable substitute for a 3TF7.

Date: Fri, 21 Sep 2007 21:45:55 -0400
From: roy.morgan@nist.gov
Subject: Re: [R-390] Ballast Auction Warning

You are correct that the 3TF4 will not do where a 3TF7 is needed.

Date: Wed, 5 Dec 2007 06:28:56 -0800 (PST)
From: Rasputin Novgorod <priapulus@yahoo.com>
Subject: [R-390] 12BY7 in my R-390A

I just discovered that I have a 12BY7 in my R-390A in the IF subchassis, RT510. Aparrently replacing the current regulator. Should I be concerned? Should I try to find the correct part? The radio works fine.

Date: Wed, 5 Dec 2007 09:38:27 -0500
From: "Walter Wilson" <wewilsonjr@gmail.com>
Subject: Re: [R-390] 12BY7 in my R-390A

The 12BH7A works fine with two added wire jumpers under the socket to allow this less expensive substitute. I'm not sure about the 12BY7 that you've listed. More info here: http://r-390a.us/R-390A_Modifications.htm

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Date: Wed, 5 Dec 2007 09:40:02 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] 12BY7 in my R-390A

There are several methods of replacing the expensive and largely unnecessary ballast tube in the R-390 and R-390A receivers. Substituting a 12BY7 is one of them. Use it and don't worry about it. It will work fine unless you plan to use it in the field with an unregulated line voltage supply. Review the "Pearls of Wisdom" in the archives for a discussion of the several methods of replacing the ballast tube.

Date: Mon, 17 Dec 2007 22:12:16 -0500
From: "Harold Hairston" <k4hca@alltel.net>
Subject: [R-390] Ballast Tube, 3TF7

The Ballast Tube in my R-390A just went bad. My usual source for tubes wants $30.00 for one 3TF7. Is this about the going rate? If not, I would appreciate reccomendations for an alternate supplier.

Date: Mon, 17 Dec 2007 22:29:36 -0500
From: "David C. Hallam" <dhallam@rapidsys.com>
Subject: RE: [R-390] Ballast Tube, 3TF7

$30 for a ballast tube is probably a little under the going price. Unless you have really fluctuating line voltage, you really don't need one. Check the Pearls of Wisdom in the archives for ways to eliminate the ballast tube: resistor or 12BY7 or change the PTO and BFO from 6BA6 to 12BA6. Personally, I went the 12BA6 route.

Date: Tue, 18 Dec 2007 11:55:53 -0500
From: Roy Morgan <roy.morgan@nist.gov>
Subject: Re: [R-390] Ballast Tube, 3TF7

Put the old tube in a little stand and put it on display. Do not buy a new one. Use a 47 ohm 10 watt resistor instead. (or whatever the right value is!) Do not make a highly engineered solid state computer controlled regulator substitute module. Or: get a 12BH7, jumper a couple of the pins and plug it in. OR put 12BA6's in the PTO and oscillator sockets, jumper either the ballast tube itself or the socket... Then use your radio. Spent the $30 on other spare tubes.

Date: Tue, 18 Dec 2007 11:04:30 -0600
From: "Les Locklear" <leslocklear@cableone.net>
Subject: Re: [R-390] Ballast Tube, 3TF7

Kinda my sentiments. But I have always been a fan of eliminating the useless ballast tube. Unless one has to have it in place, or is connected to a really rotten generator that cannot produce a decent steady current, the 3TF7 is not needed. The old stories about frequency shifting when flipping a light switch if you aren't using a ballast tube are just that, stories. I've tried most of the alternatives, guess what? They all work.

Date: Tue, 18 Dec 2007 15:00:26 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Ballast Tube, 3TF7

I'll second Roy's suggestion! I've had one R-390A that I git with a 50 ohm 10W resistor in place of the ballast tube - ran it 24/7 for three or four years. Never waivered or hiccuped! You do NOT need a 3TF7!

Date: Wed, 9 Apr 2008 18:43:04 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: [R-390] Case Comments

For the R390 the first solution to the regulator heat problem is to install the SS regulator designed by Dr. Jerry in the HNS that has been mentioned before. Dr. Jerry didn't design the solid state regulator that was the topic of that Hollow State News article. It was found installed in an R-390 purchased by, IIRC, one of the Barrys who then enlisted the help of Dr. Jerry in analyzing the regulator's circuit. It was a simple emitter follower type regulator using 2 NPN darlington-connected TV horizontal output transistors as a pass element. The reference was a zener diode with another zener ahead of it as a pre-regulator. It needs and was bolted to a large heat sink. Changing to the SS regulator would eliminate some heat otherwise generated by the tube heaters, but there would still be considerable heat due to the voltage drop in the pass element. The SS regulator would be best located outside the radio with an umbilical. <snip>

Date: Thu, 16 Jul 2009 03:51:51 +0000 (UTC)
From: odyslim@comcast.net
Subject: [R-390] off topic tube question

I have run across an Victoreen 300-8 ballast. It looks just like the 3TF7 does anybody know if it will work? Also found some Western Electric 6140's. Does anybody know what they cross reference to? Thanks for any input

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Date: Thu, 16 Jul 2009 00:32:16 -0400
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] off topic tube question

It's unlikely. See if the cold resistance is the same or similar. If not, your chances of it working are slim. There are to my knowledge only two designations of ballast tubes that work in the R-390A, the 3TF7 and this one:

Amperite PN: TJ311M01,
NSN 5905-00-681-4707;
DC, Current Range 0.31 to 0.33 Amperes, 8.0 Volts
Threshold, 9-Pin Miniature with T-6-1/2 envelope.

> Also found some Western Electric 6140's. Does anybody know what they
> cross reference to?

No info here. The WE corporate web site tube specifications page does list the WE6167 but we must assume that is a quite different thing: http://westernelectric.com/support/we_spec_sheets.html
The 6167 is a ten digit gas counting tube.

Date: Thu, 16 Jul 2009 21:03:04 -0400
From: Steve Hobensack <stevehobensack@hotmail.com>
Subject: Re: ballast

You can set up an experiment and see if it will work. You will need a variac, 120 to 25 volt stepdown transformer, two 6BA6 tubes and your ballast. Using clip leads (you can't have too many of these) connect the 25 vac, two 6BA6 filaments, and the ballast tube in series. Attach the variac to the primary of the step-down transformer and vary

the voltage from about 130v to 105v. How well is 6 volts maintained across one of the 6BA6 tubes?

Date: Wed, 22 Jul 2009 14:07:36 +0200
From: sigmapert <sigmapert@gmx.de>
Subject: [R-390] Role of the 3TF7 in PTO frequency changes

I was an active member of this list for several years in the mid-nineties. After my retirement I'm back. In context with building a jig for the measurement and alignment of PTOs I began to experiment with the 3TF7. I measured the effect of power line voltage variations on PTO frequency. The results are in accordance with the findings of Dallas Lankford. I can document that the current regulator 3TF7 is the main cause for the observed PTO frequency changes. Follow the link to get more information about my recent experiments.

http://schmid-mainz.de/3TF7-Results.pdf

Date: Wed, 22 Jul 2009 08:23:57 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

I think something gets lost in the translation from German to English.
This is like saying that fire trucks cause fires.

Date: Wed, 22 Jul 2009 14:47:25 +0200
From: sigmapert <sigmapert@gmx.de>
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

More precisely, the measurements prove that the observed power line voltage induced PTO frequency changes result from poor regulation of filament current by the 3TF7 current regulator.

Date: Wed, 22 Jul 2009 14:54:17 +0200
From: Heinz Breuer DH2FA <dh2fa@darc.de>
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

I don't see it that way. Kurt confirms Dallas' observation, that a change of the mains voltage will cause a variation in PTO frequency due to variation of the PTO tube's filament supply which is regulated by the 3TF7. A 12Hz jump for a 9% mains voltage change is probably nothing serious to worry about and the 3TF7 might have been the best regulator available in the mid 50s to achieve this. Nevertheless a solid state regulator can even avoid this 12 Hz jump. I am not into digital modes, a 12 Hz jump doesn't bother me.

Date: Wed, 22 Jul 2009 14:54:39 +0200
From: sigmapert <sigmapert@gmx.de>
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

The following link describes the the plug-in in more detail:
http://schmid-mainz.de/Flyer.pdf.

Date: Wed, 22 Jul 2009 08:57:36 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

> the measurements prove that the observed power line voltage induced
> PTO frequency changes result from poor regulation of filament current
> by the 3TF7 current regulator.

I'm sure that filament current changes can make the PTO and BFO shift frequency. In fact Dallas wrote some recommendation on picking 6BA6's which would be less sensitive to any such changes. IMHO the 3TF7 is more than good enough in the real world. Meaning it's overkill already, especially if you aren't using the 390A in a truck run from unregulated generators in the middle of nowhere. You were measuring +/- 6 Hz changes around nominal line voltage and those aren't really audible to me (I am not a particularly musical person) in my usage.

For me, the shift in the crystal oscillator frequencies due to AGC action is much more noticeable and annoying (I'm a big CW junkie). I've made some mods and measurements but haven't written them up, mostly because I'm not satisfied with the results.

Date: Wed, 22 Jul 2009 16:47:44 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

Will you please conduct two more experiments and report the results for us.

Test 1. Short the ballast tube out and install 12BA6's in the BFO and VFO.

Test 2. Use 5749's in the VFO and PTO and use a 12BY7 as a ballast tube.

