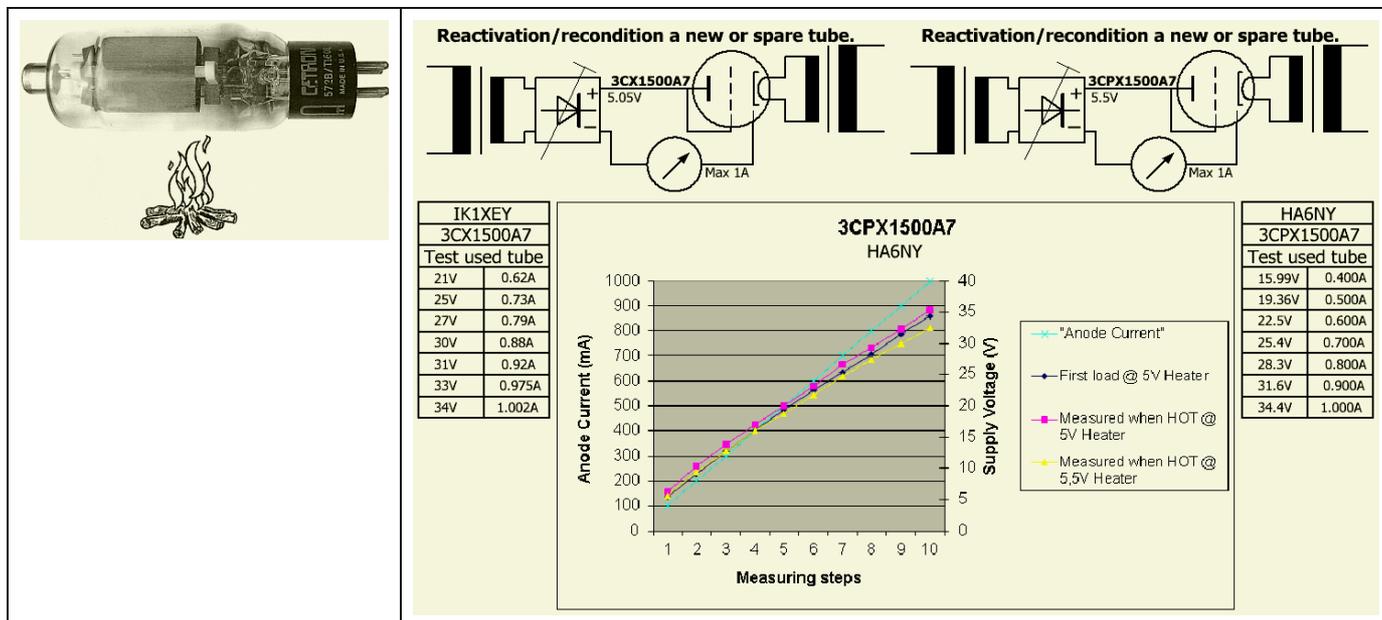


Radio tube reconditioning

RECONDITIONING TUBES

UPDATED 18-jun-2022



EMISSION



Deforming of the anode due to inefficient cooling.

The filament of a tube with either directly or indirectly heated cathode emits a flow of electrons, which depends on the voltage on the anode and grids. Even if the tube is cut-off electrons are emitted. This is a continuous process that ends when the cathode is "exhausted". In a tube having a directly heated cathode, the emission gradually decreases, the tube becomes "soft". Emissions of an indirectly heated tube can drop quite suddenly and is often accompanied by an increase of arcing (flashover). Furthermore, the filament suffers the most from switching because the warming

up caused more damage than standby. Therefore, in a broadcasting transmitter the filaments are not switched off after the end of a transmission. Does not switch off the filaments if you using a PA at different times a day, then a tube will last an amateur lifetime.

In general, the most wear is due to overload (overdrive) and insufficient cooling. Excessive ventilation is better than poor cooling. Overheating (fig») the tube (seals) can damage the gas density of metal with glass or ceramic compounds. Also a heavy inrush current causes a too rapid expansion of the metal causing permanent damage.

Probably you also always keep a few spare tubes in stock. Why? You know the practice, if one get rid of spare tubes probably the next day the PA's tube is broken (according to Murphy's law). It is wise to use the spare tubes once a year to stabilise the state of cathode and vacuum. A tube is never absolutely gas-tight. In the course of time, molecular particles sliding along the pins into the tube. Therefore combinations of substances (getter) are added to cure, but the longer the spare tube is unused the more the vacuum will be polluted, one sees a bluish glow close to the anode if the tube is in action.

REACTIVATING OR RECONDITIONING A TUBE



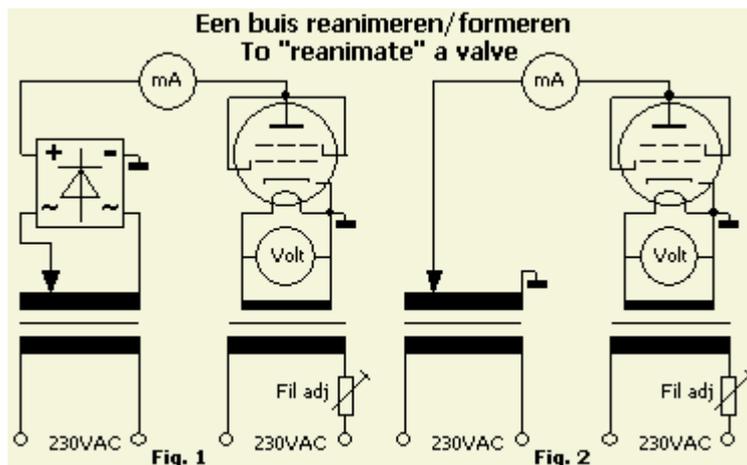
Still works well despite the black color!

To prevent arcing in a new or long time unused tube, it is wise to prepare (reactivate) for his task. It should "initiated" by heating or "degassing" in order to optimise cathode and vacuum. Residue of gas is removed or absorbed, and the cathode regains its optimal emission. If that is omitted, there is a greater risk of spark-over (flashover) between anode and other internal connections. That may be a (permanent) damage to cathode, filament and grids. Damage to a tube can also be the cause of arcing and decreased transmitting power.

The reactivation is the easiest by heating in the amplifier. Disconnect the anode voltage and heat the tube for about one hour with the filaments on and put the fan off. Note: many ceramic tubes are overheated with the fan "off".

Reconnect anode HV, activate the fan and get the tube to draw the specified idling current while holding down the PTT switch. Then leave to stand for at least an hour. To prevent any oscillation during the process, the output should be connected to a dummy load. After this treatment and if everything remains stable the drive may gradually be increased to the specified value or to the maximum anode current. So if one think a tube is worn or "useless" do not throw away, see fig»!