The question is, does the ballast tube really regulate the current shortterm and long term better than lower filament current of the 12BA6's or any other filament at 0.6 amps. I see the argument for the ballast tube smoothing short changes when the receivers were run off generator power. Also the ballast would smooth line transient from devices being switched on or off. I do not see any long term regulation as the line voltage drifts several volts do to power line sag as the neighborhood changed demand during the day. Thanks
Roger Ruszkowski

Date: Thu, 23 Jul 2009 00:46:07 +0200
From: sigmapert <sigmapert@gmx.de>
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

Hi Roger, THX for your suggestions. As far as I remember a huge number of post have dealt with 3TF7 substitutes of all sorts. Most of them tried to improve current regulation of the filament supply. It has shown by Dallas and me that voltage regulation is the better alternative to achieve constant VFO frequency when power line voltage changes. Similar to the perfect regulation of B+ using constant voltage

devices (R-390A: 0A2, R-390: 2 x 5651) constant voltage supply of the filaments leads to perfect results. Why go back? Besides the the better regulation of my replacement device power dissipation is reduced substantially. Touch the 3TF7 with your finger after touching the solid state device for several minutes and count the seconds you can grip the 3TF7 (LoL).

Now a comment to the replacement of original parts with new ones. I would e.g. NEVER replace original capacitors with orange drops. In my eyes they are oversized and look unaesthetically (the orange drop lovers will kill me). If possible I'd avoid any soldering in the radio. That was the 'ultima ratio' when designing the 3TF7 replacement. But if a replacement (even a solid state device, Hallo Heinz Breuer) fits well into the look of the radio I see no problem to install it. The 3TF7 replacement with the medium size IERC tube shield installed (http://schmid-mainz.de/Flyer.pdf) to my feeling isn't recognized as a foreign body even by the purist. Currently I'm experimenting with solid state replacements of the two 6082 tubes in the R-390 non A. These beasts cook the radio. As I stated above I'd never tolerate to do any soldering in the radio. I've good evidence to succeed in the design of a direct plug-in replacement of small size and low power dissipation using most recent switching voltage regulators.

So Roger, I've plenty of projects to deal with. Voltage regulator issues was a deviation from my long-time project 'Measurement and alignment of PTOs'. I have built a jig that uses an absolute rotary encoder to quantify the rotary angle of PTOs with high precision together with the related output frequency of the PTO. Here a picture of my setup. (http://schmid-mainz.de/Jig.jpg) For this subject I'm preparing a manuscript for 'Electric Radio'.

Regards to you and all list members. I hope you like my work and my enthusiasm for our beloved R-390(A) radios.

Date: Wed, 22 Jul 2009 19:06:57 -0500
From: "Cecil Acuff" <chacuff@cableone.net>
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

True to form Lankford fan.... Dallas wasn't the first to look at voltage regulation. If you go back far enough in the archives and also check the Chuck Rippel pages you will find him building a solid state voltage regulated replacement many years ago. You will also find Lankford's last stand on cap failures and their direct lineage to the blue striper pile which don't hold water. He has gone as far as to boil some on the stove, and then freezing them in his analytical testing to prove that as the cause and posted the results on the site he now frequents. Sorry but I'm not a big follower..

Date: Wed, 22 Jul 2009 17:13:27 -0700
From: "Craig C. Heaton" <wd8kdg@worldnet.att.net>
Subject: Re: [R-390] Role of the 3TF7 in PTO frequency changes

So, you would leave failed components in a radio? Inquiring minds would like to know? Long live BBOD's!

Date: Tue, 17 Nov 2009 21:16:23 -0600

From: "Barry" <n4buq@knology.net>
Subject: Re: [R-390] R-391 problem

Check the continuity of the pins of RT412 (the 3TF7). If it is open, then those other tubes will not work either. BTW, the 3TF7 normally doesn't "light up". It may glow faintly when the radio first starts, but then usually will drop back to just barely visible.

Date: Tue, 17 Nov 2009 20:27:29 -0800 (PST)
From: Mark McNulty <noggie1999@yahoo.ca>
Subject: [R-390] R-391 problem

Thank you to everyone who replied, it appears the problem is with the ballast tube 3TF7. I will order another one and let you know what happens, Thanks.

Date: Tue, 17 Nov 2009 23:40:52 -0500
From: Paul Anderson <paul@pdq.com>
Subject: Re: [R-390] R-391 problem

Also check the B+ voltage level before leaving the radio on for long - if the resistors or a couple of other components under the AF or PS decks are fried, you can get high B+ which could harm other parts in the radio. The B+ is supposed to be 180V, and there is a test spot on one side panel or the other (the side with the AF deck). Be careful you don't short to ground - it is somewhat easy to do. Use a good meter with good leads and again, be careful! Once you know you're not frying B+, if you leave the radio on, the tubes will get warm even if you can't see the filaments heat up, so that is another way to check.

Date: Tue, 17 Nov 2009 23:52:10 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] R-391 problem

Before you order another one, you may want to know:

- they are EXPENSIVE, and then only IF you can find a source for them. They are unique and except for a ballast tube with different numbers but being the same one, there are no substitutes. - there are a number of workarounds, the simplest one being to short out the pins on the ballast tube socket and put 12 volt tubes in the radio instead of 6 volt ones.

Date: Wed, 18 Nov 2009 08:51:51 EST
From: DJED1@aol.com
Subject: Re: [R-390] R-391 problem

It sure sounds like one of the tube filaments is open. Most likely the 3TF7, since that's the most expensive one. You can substitute a 40 ohm 5-watt resistor for the 3TF7. I've been using one for 30 years with no ill effects.

Date: Wed, 18 Nov 2009 21:08:05 -0800 (PST)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Ballastube

Most likely, as others have suggested, the problem is the 3TF7 ballast tube.

Another substitution modification which works well is to plug into the 3TF7 socket a 12v tube having the correct heater current drain. 12V of the 24V heater line is then dropped by the substitute, and the remaining 12V by the BFO and VFO tube heaters.

Add a jumper on the 3TF7 socket from pin 7 to pin 5, and another jumper from pin 2 to pin 4. You can then use a 3TF7, or a 12BH7, 12BY7, or 12BV7.

This is not the only ballast substitution scheme. Replacement schemes for the ballastube are myriad and controversy-generating. For a wealth of information on the topic, go to r-390a.net Click on references, Pearls of Wisdom. There you will find a vast wealth of collective wisdom on the topic.

Date: Mon, 8 Feb 2010 11:37:15 +0200
From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: [R-390] R390 knobs and more!

<snip> I have seen, somewhere, a current limiting circuit to replace the 3FT7 using just an LM317, a small bridge rectifier, and a specially chosen resistor to give an true RMS value of 300mA. It's one you have to build "blind" unless you have a true RMS meter to check it with. (I don't) This circuit is a true replacement, as it only has the two connections, no ground needed. Does anybody know where I could find it again?

Date: Mon, 08 Feb 2010 08:09:09 -0800
From: Renee Deeter <k6fsb.1@gmail.com>
Subject: Re: [R-390] R390 knobs and more!

Yes it still needs a ground, it was in Electric Radio, I think VK3??? had it on a web site. If you cannot find the info I'll dig it up, scan it and E mail it to you. it is nothing special, typical current reg circuit + 1 diode and 1000uf/50V on the input side. It is the circuit I use, I like it better than any of the others, I added a gnd wire to one of the unused pins on the socket, it is a half wave rectifier, no need for the RMS metre- just measure the current on the bench then plug and go, and it all fits in on tube base including the heat sink.

Date: Mon, 8 Feb 2010 11:53:13 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] Solid Stating the 3FT7

I emailed you a series of PDF's that outline your choices for replacing the ballast tube. I would go with a beefier regulator. I built one into an old tube shield.

Date: Mon, 8 Feb 2010 21:29:13 -0800 (PST)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] R390 knobs and more!

The circuit described by Renée feeds the PTO and BFO tube heaters regulated DC, but Paul inquired about a different circuit, Dr. Gerald Johnson's AC current regulator.

Dr. Johnson's circuit uses components as Paul described, no big electrolytic filter capacitor. It requires only 2 connections and no ground connection. Goto http://r-390a.net/Pearls/ballast_tube.pdf

You will find Dr. Jerry's writeup and the schematic on pages 9 and 10. <snip>

Date: Wed, 10 Feb 2010 17:33:22 +0200
From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: Re: [R-390] Constant current reg for the 3TF7

Thanks everybody for the input. It was, of course, the Dr Johnson regulator in the "Pearls" that I was thinking of, and the magic resistor value is (ta-da, wait for it!) 3.48 ohms! Fortunately. I have two working 3TF7s, but that's the SS circuit that I would use when one of them goes o/c. A couple of people quoted a test that gave constant voltage better than constant current for the frequency change, but IIRC that test was using the 3TF7 as a "constant current" regulator, which by today's standards is certainly NOT the case! Anyway, thanks everybody for the help!

Date: Wed, 10 Feb 2010 09:57:46 -0600
From: Tom Frobase <tfrobase@gmail.com>
Subject: Re: [R-390] Constant current reg for the 3TF7

I would would not mind building a circuit board for the circuit. If their is other interest please speak up. Maybe we can defer some of the cost ... tom, N3LLL

Date: Fri, 2 Apr 2010 16:33:54 EDT
From: Flowertime01@wmconnect.com
Subject: [R-390] Cooking Kielbasa 2 of 2

I used a 50 ohm 10 watt resistor for the RT512 3TF7 ballast tube in the R390. I measured a 13.6 voltage drop across the ballast and the resistor. 13.6 volts at .3 amps is 4.08 watts of heat from the resistor. I measured 12.6 volts across the two 5749's in series with the ballast tube and the 50 ohm resistor. I though the 50 ohms would be high expecting 12.6 volts at .3 amps to yield 42 ohms. I found no measurable difference in receiver performance with either device in the VFO BFO circuits.

I had potted the resistor in epoxy and PVC to make a mechanical fit of the resistor into the tube socket. I find the 4.08 watts a bit warm but not more so than the glass ballast tube. 4 watts of hot glass is just not the same as 4 watts of hot plastic. I can except finger burning glass tubes but not finger burning plastic. The replacement device works as expected, It just does not feel right.

Date: Fri, 02 Apr 2010 16:41:10 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Cooking Kielbasa 2 of 2

<snip>.....I've used a resistor in lieu of the 3TF7, but I didn't want to wrap it in anything. I wanted it to have a free flowing convection cooling. I feel that potting it

may just over do it. However, I've made use of a source I located for the 3TF7s. The resistor is on hold.

Date: Sun, 4 Apr 2010 10:37:48 +0200
From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: [R-390] Ballast Tubes (no, not the dead horse!)

I recently got two 390As, one working, one not. Both were fitted with 3TF7 ballasts. Hooray, original, great! I thought. Then I measured the voltages, 25 Vac in, 15 Vac out. Correct tubes in BFO and PTO. So at the correct current, they are not dropping the specified voltage. No problem, I put in the 42R resistor. What I want to know is - is this a common failure mode? If so, why?

Date: Sun, 4 Apr 2010 19:36:18 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Ballast Tubes (no, not the dead horse!)

>.....So at the correct current, they are not dropping.....

The current is likely not correct either. This is a reasonably common failure mode, though not as common as the filament going open. Or is it? Most of us do not notice a somewhat out-of-spec current because the radio still operates. Open filament lets us know quickly by virtue of the resultant deafening silence.

Failure to maintain correct current when operated within ratings is likely due to leakage of the backfill gas mixture of hydrogen and helium.

But need you take my word for it? Certainly not! Goto r-390a.net, references, Pearls of Wisdom, Ballast Tubes. There you will find Wei-i Li's tireless labors of collection and distillation of the wisdom and lore pertaining to this topic as has passed through this forum for over 10 years. You will learn of construction, history, failure modes, and every possible ballast substitution scheme known to mankind. Fascinating reading, thanks Mr. Li!

Date: Mon, 5 Apr 2010 08:52:07 -0400
From: "Shoppa, Tim" <tshoppa@wmata.com>
Subject: Re: [R-390] Ballast Tubes (no, not the dead horse!)

I do not see where you measured "correct current". My gut feeling would be to suspect that the current regulator is working properly but that the voltages are off for some other reason.

If the current is correct but there's 15V across the BFO and PTO tubes, this is not a failure of the regulator. This is the regulator doing its job in the face of not-quite-in-spec BFO and PTO filaments or some poor contacts in the filament circuit. I write "not quite in spec" because filament voltage vs current is not generally something you use in the same breath as a NBS calibrated standard. Oops, that's NIST now, sorry Roy :-). If a 6BA6 drew 260mA at 6.3V instead of 300mA I'm sure that it would be regarded as acceptable. Note that poor contact on the tube socket filament pins can also increase voltage drop; I've seen some pretty cruddy looking sockets in 390A's.

AC current and AC volts are important to measure properly. There's peak readings vs RMS readings. I assert that RMS numbers are the correct things to measure here. Makes sure you are using a true RMS instrument, and that it correctly reads RMS voltage as well as RMS current.

One failure mode for a ballast tube is that one but not all of the thin iron wires has broken. This will reduce the current.

Date: Tue, 6 Apr 2010 12:59:10 EDT
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] Ballast Tubes (no, not the dead horse!)

If an operator walked into the shop and said, my receiver just died, odds were someone had pulled his antenna patch or the ballast tube died. We ask do you have cal tones or not? On all bands or just some?

What I want to know is - is this a common failure mode? If so, why?

The element in the ballast tube is more like a light bulb than a vacuum tube. Yes, they do fail more often than any tube. Every six months the tubes were checked in a tube checker and then measured for noise in the receiver. Weak and noisy tubes then got replaced long before they failed to the point of no signals. A ballast tube was run in the receiver until it burned open. So ballast tubes always failed in use. Thus the perception that they were problems. But they do have a shorter life expectancy than any of the tubes. This has been known since they were designed into the receivers to start with.

Then I measured the voltages, 25 Vac in, 15 Vac out. Correct tubes in BFO and PTO. So at the correct current, they are not dropping the specified voltage. No problem, I put in the 42R resistor.

The R390 had all 25VAC circuits. The R390 had an alternate power supply and could be powered from a nominal 24 Volts military vehicle power system. The objective of the 6082 regulators was to filter all the generator crud and whine off the B+ in these applications.

The R390/A gave up on the 24 Volt source and went to just 50 - 60 Hertz 120 / 240 volt power sources.

The R390/A kept the 25 Volt filament because they kept the 26Z5's rectifier tubes. They also kept the two 5749's (VFO and BFO) in series with the ballast tube to stabilize the two oscillators. The goal was not rock solid stability. The goal was to keep the signal "readable" copyable during power line sags, lighting strikes and other power source problems.

You should watch a couple Caterpillar diesel power plants get swapped on line at a Field Station every eight hours. We calculated that we used more power in the barracks with the lights and little room air conditioners that we did in the Field Stations operations with the receivers big air conditioners and stuff.

The ballast smoothes the filament voltage through the fast flashes. The B+ is regulated. This provides a BFO and VFO that would stay on a CW signal so you could type with both fingers and not need to keep one hand on the knob and poke it out at 25 WPM with just one finger.

So the VFO tube is on the end of the line with one end at ground. The BFO is next. then the ballast is on the top of the string. You will measure 6.3 volts on one side of the BFO tube filament and 12.6 volts on the other side of the filament. The 5749 tube filament current is .3 Amp. It is as such printed in the tube manual. On one side of the ballast we expect to see the 12.6 volts to ground and the other side of the ballast is what ever the transformer winding is producing for you at the time of measurement.

The Ballast has a characteristic property of droping 0.3 amps at 12.6 volts. As the voltage drop goes up and down a few volts the tube still wants to conduct 0.3 Amps. That's the design and it works good enough. The time constant is long and that's good enough to get the job done.

We use a resistor today only because it is less expensive than a ballast tube. We can use a resistor only because the power source in most radio shacks today is so much more stable than the range of source voltage and variation the receiver was designed and expected to operate in. Simple calculations suggest we use a 42 Ohm 5 Watt resistor. I have found that 50 Ohms works OK and 10 watts just provides a little more surface area to radiate heat. Running a resistor at half its rated dissipation is expected to increase its life expectancy. Hope this helps. Roger Ruszkowski 33C4H 1968 - 1975

Date: Sat, 17 Apr 2010 13:28:15 -0400
From: Gary E Kaufman <gkaufman@the-planet.org>
Subject: [R-390] 3TF7 / 26Z5W

I was speaking with Dick Bergeron (Electron Tube Enterprises or http://www.etetubes.com/) today at the New England Antique Radio Club meet and he mentioned that he purchased a quantity of NOS 3TF7's and 26Z5W's recently. Dick is a nice person to deal with and is well known in this area as a tube vendor. I have no connection (other than being a customer for the past 15+ years) but thought I would pass it along to the group.

Date: Sat, 17 Apr 2010 13:30:32 -0500
From: mikea <mikea@mikea.ath.cx>
Subject: Re: [R-390] 3TF7 / 26Z5W

That is indeed excellent news.

Date: Sat, 17 Apr 2010 14:37:41 -0400
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] 3TF7 / 26Z5W

Yes it certainly is! He's selling them for 3/4 the price of the rest that we see asking for 3TF7s! I was starting to consider insurance for my spare pair!

Date: Fri, 18 Feb 2011 15:35:36 -0600
From: "Ben Loper" <brloper@gmail.com>
Subject: [R-390] 3TF7 Ballast Tubes

I came across some NOS 3TF7 Amperite tubes. Should I make an offer on them or is the conventional wisdom to replace them with a 12BA6 tube.

Date: Fri, 18 Feb 2011 16:43:28 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] 3TF7 Ballast Tubes

There is not a "collective" viewpoint regarding these. My view is *IF* you can get them, and don't have to give up an "arm and a Leg" to get them, then I'd stick with the 3TF7s.

The other possible method would be to place a 40 to 50 ohm 10 Watt resistor in its place. I haven't gone the route of using a 12BA6 as of yet. The resistor came in my '67 EAC, and worked just fine. Currently I have one NOS 3TF7 left that is going into my St. J's restoration of the first contract Collins. As is true in just about all instances, YMMV!

Date: Fri, 18 Feb 2011 14:24:39 -0800 (PST)
From: Joe Connor <joeconnor53@yahoo.com>
Subject: Re: [R-390] 3TF7 Ballast Tubes

For the record, 3TF7s are going for $50 apiece at Fair Radio.

Date: Fri, 18 Feb 2011 17:30:33 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] 3TF7 Ballast Tubes

Joe - We all know what they are going for. The price at Fair Radio is better than a bunch of others.

Ben - It is like I said, YMMV. The 12BA6 is always and option, as is the resistor of ample wattage. We all decide which "we" want to go.