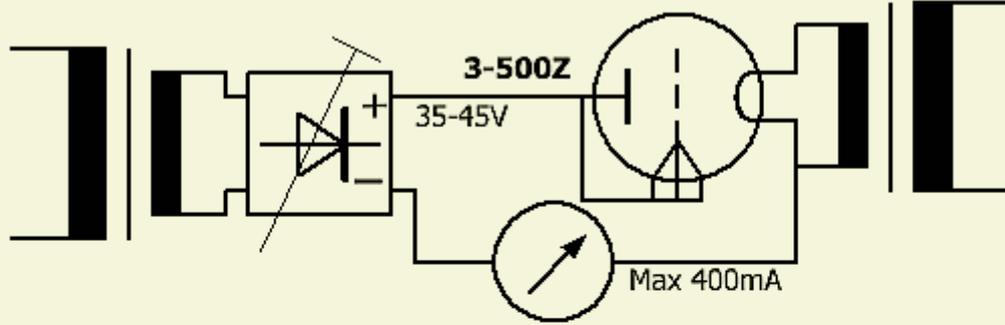
ANOTHER METHOD OF RECONDITIONING



On the Internet you can find all kinds of complex, colourful, cumbersome and lengthy procedures to achieve the same result, but try this old fashioned method: Get a socket, heater transformer, mA-meter and a variable DC supply. Connect the filament and connect all grids to the anode. Note: the tube is temporarily used as diode so that the required anode current is obtained with low DC voltage. Heat the tube for one hour with only the filament voltage on. Then apply DC, set the voltage and see if any current flows gently adjust the voltage for maximum allowable anode current.

VARIOUS TUBES

Reactivation/recondition a new or used tube.



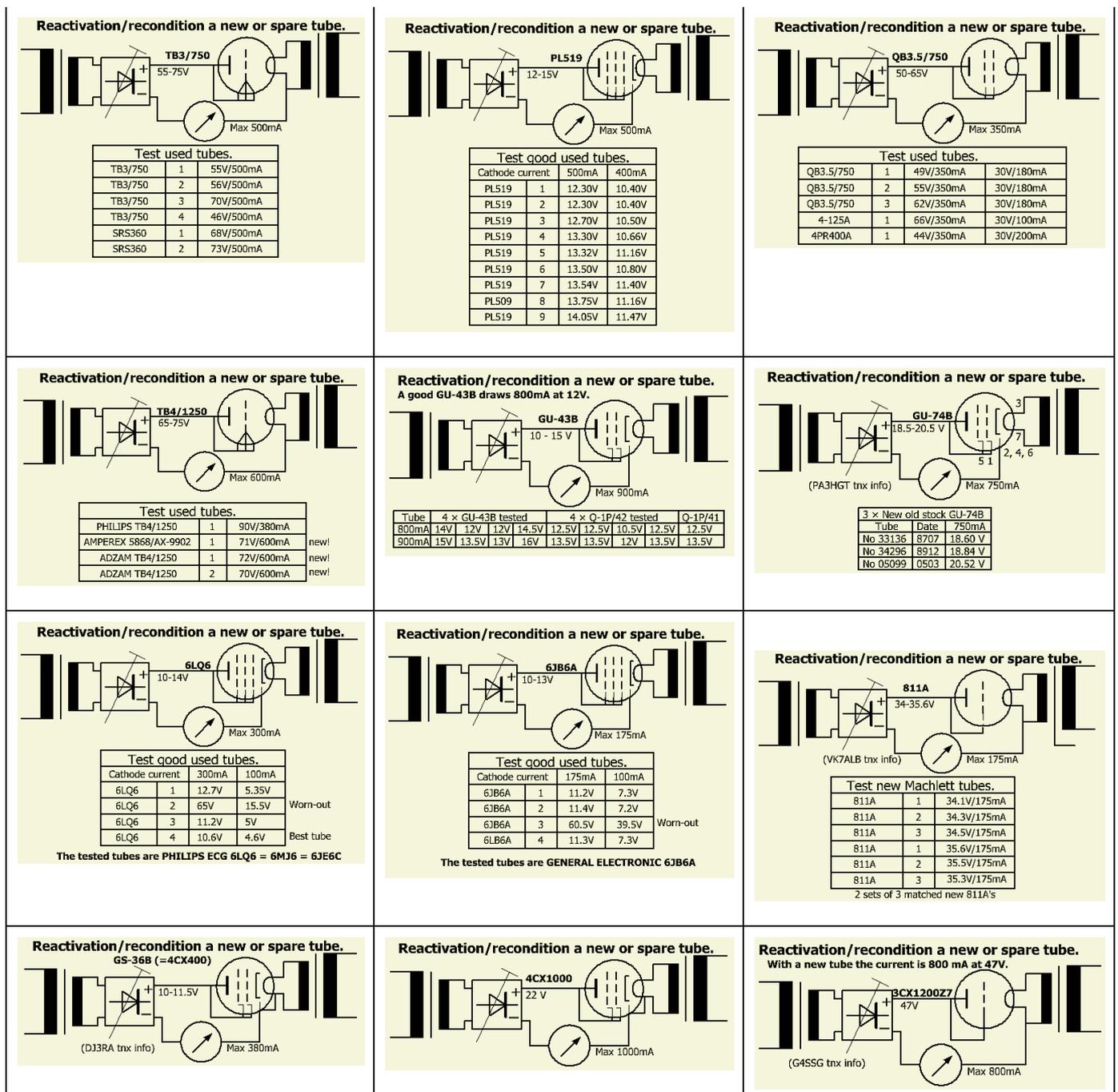
Test used tubes.			
1	3-500Z	38V	400mA
2	3-500Z	40V	400mA
3	3-500Z	37.5V	400mA
4	3-500Z	38.5V	400mA
5	3-500Z	34.5V	400mA
6	3-500ZG	39V	400mA

(1) PA1PXL (2) Wakkel (3) Daniel
(4) Daniel (5, 6) PAØFRI



The reconditioning of a 3-500Z is relatively simple. With a DC voltage 0 - 40 V you should be able to get around 400 mA anode current with maximum 40 V DC on the anode. Apply 4.9 V to the filament and "cook" the tube for an hour. Then connect the variable supply and adjust DC for 400 mA anode current. The process must be maintained until for example a stable 38 V/400 mA is obtained.