Date: Fri, 18 Feb 2011 15:58:03 -0800
From: "Rick Popovich" <RickP@uei.csus.edu>
Subject: Re: [R-390] 3TF7 Ballast Tubes

This is why I joined this list - I'm always learning something new. Which leads to my question; is the 12BA6 a DIRECT substitute for the 3TF7 ? - meaning no wiring changes are needed under the tube socket ? I just had a 3TF7 go bad on my R-390 and don't have a spare. I DO have plenty of 12BA6's. I would prefer to go that route as opposed to using the resistor if no other mods are needed.

Date: Fri, 18 Feb 2011 19:04:03 -0500
From: "James A. (Andy) Moorer" <jamminpower@earthlink.net>

Subject: Re: [R-390] 3TF7 Ballast Tubes

Hmm. In the spirit of the re-stuffed capacitor cans, maybe we could find some similar-looking dead ballast tubes, carefully hollow them out and put a nice, shiny resistor in it & seal it back up. I believe they use soft glass for tubes, so a good jeweler's torch should do the trick.

Date: Fri, 18 Feb 2011 18:42:42 -0600
From: Tom Frobase <tfrobase@gmail.com>
Subject: Re: [R-390] 3TF7 Ballast Tubes

You replace the 2 tubes that are in series with the Ballast V505 and V701 with 12BA6's and put a jumper between pins 2 and 7 on the ballast socket. tom, N3LLL

Date: Fri, 18 Feb 2011 17:00:08 -0800
From: Manfred Antar <mantar@pacbell.net>
Subject: Re: [R-390] 3TF7 Ballast Tubes

There is a guy in Germany that makes a solid state replacement that fits in the 3TF7 socket. I use one in one of my R390A's and have ordered another one for the other R-390A. They work great. The cost is $72.50 plus postage from germany. He also builds new filer caps for the AF deck that are real nice.

Here is the web address: http://www.sigma-tec.eu/cartview.php?id=16

Date: Fri, 18 Feb 2011 21:43:59 -0500
From: Roy Morgan <k1lky@earthlink.net>
Subject: Re: [R-390] 3TF7 Ballast Tubes

Ballast Tube Folks, <Dead Horse Beat Mode ON>

I recently unearthed a Boonton Model 250A RX-meter and poked around inside with a voltmeter. It uses a 6H-6 ballast tube to feed the filaments of two subminiature oscillator tubes. The filament voltage should be 6.3 +/- 0.3 volts. It was 7.7 volts. The ballast tube was operating, but one of the four segments of the filament was glowing quite strongly, with the other three segments dark. Not having a spare 6H-6 handy, I tried a 6V6, 6H6, and settled on a 6AG7, which gave 6.6 volts for the filament. The (next to) bottom line is: even if the ballast tube is operating, it might not be working right. Measure the filament voltage(s) on the supplied tube(s). <Dead Horse Beat Mode OFF>

Date: Sat, 19 Feb 2011 02:09:52 +0100
From: "Henry Mei'l's" <meils@get2net.dk>
Subject: Re: [R-390] R-390 Digest, Vol 82, Issue 18/ 12V tap

There's a 12 volt tap on the power transformer -- I used it on my first R-390A when my ballast tube went West.

Date: Sat, 19 Feb 2011 02:09:52 +0100
From: "Henry Mei'l's" <meils@get2net.dk>

Subject: Re: [R-390] R-390 Digest, Vol 82, Issue 18/ 12V tap

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Date: Fri, 18 Feb 2011 21:43:59 -0500
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Subject: Re: [R-390] 3TF7 Ballast Tubes

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Date: Fri, 18 Feb 2011 20:57:56 -0600
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] 3TF7 Ballast Tubes

I replaced the 3TF7's with this; http://www.schmid-mainz.de/Flyer.pdf
Costs less than the tube.

Date: Sat, 19 Feb 2011 09:42:08 +0100
From: "Henry Mei'l's" <meils@get2net.dk>
Subject: [R-390] 12v solution to burnt outR-390A ballast tube

I use the 12 volt tap on the power transformer.

Date: Sat, 19 Feb 2011 07:04:12 -0600
From: "Les Locklear" <leslocklear@cableone.net>
Subject: [R-390] Fw: 3TF7 Ballast Tubes

Ah, my favorite dead horse subject.....

Just about every 3TF7 I ever looked closely at looked as though some eight year old kids made those plates and filaments. Crooked some stretched, others not, and, yes the phenomena Roy mentioned. That's the reason all of the ones I used had either a 39 or 40 ohm resistor in place of the Kielballast Tube. I never tried the 12BA6 mod, but plenty of folks have and it is as simple as it gets.

One thing I didn't ever notice with the resistor in place, when a light switch was flipped on somewhere else in the house, the frequency didn't change.....
<snicker> That is a snarky response to an earlier issue of HSN (Hollow State News), and amazingly enough I could still hear that elusive heterodyne from Pitcairn Island.

YMMV

Date: Sat, 19 Feb 2011 15:38:53 +0200
From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: [R-390] Dead Horse Beat mode - ON

I was lucky enough to get two R390s, each with its 3TF7 apparently working.

These were tested by monitoring the output current from a variable Bench supply from about 2 volts to the maximum rating. As expected, the current rose with the voltage to about 9V, and then stayed constant up to about 20V then started going up again. Stopped immediately this happened. For one of them, the constant current section was 0.32A, for the other 0.37A. The high current one got retired to the emergencies only box, and was replaced by a 47R resistor. So, for any voltage between 9 and 20 across the barretter, the current is constant. In the R390A, the voltage is a nominal 12.6. Since the same current flows in the 2x 6BA6 oscillators, their heater current is constant. What this proves, though, is that your 3TF7 may be working, stabilising heater current, but it might not be the correct value of current! FWIW, I've seen the same stabilising effect in filament globes, but never a convenient value. Please, don't anyone say "but it's different with AC"!

Date: Sat, 19 Feb 2011 17:44:45 -0600
From: "Ben Loper" <brloper@gmail.com>
Subject: Re: [R-390] 3TF7 Ballast Tubes

I'm going to go ahead and buy them at $10 each I don't think I'll go too far wrong

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Date: Sat, 19 Feb 2011 19:10:01 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] 3TF7 Ballast Tubes

Eliminating all the useless blather, since NONE of us are trying precision frequency reception anyway.... Ben - at $10 dollars each - you can't go wrong! 10W 40 to 50 ohm resistors just about go for that any more!

Date: Sat, 19 Feb 2011 13:03:23 -0500 (EST)
From: frankshughes@aim.com
Subject: [R-390] 3TF7 replacement from Germany

http://www.schmid-mainz.de/Flyer.pdf (Dr. Kurt Schmid, DH3PJ)
I also use these wonderful devices from the professor in my 390A and 390.

Date: Sat, 19 Feb 2011 21:10:28 -0600
From: Randy and Sherry Guttery <comcents@bellsouth.net>
Subject: Re: [R-390] 3TF7 Ballast Tubes

I'm sure that I'm going to get shot at for this - but - in the interest of completeness - I'm going to "stick it out there"...

<snip> There is, however - a much more elegant solution - a capacitor. By correctly

calculating the capacitance reactance - a capacitor can be used in place of the ballast tube - and while it will *not* provide any regulation (but then neither does a resistor - or using 2 12BA6s) - it drops the required 12.6 volts with nearly zero heat... Granted that's a "savings" of a little less than 4 watts - but then again - go hold a 4W incandescent night light in your bare hand for a while...<snip>

Date: Sat, 19 Feb 2011 23:40:38 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] HP-410B Question

That's what I figured. While the meter will function without that 50uF, I think I will replace it. I really like the damped meter movement on these VTVMs.

Date: Sun, 20 Feb 2011 08:20:45 +0100
From: "Henry Mei'l's" <meils@get2net.dk>
Subject: [R-390] Regulated filament voltage

If you really want stabilized, constant filament voltage then why not just a add a dc regulator circuit, set to 12.6V or thereabouts? This wouldn't take up much space and is entirely retro-able. I know others have done this for other receivers using ballast tube filament stabilization.

Date: Sun, 20 Feb 2011 06:31:20 -0500
From: "David C. Hallam" <dhallam@knology.net>
Subject: Re: [R-390] Regulated filament voltage

Please read Dallas Lankford's notes on R-390 filament voltage regulation.
http://www.kongsfjord.no/dl/dl.htm

Date: Sun, 20 Feb 2011 12:54:53 +0100
From: "Henry Mei'l's" <meils@get2net.dk>
Subject: Re: [R-390] Regulated filament voltage

Thanks David - I clicked into DL's www and can see he wrote did exactly that kind of mod in 04. He cleverly does this using a plug-in mock tube construction.

Date: Sun, 20 Feb 2011 10:52:08 -0500
From: "Bernie Doran" <qedconsultants@embarqmail.com>
Subject: Re: [R-390] Regulated filament voltage

If regulated fil voltage is so important, why not just regulate the AC line voltage and perhaps drop it down a bit? That pretty much covers everything.

Date: Sun, 20 Feb 2011 11:17:38 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] Regulated filament voltage

When one considers the time frame that these radios were built and used, the methods of providing the the power source, and the overall use, the entire voltage regulation thread is pretty moot. <snip>

Any "hairball" idea to build a SS voltage regulator is ridiculous, since it creates internal noise to a receiver that was designed to be SENSITIVE. The use of 3TF7s, 12BA6s, or the 40 to 50 Ohm @10W resistor is more than adequate. This entire idea of "attempting" to regulate the filaments of the PTO and BFO is like suddenly deciding that you wand Solid State and Digital Readout precision. (That's all flawed in itself! Whom is it that has the *correct* zero beat with WWV? The signal path pretty well throws that all over the charts.) <snip>

Date: Sun, 20 Feb 2011 17:40:58 +0100
From: "Henry Mei'l's" <meils@get2net.dk>
Subject: [R-390] filament series capacitor can be risky

I tried that approach with an receiver once -- depending upon the phase point of the ac cycle, your series capacitor could look like a short circuit at the instant of energization. Of course you could insert a time delayed startup series resistor, which then can be shunted out via a relay -- but this seems rather over elaborate I really can't see what's wrong with utilizing the existing 12 volt transformer tap or the notion of inserting a plug-into ballast tube socket, regulator unit. Also, regulating mains/ power line ac input sounds like a good idea but requires a rather bulky and sometimes expensive outboard ac magnetic regulating unit. I suppose you could have some DC to AC electronically regulated converter circuit to regulate your AC but isn't this another overkill?