<p>Reactivation/recondition a new or spare tube. With a new tube the current is 1000 mA at 25 V.</p>	<p>Reactivation/recondition a new or spare tube. With a new tube the current is 250 mA at abt 44 V.</p> <p>All good used or new TAYLOR, WATERS and CETRON tubes that I tested were remarkably similar: 250 mA at 44 Volts.</p>	<p>Reactivation/recondition a new or spare tube.</p> <table border="1"> <thead> <tr> <th colspan="4">Test used tubes.</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>3-500Z</td> <td>38V</td> <td>400mA</td> </tr> <tr> <td>2</td> <td>3-500Z</td> <td>40V</td> <td>400mA</td> </tr> <tr> <td>3</td> <td>3-500Z</td> <td>37.5V</td> <td>400mA</td> </tr> <tr> <td>4</td> <td>3-500Z</td> <td>38.5V</td> <td>400mA</td> </tr> <tr> <td>5</td> <td>3-500Z</td> <td>34.5V</td> <td>400mA</td> </tr> <tr> <td>6</td> <td>3-500ZG</td> <td>39V</td> <td>400mA</td> </tr> </tbody> </table>	Test used tubes.				1	3-500Z	38V	400mA	2	3-500Z	40V	400mA	3	3-500Z	37.5V	400mA	4	3-500Z	38.5V	400mA	5	3-500Z	34.5V	400mA	6	3-500ZG	39V	400mA
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To compare you need a good tube to determine at which voltage the maximum anode current is obtained.

A tube is not cooled unless the manufacturer requires that its product (eg ceramic tube) must be cooled as the filament is on. Eventually use a fan for the seals to prevent over heating. If a tube is new or for a long time unused, the current will gradually increase so that the voltage had to be decreased. Actually the fixture should be permanently monitored because it is possible that the current suddenly jumps to a higher value, a sign that the tube becomes "better". If for a period of a couple of hours the anode current remains stable at a particular voltage for example GU-43B: 12 V/800 mA, then the reactivation may be terminated.

One may extend the reconditioning, my experience is that after 2 - 5 hours the process can be stopped because the tube is worn out but it's worth a try.

SOME TUBES TESTED IN RF AMPLIFIER

In my home made PA I have tested some of my tubes and borrowed ones. The driving power (P_i) was respectively 10-, 50- and 100 W. At each step, the output power (P_o), grid current (I_g) and anode current (I_a) was listed at an anode voltage of 2500 V and 1700 V. Please note that some tubes are overloaded as experiment.

See tables: [Table 1](#), [Table 2](#), [Table 3](#), [Table 4](#).

All measurements were carried out under the same conditions as much as possible. There is no account of up to 10 V changes of the supply voltage. A DAIWA CN101-L power meter was calibrated in two ranges 100 W and 400 W at 14.2 MHz. On 10 and 160 m bands, the meter indication was less than the reality, but the corresponding values are listed in the tables.

SAFETY





Be careful, prevention is better than cure.

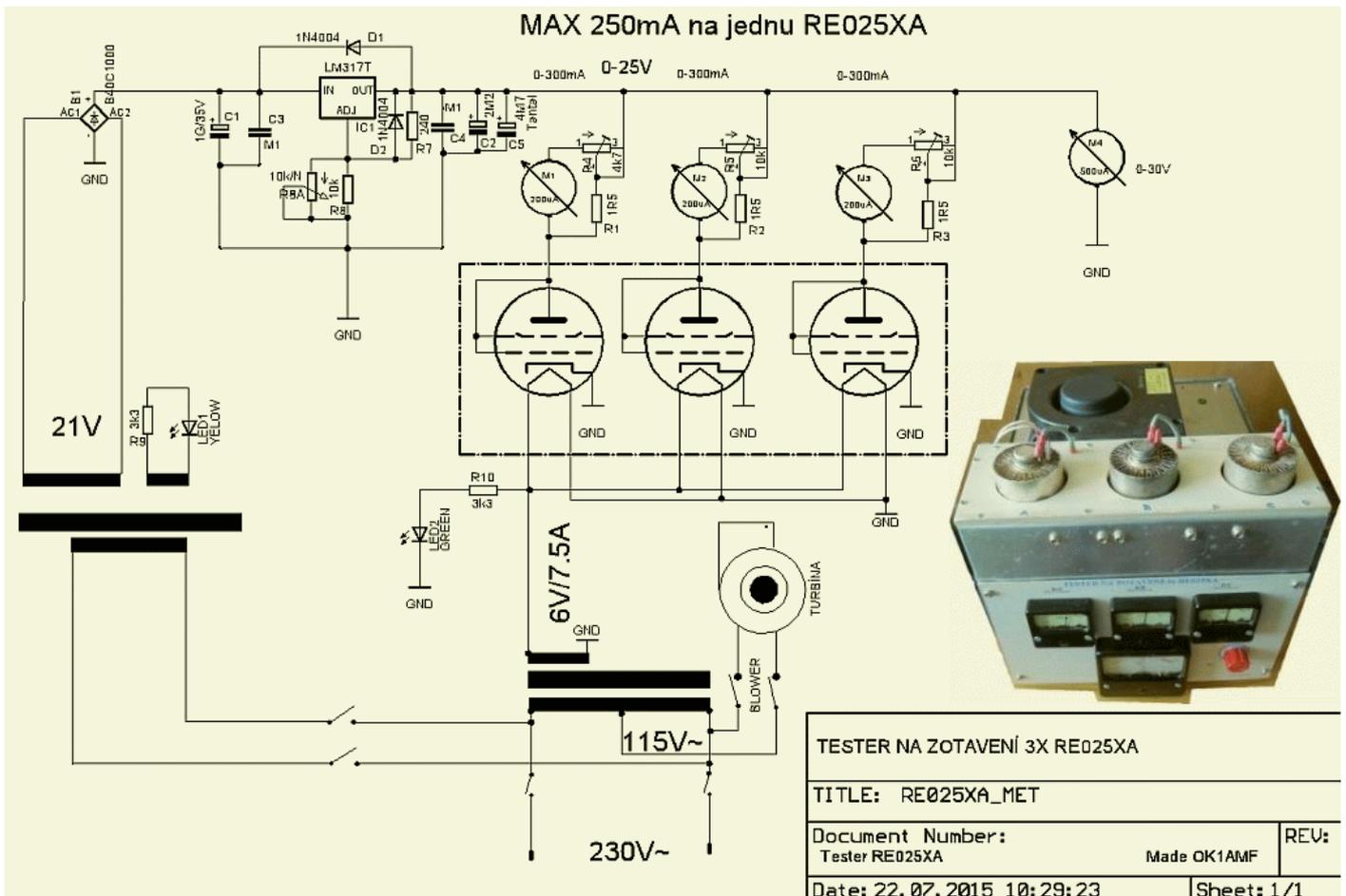
ON4JMV wrote: "a GU-43B was modified according to your instructions. The tube was not used for a long period of time. I wanted a degassing process during the night with filament and anode voltages on. The next morning I saw that a fuse of the mains fuse box was blown. I replaced a new fuse and the PA started up normally, but after a few seconds I heard a strange stronger becoming hum, immediately I realised that the high voltage transformer was burning out! There was some smoke and happily my camera was on hand so I took in a reflex a few pictures. During the third shot the transformer was on fire. The worst thing was that fuse of the mains fuse box did not blow. This could happen at night with dangerous and annoying consequences.