Date: Sun, 20 Feb 2011 10:03:19 -0700 (GMT-07:00)
From: "Richard W. Solomon" <w1ksz@earthlink.net>
Subject: Re: [R-390] 3TF7 Ballast Tubes

I have a large quantity of 50 ohm 10 watt Dale Ceramic 10% resistors. I used one in my R-390A in place of the Ballast Tube and it worked fine. Anyone need any, I'll mail 3 of them postpaid in the USA for $4. Address OK on QRZ.com.

Date: Sun, 20 Feb 2011 10:10:18 -0800 (PST)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Regulated filament voltage

>He cleverly does this using a plug-in mock tube construction.

Even more clever is the high tech plug-in regulator designed, built, and tested a few years back by list heavyweight Dave Wise. His device is no larger than a 3TF7, is truly 2 terminal (does not need a ground lug unlike most other regulator schemes), regulates closely, and dissipates no heat to speak of. He did this with a microcontroller, driving a pair of MOSFETS in a zero crossing phase control scheme. This results in little to no RF noise production.

Now, I can envision the wheels of Dave's mind turning as he implements a way to accomplish 2 terminal series voltage regulation in place of current regulation, all with just a software revision to his present design.

Date: Sun, 20 Feb 2011 20:26:29 +0200

From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: Re: [R-390] R-390 Digest, Vol 82, Issue 23

> <snip> the entire voltage regulation thread is pretty moot.....
><snip>The use of 3TF7s, 12BA6s, or the 40 to 50 Ohm @10W resistor.....
> <snip> suddenly deciding that you wand Solid State and Digital.....

><snip> I really can't see what's wrong with utilizing the existing 12 volt transformer tap or the notion of inserting a plug-in ballast tube regulator unit.

I say "Yes, yes, and yes!" But it's fun to do these theoretical brain exercises, think up an idea, and see what might happen as a result! Of course, if you are trying to keep it original, then the 12V tap is out, as is the three-core mains connector. My take is to make it safe (3-core mains lead), use a good 3TF7 if you have one, Otherwise a 42R resistor is quite adequate. 2x 12BA6, or 12V tap, make unit swapping just a tad more difficult.

In my two R390As I have one original PSU, and one with a "made-to-order" transformer. 24V ac only - no 12Vac tap, and I only have 2x 12BA6s. So I am staying with the power wastage of a 42R5W in one set and a good (0.31A) 3TF7 in the other.

Date: Sun, 20 Feb 2011 10:31:47 -0800 (PST)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] Regulated filament voltage

[snipped] "Why is it that some folks simply cannot leave this wonderful working design alone? I certainly have YET to see or hear a single individual whom has the mental and design wherewithal that equals, much less *exceeds* the collective knowledge and wisdom of the entire Collins team."

We tinker with these radios because we like to tinker. Atop that, we, as stewards of these fine receivers, in a way envision ourselves to be somehow allied with the brilliant designers who created them. We then become "armchair engineers". We conduct seances to commune with the ghost of Art Collins on the Astral Plane. No harm in that. We see the Achilles Heel (every design, even the best, has at least one) as the somewhat failure prone 3TF7, and this coupled with the high price of a 3TF7, and ready availability of technology that wasn't around when these were designed, makes BallaSubstitutes ir-"resist"-ible.

How many mods do you see for the RF deck? Not many. We can't find a way to REALLY improve upon it.

But a BallasTube that goes "pop", $50 or more for a new one, cheap new electronics, a cheapskate mentality, mostly easy design at 60 Hz and no RF to deal with, and idle time making the hands wanto do the Devil's work....you get the picture.

"That LM-317? I swear, Art made me do it!!"

Date: Sun, 20 Feb 2011 13:50:51 -0500
From: rbethman <rbethman@comcast.net>

Subject: Re: [R-390] Regulated filament voltage

I see the 3TF7 and the other mentioned methods as adequate. It is that simple. With over ten years of running an R-390A running 24/7, I have have had "other" things go pfft! Like a 6AK5, that took out a resistor in the the audio deck.

I've yet to have a ballast tube go pfft! I also acquired a number of them that are kept as spares, BEFORE they hit a ridiculous price. I get more concerned with the ones out there that STILL have the selenium rectifier in use. That would be a very wise change, since the gases emitted when THEY croak are very unhealthy. The same can be said for the AC line input filters, since the GFCI issue is hitting more and more of us. The addition of an external bucking transformer comes to mind as a wise thing with the power companies pushing line voltages up into the near 130VAC range to keep from replacing all that wire to carry the load.

I have NO objection to tinkering! I just like to do so in the areas that really are issues. YMMV, and each to his own.

Date: Mon, 21 Feb 2011 12:56:08 EST
From: Flowertime01@wmconnect.com
Subject: Re: [R-390] 3TF7 Ballast Tubes

You wrote that you had a ballast tube with a bright spot in it. Most of the 3FT7 tubes also operate that way. some small portion or maybe two small segments glow and the rest of the filament is dark. We did worry when we did see a very short section glowing very bright. We though these tubes were about to burn out. I agree the voltage is off when you get a tube in this condition. Mostly we just considered we were looking for stable operation not exact value operation and as long as the R390 or R390A was not drifting or jumping around in frequency we let the tube go until it opened.

For test gear, I think you went the right way. Your looking for better than just kind of close performance from the test gear. My emotions and my wallet are in violent churn over this problem.

Date: Wed, 9 Mar 2011 11:36:06 -0500
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] Ballast Tube Folly

On a serious note, where can I find tube data for various ballast tubes? Google doesn't seem to find much about them - at least not the types I've searched on.

Date: Wed, 9 Mar 2011 11:44:40 -0500
From: "Bryan A. Stephens" <bryanste@yahoo.com>
Subject: Re: [R-390] Ballast Tube Folly

http://www.amperite.com/assets/Documents/Ballasts.pdf

Date: Wed, 9 Mar 2011 11:48:31 -0500
From: "Shoppa, Tim" <tshoppa@wmata.com>

Subject: Re: [R-390] Ballast Tube Folly

What I always appreciated most in that Amperite document was:

Resistor current regulator (ballast) part numbers still available:

1-1 2-20-30 3TF3B 6H-16 D9T1
1-15 20-1H 3TF4 6H-4 EW23B
1-16 20-3 3TF4A 6H-6 F4120A
1-1E 20-4 3TF4B 6H10 GL522-B25
1-3 20A10 3TF7 6HTF4 GL5621/B6
1-30 21-2A 3TF7A 6T1H GL5624/B46
1-4 210511-A 3TF7B 6T4 K26J218
10-11 22-4 3TF7/H 6T4A KS14595

Date: Wed, 18 May 2011 21:19:05 -0700 (PDT)
From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] RF Module Adjustable ……

<snipped>……Has anyone tried keeping the 6BA6 PTO/BFO tubes intact and used a diode to replace the ballast tube ?"

The radio will work with just a diode to replace the ballast tube, but the voltage to the PTO and BFO tube heaters will be too high - about 9 volts RMS on each of the two heaters. If you place a 20 ohm resistor in series with the diode, then all will be copacetic in Heatersville.

Date: Sun, 13 May 2012 20:37:14 -0400
From: John Wendler <wendlerjrv@gmail.com>
Subject: [R-390] Ballast App Note

Probably no new information to the list here, but fwiw, I came across this by googling; it does not seem accessible from the Amperite homepage:
http://www.amperite.com/assets/Documents/Ballasts.pdf
At least one person has done a solid state replacement:
http://www.radiomuseum.org/tubes/tube_3tf7.html

Date: Mon, 14 May 2012 10:06:58 +0200
From: sigmapert <sigmapert@gmx.de>
Subject: Re: [R-390] Ballast App Note

Here a link to an article dealing with the comparison of the original 3TF7 and a SS replacement of the 3TF7:

a)http://www.radiomuseum.org/forum/
ballast_tubes_in_filament_regulation_of_vfo_tubes.html

At the end of the above contribution you'll find another reference:

b) Schmid, Kurt, 4H4C Ballast Tube Replacements, Electric Radio 264: 40 (2011)

c) A solid state replacement for the 3TF7 current regulatorof the R-390 and R-390A receiver: http://schmid-mainz.de/Flyer.pdf

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Date: Thu, 24 Jan 2013 18:56:35 -0600
From: "Ron.K3PID" <ron.k3pid@sbcglobal.net>
Subject: [R-390] 12BH7A

My R-390 has a 12BH7A in place of the 3TF7 Ballast tube. Is this a documented modification?

Date: Thu, 24 Jan 2013 17:19:58 -0800
From: "Craig Heaton" <hamfish@efn.org>
Subject: Re: [R-390] 12BH7A

Yes, the socket has to be rewired also.

Date: Thu, 24 Jan 2013 17:59:45 -0800
From: Renee K6FSB <k6fsb.1@gmail.com>
Subject: Re: [R-390] 12BH7A

Hi Ron- almost anything can be used to drop the voltage, the 12BH7 or equivalent filament current (may require socket rewire/mod), a 43 ohm 10W(I think if memory serves), a replacement circuit for current limit or voltage control, replacement of the of the other 2 tubes in the string with their 12 volt equivalents and having a jumper in place of the 3TF7 pins. and if you are really lucky.....<snip>

Date: Fri, 25 Jan 2013 21:06:32 -0800 (PST)

From: "Drew P." <drewrailleur807@yahoo.com>
Subject: Re: [R-390] 12BH7A

Add 2 jumpers to the underside of the 3TF7's socket, plug in a 12BH7, 12BY7, or 12BV7, and away you go. The tube used can have gas, shorts, poor emission, grid emission - a large number of faults as the only requirement is that the heater be good - the tube is being used only as a resistor. I like this mod - you can plug in a dud tube that is good for nothing else, and it will serve you - kinda like getting sumpin' for nuttin'.

If the 12BH7 is good, swap it out with that dud 12BY7A driver tube from your HW-101, and then sell the 12BH7 to the highest bidder on the 'Bay; the 12BH7 is coveted by the audio guys.

Date: Sun, 27 Jan 2013 00:14:04 -0500
From: "Todd, KA1KAQ" <ka1kaq@gmail.com>
Subject: Re: [R-390] 12BH7A

> kinda like getting sumpin' for nuttin'

But if you have to remove a module to solder jumpers into place, swap PTO tubes or whatever else, it's no longer something for nothing. (o:

I understand that Ron's radio has apparently been modified already, but it still baffles me that more folks either don't use or perhaps aren't aware of the simple resistor substitution solution (RSS), particulalry since the ballast tube is referred to as a 'current limiting resistor'. A basic 40-50 ohm 5-10 watt resistor (think I used 43 or 45 ohms) is all that is required. Simply bend the leads so they don't come into contact with anything nearby (or dress them with spaghetti if you're really worried) and insert into pins 2 and 7 of the socket. No soldering required, the leads plug in just as tube pins would. Allen Bradley carbon comps might not be the best choice if you receiver lives in a humid environment.

If you've ever overcome with guilt or insanity and want to reinstall a 3TF7 in the socket, just yank out the resistor. It'll take more time to align and stuff the tube back in. Beyond completing the circuit, the ballast tube serves no real function in today's world. Elevated line voltage is far more of a concern than poor regulation. It was supposed to be removed from the cost-reduced R-390A design but somehow managed to hang around.

You can even hide said resistor inside of a tube shield if the Originality Police have you staked out.

Date: Sun, 27 Jan 2013 07:27:14 -0500
From: "Bernie Doran" <qedconsultants@embarqmail.com>
Subject: Re: [R-390] 12BH7A

If one is really fussy about appearing totally stock, carefull bend some small wires around the pins on the 3tf7, then rub the 12 of of the 12 volt replacements. Isn't that being a little silly though? perhaps you might have a larger problem if you are that

concerned. Bernie W8RPW

Date: Sun, 27 Jan 2013 09:53:29 -0700
From: Transmaster <22hornet@gmail.com>
Subject: Re: [R-390] 12BH7A

I did this mod to my R390A years ago, I picked one of the tubes listed as being a substitute and changed the wiring on the socket to match. It has worked. In retro spec a wire wound ceramic would have worked just as well but at the time 3TF7's where merely hard to find so the idea was to be able to use the original ballast tube if you found one.

Date: Sun, 27 Jan 2013 12:10:53 -0500
From: rbethman <rbethman@comcast.net>
Subject: Re: [R-390] 12BH7A

My first '67 EAC came to me by way of WC3K (sk), withe the already mentioned "43ohm 10 watt sand style resistor. I did indeed obtain a 3TF7 and put it in place instead. No alignment was necessary - PERIOD! Either way the performance was identical. The radio was hot as any! <snip>

Date: Thu, 07 Aug 2014 19:05:28 -0500
From: Dan Osborne <wb5afy@wb5afy.net>
Subject: [R-390] Nolan Lee reposts - tech

You know - I must admit - seeing all the responses to Nolan's "essays" really is enjoyable !!! Nolan's work helped me a great deal with bring several "blue stripers" back to life...so – if everyone is in agreement - more of Nolan will follow - enjoy.

I originally posted the following message to the list here on Jan 27th of 1999. I've corrected a few spelling errors and added a few more comments to it with this posting. Al, you might want to replace the original message with this one at your R390A FAQ site.
-----<snip>-----
OK, after listening to all of the hype and BS about the ballast tubes in the R390A, I figured I'd research it a bit an post my findings. Put your boots on bubba, it's gonna get deep... <grin>

If one of you guys is saving stuff for an R390A FAQ, the info below would go well in it.

Digging thru a 1982 Amperite AM-82 application guide, I found a few interesting things that I'll pass on to you guys. If you deal with a distributor that handles Amperite, get them to get you a copy, it's an interesting book.

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. Since I'm one of those people that refuses to use the metric system, you

know WHICH 160 degrees I'm talking about. <hint> It ain't Kelvin either.

<added comment> One of the posts I read today mentioned a shelf life with ballast tubes. I suspect that it's related to ballast tubes that use helium as the filler gas. Helium is famous for it's ability to pass thru the wall of sealed steel high pressure cylinders. I ain't no engineer or chemist but have had some experience with high pressure gases and have see firsthand that helium will "disappear" from sealed bottles. If I'm not mistaken, the 3TF7 ballast tube is filled with hydrogen rather than helium. OK, back to my original post...

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 it's 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.

Here's a direct quote from Amperite AM-82 that you'll really find interesting:
---snip---
DUTY CYCLE DEPENDENT

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 if 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.
---snip---
I figure that over the last 23+ years that I've had the old Collins, it's been on for "24 and 7" for at least 15 of those years. 15 years is 131,400 hours. That original 3TF7 is still going just fine. I'm not saying that it won't puke when I finish the overhaul of the receiver and power it up, but even if it did, it gave pretty damn good service.

<added comment> I finished my OH of my 67 EAC back in the middle of October of 1998. It's been running 24 hours a day and seven days a week since then. That's about 18 and a half months or more than 13,300 hours on the very same ballast tube that was installed in it when it was assembled back in 1968. If the gas hasn't leaked out yet, I suspect that it won't. Back to my original post...

The folks at Amperite that I've dealt with have been a hell of a nice bunch. I needed some information on some odd "non standard" numbered ballast tubes. They transferred me to an engineer and I received all of the answers that I needed. Very sharp and friendly bunch of people.

For what it's worth, there's another part number for the 3TF7 that was used for tubes that had different testing requirements than the standard mil-spec and was for a Govt contract in 1978, and not for civilian or commercial sales. After I corner the market on them I'll post the number. <grin> Just joking...a friend of mine found a stash of them and sent me three of them last week or so to research and experiment with. After talking to the engineer at Amperite a few hours ago, there's no need to experiment. I now know exactly what they are.

The end flap of the boxes is labeled as follows:
Amperite
TJ311M01

The side panel is labeled as follows:
5905-00-681-4707
Resistor Current Regulating
1 ea. DLA900 78-M-T921A 5/78

The tubes themselves are labeled as follows:
(circled Amperite "A" with lightening bolt)
Amperite
TJ311M01
Ballast
820
So, if you spot any of these TJ311M01 marked ballast tubes, grab a few, they'll work just fine in your R390A. I'd be curious to hear from any of you that bought an R390A that contained one of these or any of you that have information on the contract number or the FSN for them, listed above. nolan

"if you see us running, catch up"
bomb squad motto

Date: Fri, 8 Apr 2016 03:52:23 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>
Subject: Re: [R-390] VU Meter Issue...newbie on first 390a

Nice meters!? I give you credit on the rebuild. I really like the contrast. Your suggestions have been noted and I may dig in to it tomorrow to see what I can figure out with the meter. On a different note....were these meters ever lit or strictly "glow" style?

Date: Fri, 8 Apr 2016 04:34:48 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: [R-390] R-390A Alternatives for regulator 3TF7 - 12BH7, 12BY7, etc

If you have the 2 wire change on the regulator socket, these can be plugged in and work well:?12BH7, 12BY7, 12CT8, 12DQ7, and 12FX8.

Date: Fri, 8 Apr 2016 06:25:27 -0700
From: "Craig" <hamfish@comcast.net>
Subject: Re: [R-390] R-390A Alternatives for regulator 3TF7 - 12BH7, 12BY7, etc

Another option to replace the 3TF7, thus saving money for good whiskey: Jumper pins 2 & 7 on the 3TF7 socket and replace the 6BA6 tubes for the BFO & PTO with 12BA6 tubes.

Date: Fri, 8 Apr 2016 09:44:39 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] R-390A Alternatives for regulator 3TF7 - 12BH7, 12BY7, etc

It's a bit kludgey but I think there's a 6.3V tap on the transformer that can be brought up to the 3TF7 socket and then you can continue to use the 6V tubes without a regulator or 12V tube in the 3TF7 socket with a jumper. I did that with one of my previous radios by routing a wire through the wiring harness to the IF module's plug/ socket and then on to the 3TF7 socket, but a plain old jumper wire all the way from the P/S up to the IF chassis would do in a pinch (and would be more obvious to the next owner as well).