NEVER OR NEVER leave an operating device unattended. One can not always be as lucky or how a hobby could turn into a nightmare. "

So beware, be careful!

OK1AMF

For reactivating his tubes, OK1AMF has taken the trouble to make an extensive test setup.



DL6NAA describes his [reaktivator](#).

It is not recommended to install a 3-500Z horizontal, because the filament will gradually sag and short circuit may occur between grid and filament. The tube's specs states that it must be mounted vertically.

G8TIC was [sceptical](#).

6155	40	085	085	140	195	320	205	255	430
QB3/300	40	085	095	145	190	320	200	260	430
QB3/200	-	-	-	-	-	-	-	-	-
TB2.5/300	05	070	070	025	205	360	030	270	490
4-250A	35	115	115	135	280	380	170	355	490
QB3.5/750	40	150	150	140	350	460	205	430	590
4PR400A	55	150	130	225	315	420	325	390	560
QB4/1100	45	120	170	125	290	460	190	340	600
RS686	40	120	155	140	280	460	200	355	620
TB3/750	00	150	120	045	355	520	075	460	710
20m									
6155	45	080	105	150	200	330	210	270	50
QB3/300	45	080	105	150	195	330	200	265	450
QB3/200	30	085	115	095	210	350	135	270	450
TB2.5/300	05	070	085	025	200	360	030	260	470
4-250A	35	115	115	125	280	360	175	360	490
QB3.5/750	35	150	115	140	340	400	200	420	520
4PR400A	55	135	135	220	305	410	325	390	540
QB4/1100	45	120	170	125	290	460	185	355	600
RS686	40	125	155	145	280	470	210	365	620
TB3/750	00	150	120	035	375	510	080	480	720

TB2.5/300 = 5866, AX7986, SRS361. TB2.5/400 = 7986, RS1006B.

TB3/750 = 5867(A), CV1350, TGL9461, RS630, RS1026, SRS360. QB3/200 = 8165, 4-65A.

QB3/300 = CV2130,6155, 4-125A, 4D21,QY3-125, RS1007, RS685, SRS455.

QB3.5/750 = 6156, CV2131, SRS465, QY4-250, 4-250A, Jan 5D22.

QB4/1100 = 7527, 4-400A, RE400C, 4PR400A, 8188, RS1002A, RS686.

Ua = 2500V	Pi = 10W			Pi = 50W			Pi = 100W		
Ig/Ia = mA, Po = W	Ig	Ia	Po	Ig	Ia	Po	Ig	Ia	Po
17m	17m	17m	17m	17m	17m	17m	17m	17m	17m
6155	45	075	100	140	195	320	205	260	430
QB3/300	40	080	100	140	195	320	195	260	420
QB2/300	-	-	-	-	-	-	-	-	-
TB2.5/300	05	070	75	025	190	340	030	250	430
4-250A	35	110	110	130	270	340	165	365	450
QB3.5/750	40	145	135	145	335	420	205	410	540
4PR400A	60	140	140	210	320	400	300	405	520
QB4/1100	45	120	155	125	285	430	180	350	580
RS686	40	115	160	145	275	460	215	355	610
TB3/750	00	145	115	035	365	500	070	475	690
15m	15m	15m	15m	15m	15m	15m	15m	15m	15m
6155	45	080	095	145	200	310	205	270	430
QB3/300	45	080	095	140	200	310	195	265	420
QB3/200	-	-	-	-	-	-	-	-	-
TB2.5/300	05	070	075	025	195	330	030	240	420
4-250A	35	120	100	130	275	320	170	370	420
QB3.5/750	40	145	125	140	395	410	200	425	520
4PR400A	60	130	135	200	320	380	300	400	500
QB4/1100	45	120	150	135	280	420	200	350	560
RS686	40	120	155	145	280	440	215	360	600
TB3/750	00	150	110	030	365	480	075	460	680
12m	12m	12m	12m	12m	12m	12m	12m	12m	12m
6155	45	070	085	135	200	310	205	265	410

QB3/300	40	075	090	135	205	300	190	265	400
QB2/300	-	-	-	-	-	-	-	-	-
TB2.5/300	05	070	070	025	190	320	030	250	410
4-250A	35	105	100	120	270	310	155	360	410
QB3.5/750	25	160	040	100	370	200	140	470	300
4PR400A	65	125	130	205	310	380	300	390	490
QB4/1100	40	125	135	130	275	400	170	360	540
RS686	40	110	145	135	275	420	205	355	590
TB3/750	00	145	105	035	345	460	070	455	640
10m									
6155	45	075	100	145	200	320	210	270	430
QB3/300	40	085	100	145	200	320	200	275	430
QB3/200	25	090	095	-	-	-	-	-	-
TB2.5/300	05	080	065	025	185	320	030	260	410
4-250A	35	115	110	130	260	310	180	350	400
QB3.5/750	30	155	105	140	335	400	205	420	520
4PR400A	50	150	110	210	315	380	295	400	490
QB4/1100	45	125	135	125	290	400	190	365	550
RS686	35	125	145	135	295	440	210	370	600
TB3/750	00	150	105	040	340	480	075	450	660

TB2.5/300 = 5866, AX7986, SRS361. TB2.5/400 = 7986, RS1006B.

TB3/750 = 5867(A), CV1350, TGL9461, RS630, RS1026, SRS360. QB3/200 = 8165, 4-65A.

QB3/300 = CV2130, 6155, 4-125A, 4D21, QY3-125, RS1007, RS658, SRS455.

QB3.5/750 = 6156, CV2131, SRS465, QY4-250, 4-250A, JAN 5D22.

QB4/1100 = 7527, 4-400A, RE400C, 4PR400A, 8188, RS1002A, RS686.