Date: Fri, 8 Apr 2016 10:07:24 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] R-390A Alternatives for regulator 3TF7 - 12BH7, 12BY7, etc

The two solutions work equally well, but using 12BA6s consume less power(!).
I always had concerns about replacing the 3TF7 with solid-state "substitutes".
I tried this on the HRO-60 also but never been satisfied with the results... using a 6V6 there is the most convenient. About the 3TF7: if ever someone runs across a 2HTF11B, it can be used, because it measures identical to the 3TF7.
For the ones that have doubts, just look in the Collins R-390 manual (order 14214-P-51) dated Oct. 23, 1953 or the TM 11-856 on page 10, fig. 11 and just read what is stamped on the IF chassis for RT512.

Date: Fri, 8 Apr 2016 10:21:59 -0400
From: djed1@aol.com
Subject: Re: [R-390] 3TF7 replacement...newbie on first 390a

I've been using a resistor in my R-390A for 30 years with no discernible effect on stability (replacement tubes were hard to find back then). I've got a couple of spare 3TF7s, but have found no need to use them. So I was interested to see Electric Radio publish an article in their Feb 2016 issue which quantified the benefit of filament regulation. The author, DH3PJ, tested the stability of the radio using a resistor, 3TF7 and a solid state regulator. Under a 8.5% change in line voltage, the

frequency shift was 27 Hz for the resistor, 11 Hz for the 3TF7, and 2 Hz for the solid state. So if you're listening to SSB, it probably doesn't matter. If you're going for the ultimate in long term stability for digital modes, then the solid state is 5 times better than the 3TF7. Since I use the radio for casual SSB and AM reception, I'm sticking with my resistor.

Date: Fri, 8 Apr 2016 10:43:13 -0400
From: "Todd, KA1KAQ" <ka1kaq@gmail.com>
Subject: Re: [R-390] 3TF7 replacement...newbie on first 390a

I've used the resistor approach with no issues over the years, too. 47 ohm, 2 (or 5?) watt IIRC. In fact, one A model that I sold to a list member had a very nice, heavy duty version installed with its own heat sink, which was mounted on the side of the chassis. Much cheaper and more reliable than the ballast tube. Easy to install - stuff a resistor into the socket between the correct pins (2 and 7 I think?), completely and quickly reversible if the Originality Police show up for a surprise inspection.

Interesting tidbit: most know that the R-390A is the cost-reduced/updated version of the original R-390. Less known is that the ballast tube was one of the original features that was supposed to be dropped from the overall design as it was deemed unnecessary at that point. Somehow it remained.

Had my first 3TF7 burn out last year. Including the one I stepped on a few years back, that's only 2 in 3+ decades.

Date: Fri, 8 Apr 2016 17:11:41 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>
Subject: Re: [R-390] 3TF7 replacement...newbie on first 390a

This is interesting. I wonder how long the solid state version would last since heat is always a concern. But there is no doubt that the 3tf7 would a more rugged option. I saw that someone on ebay is selling a plug in module that is a solid state replacemnt...I wonder how they perform.... Thankfully, there are options and its a choice of picking your right medicine!

Date: Fri, 8 Apr 2016 13:44:47 -0400
From: djed1@aol.com
Subject: Re: [R-390] 3TF7 replacement...newbie on first 390a

I believe the article uses the eBay regulator.

Date: Fri, 8 Apr 2016 17:59:15 +0000 (UTC)
From: g.balinski@comcast.net
Subject: Re: [R-390] 3TF7 replacement...newbie on first 390a

I have the solid state replacement for the 3TF7 in my R-390.
It works well. I would never go back. Ebay item #? 111961199507

Date: Fri, 8 Apr 2016 22:25:37 -0400
From: "David S." <k7iou1@gmail.com>

Subject: [R-390] 3TF7 replacement

Why buy when you can build it yourself?
I'm sure many of you have seen this.
http://militaryradio.com/manuals/HSN/HSN-R390.pdf
I modified a 12BH7A

Here is a link to the Dallas Lankford files, scroll down to Collins and the 3TF7 article.
https://web.archive.org/web/20101124124237/http://kongsfjord.no/dl/dl.htm

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Date: Sat, 9 Apr 2016 12:49:26 +0200
From: "Paul Galpin" <galpinp@absamail.co.za>
Subject: [R-390] 3TF7 replacement

I believe in keeping my R390A as original as possible, but there are caveats. Before shouting "Hallelulya, I've got the original" and plugging in your new(?) 3TF7, have you thought what it might actually be doing? I decided to check out my two 3FT7s. One of them was not too bad, but the other definitely overloaded the heaters, in my opinion.

The test needs only a variable PSU, an accurate voltmeter, and an accurate ammeter. This last can be a digital voltmeter looking across an accurate resistance, the current is the important thing in an iron-hydrogen barretter like the 3TF7. One reached the "stable level" at about 9.0v, and kept it there up to 20V. No further, I didn't know when the filament might pop! So the stable level current was between 0.310 and 0.312A for a range of 9 to 20V, not too bad.

The other reached 0.3A at 6.5V and continued to climb up to 0.37A at 11V where it stayed up to 20V. Not healthy, IMHO! I suspect that as these were originally hydrogen filled, over the years the gas has become diluted with air, which gives a different cooling effect to the iron wire. Or something.

Date: Sat, 9 Apr 2016 06:59:31 -0700
From: "Craig" <hamfish@comcast.net>
Subject: Re: [R-390] 3TF7 replacement

For the purist, plug that puppy in (3FT7)!The belief is the 3FT7 regulator tube was included in the design to control variations in supply voltage to the receiver; such as a R-390/A installed in the rear of a deuce & a-half towing a generator thru swamps, over hill & dale, etc. Highly recommended for those who own a deuce & a-half! On the other hand, the voltage to my abode is quite stable. I'll spend the money on good whiskey rather than a 3FT7. Your money, time, and radio; YMMV

Date: Sat, 9 Apr 2016 16:22:57 +0000 (UTC)
From: g.balinski@comcast.net
Subject: Re: [R-390] 3TF7 replacement

Simple. Because it would end up as "round-tuit" # 4017, and the radio would sit unused until then.

Date: Sun, 10 Apr 2016 02:31:08 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] 7 pin male header

I'm looking for seven pin male header that would fit into a 7 pin tube socket.
I did a net search and can't find any. ?I saw several products on the R390A list that used them. ?They appear to have a PC board shape. Epay was a but also.

Date: Sun, 10 Apr 2016 03:01:20 +0000 (UTC)
From: Perry Sandeen <sandeenpa@yahoo.com>
Subject: [R-390] ER article for R390A SS regulator

I read the article with a keen hope that this was the "Real Deal". I had seen it advertised on epay and it looked very nice. When I read the article and saw the graphs I was highly disappointed. First one graph showed upon turn on an almost instantaneous jump to full voltage. Another graph showed its voltage response to the change of input voltage to the receiver. There seems to be a lag period after the input voltage changes before a settling to a value. I have no idea whats inside that makes it work that way.

With a small bridge rectifier, a LM317 regulator, a 4.2 Ohm resistor would give one almost exactly 300 mA when set up as a constant current regulator. (Perhaps a couple of filter caps should be added) Total cost, less than seven dollars. One would have to make a 7 pin header but that could be done with two seven pin tube sockets mounted face-to-face and some #20 solid wire. See the Y2KR3 anthology for details

I'm all for the free enterprise system but this product doesn't seem to work very well. That said there is another SS regulator on epay for about the same amount of money that might perform much better,

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Date: Sun, 10 Apr 2016 08:53:31 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] 7 pin male header

There are 7 and 9 pin male 'header' plug kits on ebay. ?The 7 pin pcb is #?? 191612800329. ?The 9 pin pcb is # ?201378227328. ?The pins for them are #? 191746566522.

Date: Sun, 10 Apr 2016 13:47:17 +0000 (UTC)
From: "R. David Eagle" <kb8nnu@yahoo.com>
Subject: Re: [R-390] ER article for R390A SS regulator

I agree....it seems like a pretty simple design and I will admit that I am not a purist when it comes to making my 390a work. I have one of the eBay modules on the way so I am hoping it works good!

Date: Sun, 10 Apr 2016 10:59:31 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: [R-390] 3TF7 replacement

I have one of the plug-in sold state replacements made by Dr Kurt Schmid (ebay: sigmapert) for the 3FT7. Here are some things to consider when looking at a solid-state current regulator;

If you use a linear regulator the device must be capable of dissipating about 8 watts of heat due to voltage drop. This requires some forethought when coming up with a heat sink. The specifications for the regulator are built right in to the model number of the tube; 3FT7 means 300 mA, 7 V drop.

Ballast tube regulation is not all that good when compared to a solid-state device. Not that it takes much regulation for the PTO/BFO to remain frequency-stable. NIB 3FT7's can cost $30-$60 USD. You can buy a good solid state regulator for about the same and never have to worry about it again.

A good article on the 3FT7 ballast can be found at;
http://www.radiomuseum.org/forum/ballast_tubes_in_filament_regulation_of_vfo_tubes.html

And on the particular regulator I have;
http://schmid-mainz.de/Flyer.pdf

Date: Sun, 10 Apr 2016 15:08:22 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] 7 pin male header

The two pcbs listed below are pin swap pcbs made to adapt a given tube type to another one pinout.

Date: Sun, 10 Apr 2016 23:33:41 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: [R-390] FS: 3TF7 Regulator tubes NOS NIB

Hi all, I have a few 3TF7's regulator tubes that I will sell for $18 each plus $3 for shipping. They are New In the Box and never used. I checked the filament with my ohm meter and they read good. Please send me an email directly if interested.

Date: Mon, 11 Apr 2016 09:56:18 -0500
From: Tisha Hayes <tisha.hayes@gmail.com>
Subject: Re: [R-390] ER article for R390A SS regulator

When the radio was used in RTTY service while being powered from fairly unstable electric generators it could get drifty enough that the op would need to be constantly tweaking the frequency on a bank of receivers as line voltages went up and down. It made perfect sense to stabilize heater current the BFO and PTO tubes through the use of a ballast tube in series with the tube filaments.

It may be that most radios that are out there today are not going to be operating from a small generator in RTTY service. For those applications maybe it is just fine to use a dropping resistor or another tube filament in series to just keep the bulbs lit.

The 3FT7 is not a perfect solution; as has been said, it is a fairly fragile tube that is getting pretty rare and expensive and there are alternative approaches we can take to further reduce the heat and electrical load inside of the radio.

Any linear device; like a resistor or an LM series regulator is going to need to contend with heat dissipation as the voltage drop is going to be translated in to thermal energy. The difference in voltage between both sides of the device is the voltage drop, times the current (good 'ol ohms law) equals electrical watts that is the same as thermal watts.

If you use a very tiny switching converter as the "sigmapert" device made by Dr. Kurt Schmid the total current goes down because of the conversion in the supply. The heat dissipation drops down to around 1 watt as the converter efficiency is 94%. It is not a magical device, it contains a small commercially made switching regulator with a few other peripheral components for AC to DC rectification and some caps. It does require an additional connection to chassis ground; either by attaching a ground lead to what looks like an anode at the top of the metallic tube shaped device or by running a ground wire to pin #1 of the tube socket. Pin #1 is not used by the 3FT7 tube so if you later decide to pull the solid state converter and put in an old 3FT7 it does not cause a problem.

I have one in my primary R-390A and it has been there for a few years now. It does not run warm and has been reliable. If I feel any guilt I can always pop in a 3FT7 as I have a few spares that I am saving as investment properties to resell to 'yall when the prices climb to $200 each.

Date: Mon, 11 Apr 2016 09:27:35 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] 3TF7 replacement

I too invented a plug-and-play cool-running SS 3TF7. Search the archive for "3DW7".

Date: Mon, 11 Apr 2016 11:09:24 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] ER article for R390A SS regulator

I have two basic questions regarding 3TF7s and the R390.

1. If I understand the ballast operation correctly, when the voltage changes, the current through the circuit changes. The ballast reacts to that change and the voltage drop across it changes to bring the current back to 300 mA. Is that correct? If so, how quickly does the ballast react to get the current back to its specified value?

2 (and this one might get me kicked off the list). Are there solid-state (FET, etc.) replacements for the oscillator tubes that would eliminate the need to regulate any filament voltages?

Date: Mon, 11 Apr 2016 13:40:17 -0400
From: Roger Ruszkowski <flowertime01@wmconnect.com>

Subject: Re: [R-390] "sigmapert" device made by Dr. Kurt Schmid

Where can I get some of these regulators.
Please plug a sales site for me.

Date: Mon, 11 Apr 2016 14:17:29 -0400
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] ER article for R390A SS regulator

>Are there solid-state (FET, etc.) replacements for the oscillator tubes that >would eliminate the need to regulate any filament voltages?

Barry, there once was a fellow in San Francisco (20 years ago) who claimed any tube (R390 size) could be built as a plug in solid state device. He did a 6DC6 for me. Compared to a real tube in the front end of a receiver my one
off device did not have the gain. A real tube was hearing more signals than the solid state device. The noise floor was up as there was more in the band pass to hear. If you can not hear the signal noise floor means nothing. But for an oscillator a solid state device could be a real possibility. Perry was looking for some 7 pin male plugs as was I. This is the current limit in experiments.

Tish put up a link to a PDF on the once offered device to replace the ballast tube. Read the fine print. Playing with the line voltage / current / power in the lab only produced a 12 hertz VFO frequency shift. There is a thermal lag in the ballast tube. Some lag also comes from the filaments of the VFO and BFO themselves.

The solid state device looks to even regulate this 12 hertz oscillator shift. Just the idea of running the two oscillators in tubes with filtered DC filaments sound like a step forward in lowering the noise from the oscillators into the receivers signal path mix. An then get voltage regulation on top of that.

But now we have to remember the whole VFO stability drift topic is over a shift of just 12 hertz. The Doctor said so. He did the definitive testing.

Solid stating the oscillators has got to offer more than 12 hertz stability. Some thing has to come in better noise floor. Possible a different signal level being presented to the mixer thus yielding a better stronger, less noise output from the mixer tube whit out other modification beyond just swapping in a solid state VFO and BFO device. You will want both as the filament string goes open with just one device. Drive up the part count to sell a few more to dive down cost.
Both VFO and BFO would be useful.

Date: Mon, 11 Apr 2016 14:19:22 -0400
From: "Jacques Fortin" <jacques.f@videotron.ca>
Subject: Re: [R-390] 7 pin male header
Message-ID: <002e01d1941e$ad0bdaa0$07238fe0$@videotron.ca>

Maybe I am lucky with Google, but I found two places :
https://www.surplussales.com/Tube-Sockets/TubeSkts-2.html
scroll down until you see (TUA) 907MIB

http://www.leedsradio.com/parts-sockets.html
scroll down the page until you see:

7 pin minature plug -fits sockets for 1L6, 6AU6 etc
good for making tube adapters and test jigs with
screw on back shell - NOS
and
9 pin shielded plug - made by Vector (rfe)
9 pin shielded plug - made by Vector, w/o cable hole
great for making plug-in modules for RIAA etc
9 pin miniature plug fits sockets for ECC-83, 12AX7
good for making tube adapters and test jigs (rfe) -.--
9 pin miniature plug - Amphenol - silver plated
contacts with rubber boot -.--
9 pin miniature plug - Amphenol - gold plated
contacts with rubber boot

And yes, I have some of each kind, NOS in my parts bin.
Depend how much you need and for which purpose.

Date: Mon, 11 Apr 2016 14:37:06 -0400
From: Roger Ruszkowski <flowertime01@wmconnect.com>
Subject: Re: [R-390] 7 and 9 pin plugs

The E bay folks are offering both 7 and 9 pin printed circuit board round wafers.
With holes on the tube socket pin pattern as we need.
Some pins are offered being of fair length.

You need two wafers and the 7 or 9 pins. You space the wafers one on top one mid way to leave pins sticking out the bottom. You get a bird cage you can build into between the upper and lower wafer. You can build all over the top side.
Look inside an R390 RF can for the construction idea of how parts solder to pins. Wrap proto types in shrink tubing and heat gently. Production runs could sand PC disk to nice circle diameter and a hard plastic tube sleeve could be added. A plastic plug would form the top. Glue it all together. I do contact cement that I can chisel open. I see the socket savers on E bay. These could be built on and wrapped with a sleeve type tube cover. Finding plugs to build on is a problem for us hobby experimenters.

Date: Mon, 11 Apr 2016 18:44:04 +0000 (UTC)
From: Steve Toth <stoth47@yahoo.com>
Subject: Re: [R-390] "sigmapert" device made by Dr. Kurt Schmid

I purchased two of the 3TF7 replacements as well as a couple of his R390A antenna baluns from Kurt directly via email and Paypal. At the time Kurt was giving a discount on direct purchases - be sure to ask him. Also the price included the shipping from Germany. Great service with prompt shipping and quality products. Kurt's email: sigmapert@r-390a.eu
(No financial interest, just responding to Roger's request for info)

Date: Mon, 11 Apr 2016 15:12:22 -0400 (EDT)
From: Barry <n4buq@knology.net>
Subject: Re: [R-390] "sigmapert" device made by Dr. Kurt Schmid

I seem to recall Chuck Rippel making a regulator that fit in the space just in front of the power transformer; however, I can't seem to find any references to that anymore. Anyone else remember that?

Date: Mon, 11 Apr 2016 12:23:24 -0700
From: Renee K6FSB <k6fsb.1@gmail.com>
Subject: Re: [R-390] "sigmapert" device made by Dr. Kurt Schmid

I have been using his 25Z5W replacements and am extremely pleased!
Renée

Date: Mon, 11 Apr 2016 19:51:11 +0000 (UTC)
From: Larry H <dinlarh@att.net>
Subject: Re: [R-390] FS: 3TF7 Regulator tubes NOS NIB - SOLD OUT

Hi all, Thank you for your interest. I have sold out of them.

Date: Tue, 12 Apr 2016 00:10:49 +0200
From: sigmapert <sigmapert@gmx.de>
Subject: [R-390] More Info about the 3TF7 replacement using a high efficiency switching regulator

As Tisha Hayes already stated there is no magic with this device. Here two links to:
a) the location of the 3TF7 and the 3TF/ replacement within the circuitry in the R-390A: http://schmid-mainz.de/3TF7/01.jpg

b) top and bottom view of the small printed circuit board (not yet wired to the 9 pin miniature base) as contained in the housing of the device:
http://schmid-mainz.de/3TF7/02.jpg

Date: Mon, 11 Apr 2016 15:48:37 -0700
From: David Wise <David_Wise@Phoenix.com>
Subject: Re: [R-390] More Info about the 3TF7 replacement using a high efficiency switching regulator

I wondered how you found room for the reservoir cap. Answer: With great difficulty. :) I took a different approach with my 3DW7. It regulates AC RMS, not DC. It switches at mains frequency, and lets the heaters do the filtering. It powers itself through the load, so it does not need an earth connection. It has a small reservoir cap, just enough to keep the microcontroller alive when the pass transistors are on.