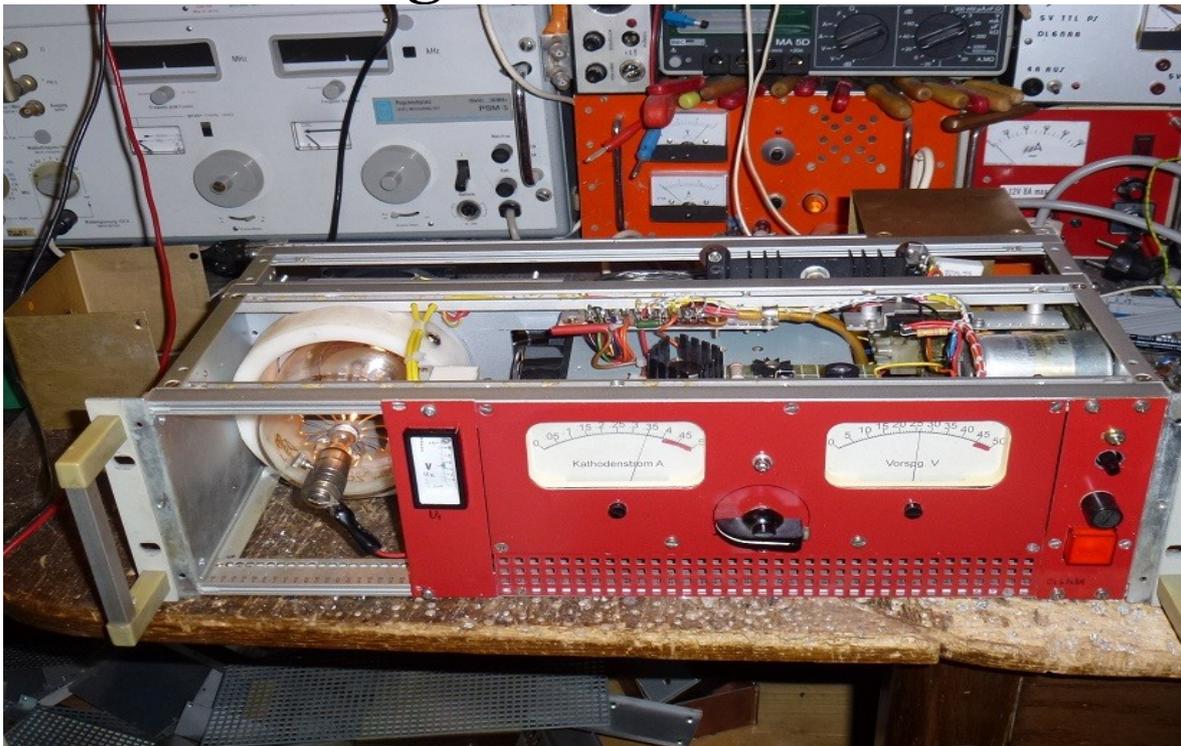
Ua = 1700V	Pi = 10W			Pi = 50W			Pi = 100W		
Ig/Ia = mA, Po = W	Ig	Ia	Po	Ig	Ia	Po	Ig	Ia	Po
160m	160m	160m	160m	160m	160m	160m	160m	160m	160m
QB3/300	45	100	42	170	250	180	250	310	300
6155	45	100	42	180	255	190	250	310	300
TB2.5/300	6	120	42	24	300	250	36	340	320
RS686	42	140	100	200	320	330	240	390	420
CV2131	42	140	100	165	340	340	255	420	440
QB3.5/750	45	150	100	165	340	340	245	410	440
QY4-250	39	150	100	160	340	340	240	420	440
TB3/750	4	190	120	59	380	410	96	520	560
3-500Z	42	200	160	120	400	420	-	-	-
80m	80m	80m	80m	80m	80m	80m	80m	80m	80m
QB3/300	45	100	50	180	220	230	250	290	310
6155	48	100	80	190	230	250	270	300	320
4PR400A	60	130	80	220	270	290	300	310	360
TB2.5/300	8	110	65	40	280	310	57	350	390
RS686	45	140	100	200	300	330	240	380	420
CV2131	48	160	100	180	300	340	260	400	430
QB3.5/750	51	160	100	180	300	340	260	400	430
QY4-250	41	140	100	180	320	340	240	420	440
TB3/750	7	185	120	73	380	410	106	510	560
3-500Z	45	200	160	120	400	420	200	560	560
QB3/200	29	100	55	126	240	260	-	-	-
40m	40m	40m	40m	40m	40m	40m	40m	40m	40m
QB3/300	46	100	50	180	220	240	270	270	320
6155	46	100	50	180	220	250	260	280	320
TB2.5/300	6	110	70	42	270	310	57	350	390
RS686	45	140	100	195	300	330	240	380	420

CV2131	36	140	95	180	310	340	260	400	460
QB3.5/750	45	140	95	180	300	340	260	400	460
QY4-250	39	140	100	160	320	360	240	410	460
TB3/750	5	170	110	70	350	400	101	490	560
3-500Z	60	240	210	120	400	420	-	-	-
30m									
QB3/300	60	100	95	200	220	280	280	290	370
6155	60	90	95	190	220	280	280	290	370
TB2.5/300	9	90	105	48	260	350	60	340	430
RS686	60	110	130	195	290	340	260	370	420
CV2131	54	160	130	180	290	360	260	380	480
QB3.5/750	53	120	135	175	300	380	240	380	480
QY4-250	53	110	130	160	300	360	240	390	490
TB3/750	9	150	130	68	350	450	115	470	580
3-500Z	51	180	210	120	400	420	-	-	-
20m									
QB3/300	53	90	70	190	220	240	280	290	320
6155	54	90	70	185	220	240	270	300	320
4PR400A	60	110	90	215	250	260	280	340	330
TB2.5/300	7	90	70	48	250	300	62	350	380
RS686	56	120	115	195	300	320	240	380	410
CV2131	50	120	110	180	320	330	240	410	420
QB3.5/750	48	130	110	180	320	330	260	410	430
QY4-250	50	120	115	160	300	330	245	390	490
TB3/750	6	165	115	68	380	400	102	500	560
3-500Z	45	180	180	128	400	420	-		
QB3/200	33	90	75	126	230	250	-		

Ua = 1700V	Pi = 10W			Pi = 50W			Pi = 100W		
Ig/Ia = mA, Po = W	Ig	Ia	Po	Ig	Ia	Po	Ig	Ia	Po
17m	17m	17m	17m	17m	17m	17m	17m	17m	17m
QB3/300	58	80	80	205	215	245	280	290	320
6155	57	80	80	190	215	245	290	280	320
TB2.5/300	7	100	80	45	270	310	69	340	390
RS686	60	120	115	200	300	330	240	380	410
CV2131	45	120	110	185	300	330	260	400	420
QB3.5/750	56	120	120	180	310	330	255	400	420
QY4-250	48	125	120	165	310	330	240	400	430
TB3/750	8	160	120	69	370	400	106	480	540
3-500Z	53	180	180	135	400	400	-	-	-
15m	15m	15m	15m	15m	15m	15m	15m	15m	15m
QB3/300	54	85	75	200	220	240	240	310	310
6155	58	85	75	200	220	250	290	290	310
TB2.5/300	7	90	80	42	270	310	61	340	390
RS686	57	120	115	200	320	330	255	390	400
CV2131	48	125	110	185	320	330	240	400	420
QB3.5/750	57	120	120	180	320	330	240	400	420
QY4-250	45	130	115	200	300	330	240	400	420
TB3/750	10	160	120	72	360	400	110	480	530
3-500Z	51	180	180	128	400	400	-	-	-
12m	12m	12m	12m	12m	12m	12m	12m	12m	12m
QB3/300	63	100	70	220	260	230	285	320	300
6155	63	100	70	215	250	240	290	300	300
TB2.5/300	8	90	70	49	270	290	58	350	360

RS686	51	140	100	200	310	310	240	400	400
CV2131	57	120	100	180	320	320	255	420	400
QB3.5/750	60	120	100	165	330	320	240	440	400
QY4-250	50	130	110	160	320	320	240	420	410
TB3/750	9	180	120	74	415	410	112	480	510
3-500Z	42	170	170	135	400	400	-	-	-
10m									
QB3/300	54	90	75	200	205	215	290	290	300
6155	51	90	70	200	240	240	300	290	310
4PR400A	62	130	80	220	270	260	270	340	320
TB2.5/300	6	110	70	45	270	290	63	350	360
RS686	48	140	100	220	300	330	300	390	400
CV2131	63	120	100	200	320	310	280	420	400
QB3.5/750	45	140	90	195	330	330	260	440	430
QY4-250	50	130	115	180	330	330	255	430	410
TB3/750	11	160	120	68	405	410	106	500	510
3-500Z	54	190	180	135	400	400	-		
QB3/200	44	80	70	150	220	230	-		

„Reaktivierung“ von Röhren 3-500Z“

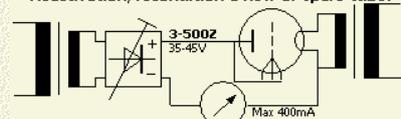


Bei der KW- PA SB-1000 von HEATH eines Bekannten lösten nach etwa 20- jährigen störungsfreien Dienst „aus heiteren Himmel“ die beiden 10A Netzsicherungen aus. Bei der Suche nach der Ursache stellte ich nach Überprüfung der „üblichen Verdächtigen“, Netztrafo, Elkos, Gleichrichterkeite, einen Anoden- Gitterschluß der Röhre 3-500Z fest. Da ich noch nicht sehr viel mit „Glasröhren“ mich beschäftigt hatte, suchte ich als erstes im Internet nach „Erfahrungen“ anderer OMs, dabei stieß ich auf die Web- Seite von PA0FRI, wo manch lesenswertes über Röhren PAs zu finden ist. Besonderes Interesse erweckte folgender Abschnitt:

REACTIVATON 3-500Z

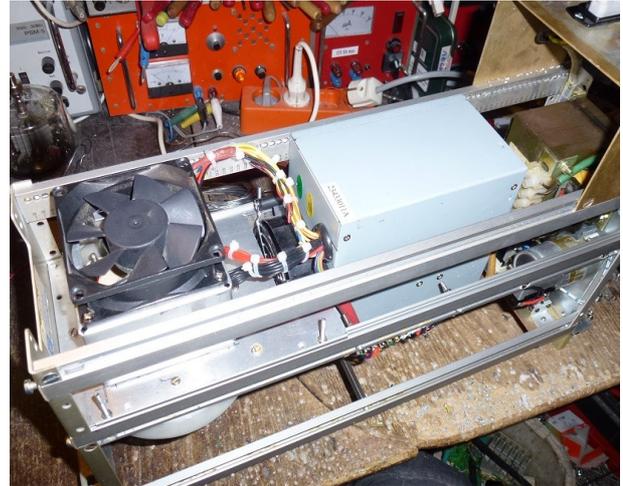
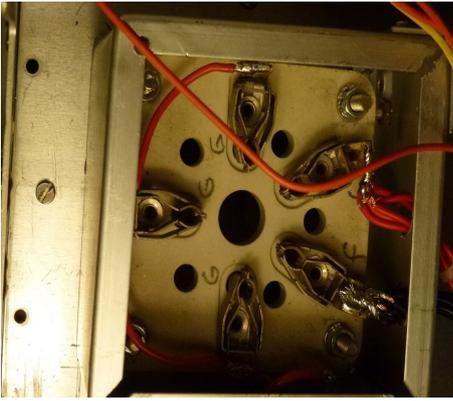
To avoid flashover in a new or a long time unused tube, it is prudent to prepare ("reactivate") it for his task. There are various opinions and solutions how to do it, but with a 3-500Z it can be relatively simple. A DC of 30 to 40 V is sufficient for the tube to draw 400 mA as the grid is connected to the anode. Heat the tube 30 minutes with a filament voltage of 4.9 V. Then supply a "high voltage" of about 35 V and set the voltage to a current of 400 mA. If possible use a current limiter, because during reactivate the current can increase suddenly so that continue monitoring could be necessary to maintain 400 mA. Usually I will not reactivate longer than an hour or so. Soon you will find out that a good tube behaves like the showed table.

Reactivation/recondition a new or spare tube.

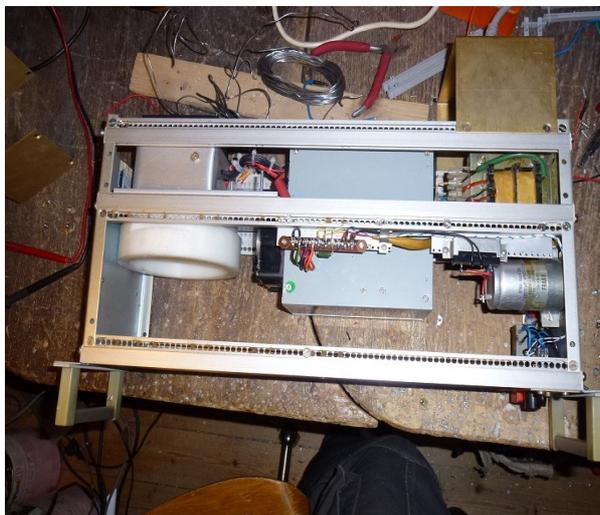


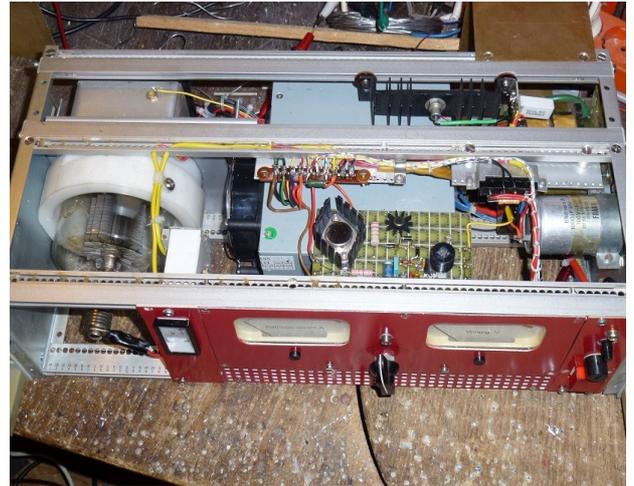
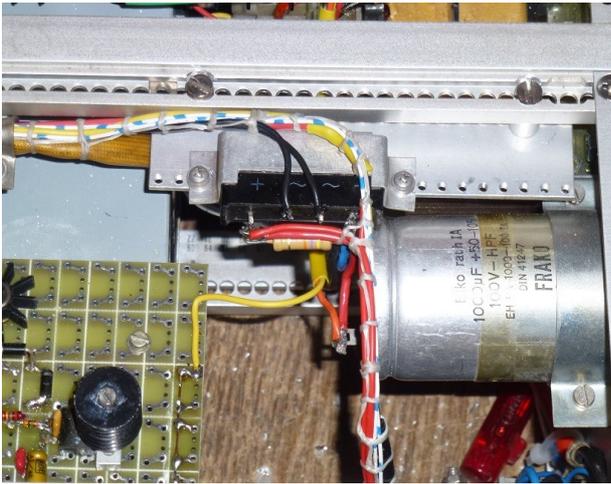
Test used tubes.		
3-500Z	1	38V/400mA
3-500Z	2	40V/400mA
3-500Z	3	37.5V/400mA
3-500Z	4	38.5V/400mA
3-500ZG	5	39V/400mA

Zufällig war hier eine Ersatzröhre vorhanden, allerdings war über den Zustand dieser Röhre nichts bekannt. Also beschloß ich den „Reactivator“ nach PA0FRI mit hier vorhandenen Teilen aus der Bastelkiste nachzubauen, Kosten durften nicht entstehen! Ein vorhandener 19Zoll Einschub sollte alles einigermaßen betriebssicher aufnehmen. Den benötigten Sockel „Giant 5“ konnte ich bei einem Bekannten „schnorren!“ Das nächste Problem, nämlich die Erzeugung der 5V Heizspannung bei einem Dauerstrom von 15A löste ich mittels eines Schaltnetzteils aus der Computertechnik. Hier einige Bilder meiner Konstruktion:

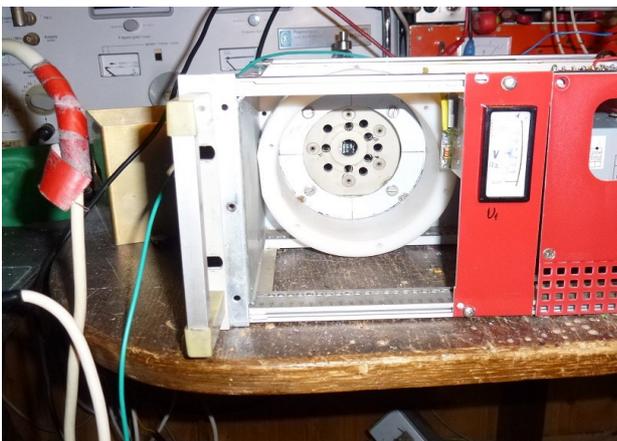
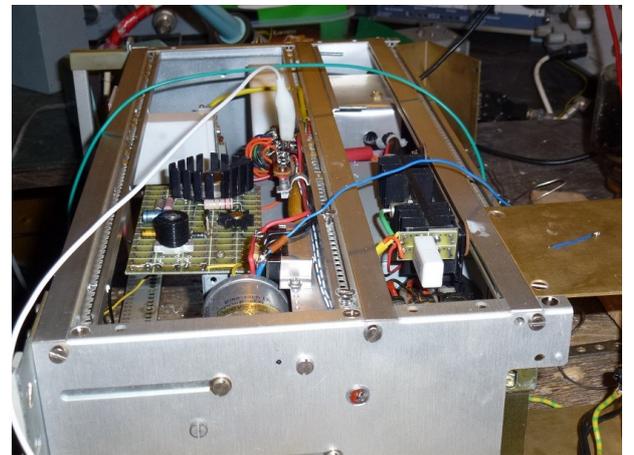
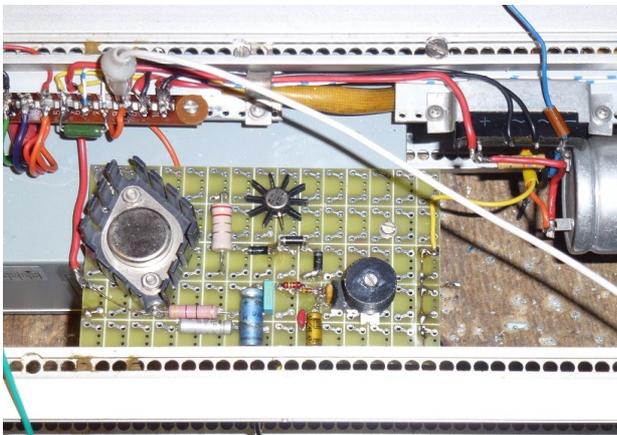
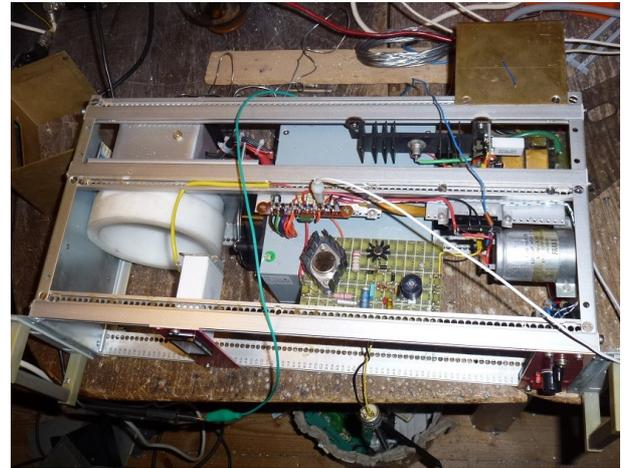
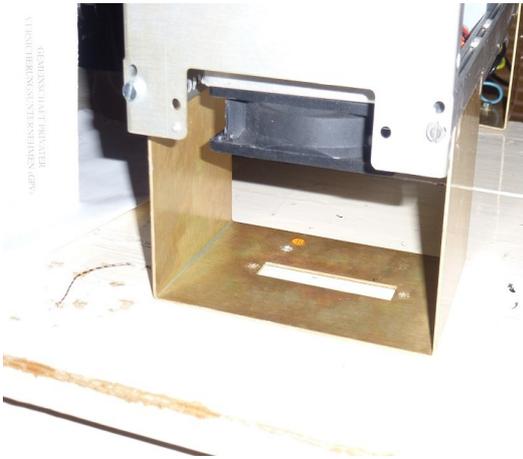


Die Röhre wird über einen Luftstrom von unten über einen Spalt zwischen Sockel und Chassis durch einen Kamin gekühlt. Da der Ventilator „unten“ angebracht ist, wird auch eine Kühlung der Röhrenstifte, so wie es das Datenblatt des Herstellers EIMAC verlangt, sichergestellt. Bei meinen Recherchen im Internet mußte ich entsetzt feststellen, dass die einzige PA, welche ich finden konnte, die alte DRAKE L4B ist, bei welcher diese Forderung beachtet wird. Alle anderen PAs werden folglich nicht vorschriftsmäßig gekühlt! (Der Glaskamin fehlt überall, meist wird die Röhre nur an einer Seite angeblasen. Dadurch wird eine Seite des Röhrenkolbens heiß, die andere bleibt kalt. (LEE und LUV nennt das der Seemann, stimmts Rolf?)





Details meines Aufbaues...

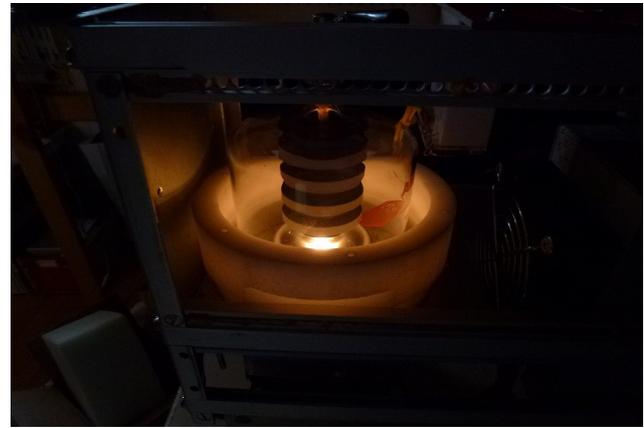
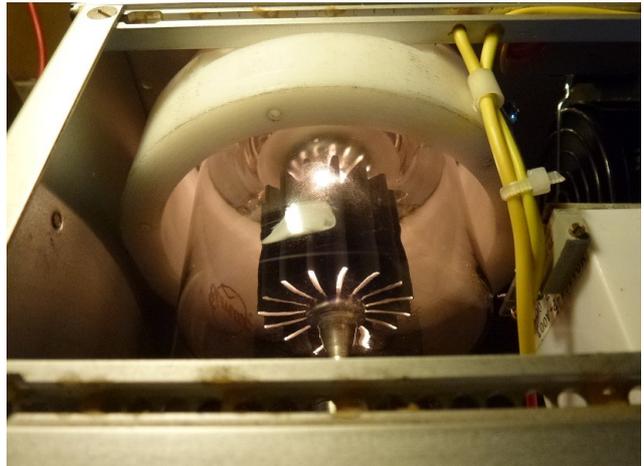


Die Anzeigeeinstrumente wurden aus „Surplusmaterial“ gefertigt:



Im Bild links ist die „Meßbereichserweiterung“ durch „Shunt“ b.z.w. durch Vorschaltwiderstand mit wohlwollen zu erkennen. Rechts das beinahe fertige Gerät.

Um Kritikern zuvor zu kommen, mir ist bekannt dass die Röhre in vertikaler Lage betrieben werden soll. Beim Betrieb steht deshalb der gesamte Einschub mit „Frontplatte nach oben“ auf den hinten angeschraubten Aluwinkeln....

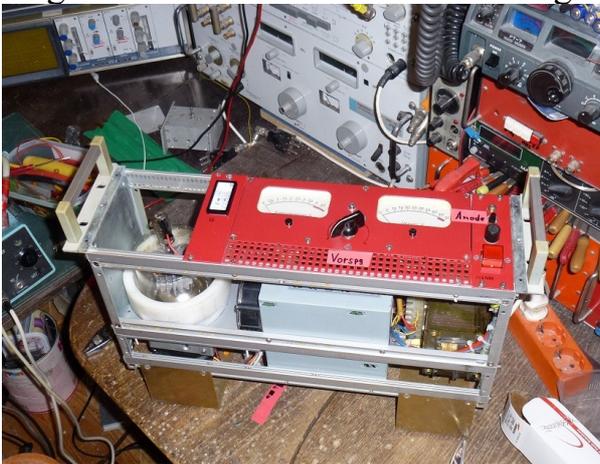


Links Blechanode, rechts Graphitanode. Wenn die gebrauchte Röhre noch zu 100% i.o. ist, dann ist die nagelneue „Graphitröhre“ von Amperex etwas steiler, denn für den selben Emissionsstrom wurde weniger Vorspannung benötigt.





Eine eingebaute Strombegrenzung lässt maximal 400mA zu. Wie bei PA0FRI beschrieben, schwankt am Anfang der Strom etwas, „beruhigt sich aber nach einiger Zeit. Das soll wohl so mit dieser Anordnung bewirkt werden. Sinn ist es nicht irgendwelche Betriebsdaten oder Kennlinien zu erfassen, lediglich die Kathode soll aufgeheizt werden um eventuell mangelhafte Getterung wieder zu regenerieren!



Selbst bei der fabrikneuen, original verpackten Röhre war anfangs ein, wenn auch geringes, Schwanken des Kathodenstromes zu erkennen. Eigentlich, so denke ich, hätte ich durch einfaches „einstecken“ und längeren Vorheizen der Röhre auch keinen Überschlag verursacht, allerdings „auf der sicheren Seite“ ist man letztendlich nur, wenn man die Röhre an ihr „neues Leben“ vorsichtig gewöhnt...

I was sceptical - but it works!

Get a socket, heater transformer, milliammeter, a variable DC supply 0-40V and a cooling fan (a muffin fan will do).

Connect the filament, connect the grid to the anode (yes, the anode) and apply DC supply (+ve) to the anode+grid and -ve to filament (either side will do). Put the fan on to stop the tube seals from over heating.

Set the DC voltage to around 35V and see if any current flows - there's a good chance that you'll see no significant current flow (perhaps a few tens of uA)...

Now, leave your fixture on for several hours to 'cook'. This can take several tens of hours... eventually you should see the some signs of current flow - the meter may flick up to 10-50mA now and then... this is the Thorium migrating back to the surface of the heater and starting to emit electrons.

After several more hours it should settle down and you should be able to get around 400mA of anode current with just 40V DC on the anode (remember that you've got the grid tied up to the anode, so you really have a big diode at this point). At this point the power dissipation is 40V DC 400mA => 16 watts.

Now if you adjust the anode voltage up and down the lower voltage at which you can achieve 400mA anode current the better the tube.

Until you've checked out your tubes and got them emitting electrons there's not much point in worrying about gettering them ;-)

Now, the getter in the 3-500Z is a coating painted on to the outside of the anode. The getter only works when the tube's anode is hot (glowing dull red/orange), for this you need to be dissipating approx. 300-400W.

I gettered my reclaimed tubes with a 1200V DC supply, 1A anode meter (1A fuse in series) and a DC supply. You need to get the tube to draw around 250-300mA and to do this you need positive DC on the grid - I used a 20V DC bench supply.

You need the tube in a proper fixture with plenty of cooling and then to cook it for a period of a couple of hours.

After re-activating and re-gettering several tubes that were given to be as 'soft' and unsable I have one in my homebrew 6m amp (QST 1971 design) and two in my TL922. The 6m amp will give over 800W out for 35-40W drive... not bad for a "useless" tube (according to its previous owner).

Mike G8TIC