



222-1 shortwave receiver Service log
Virgil Cheng vr2xgm

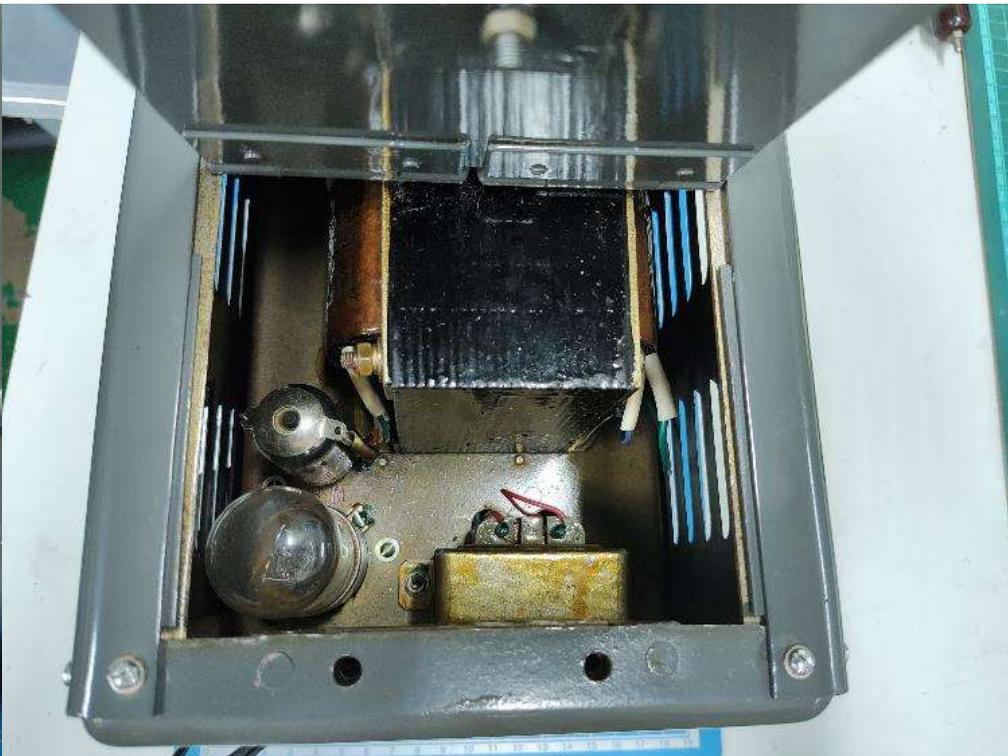
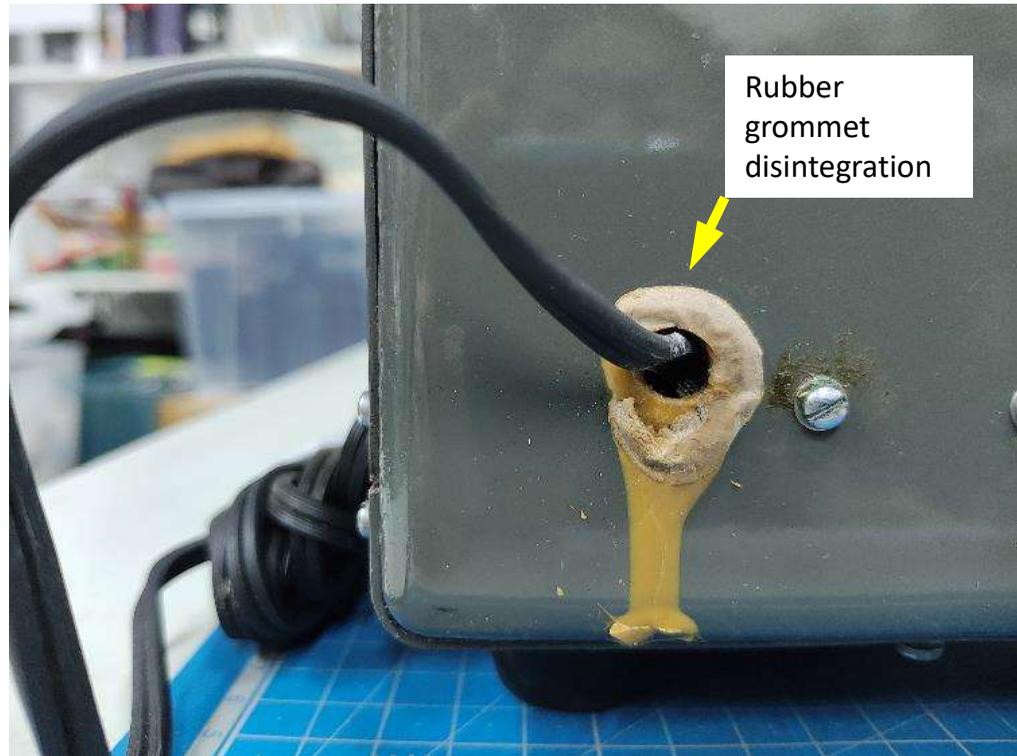
19-Mar-2025, PSU unit, History:

- Units acquired early 2000s
- 222-1 not frequently used SW receiver, put in storage
- Unit #1 dated Sep-1971, without serial number
- Unit #2 dated Feb-1974, without serial number
- Recently retrieved for inspection

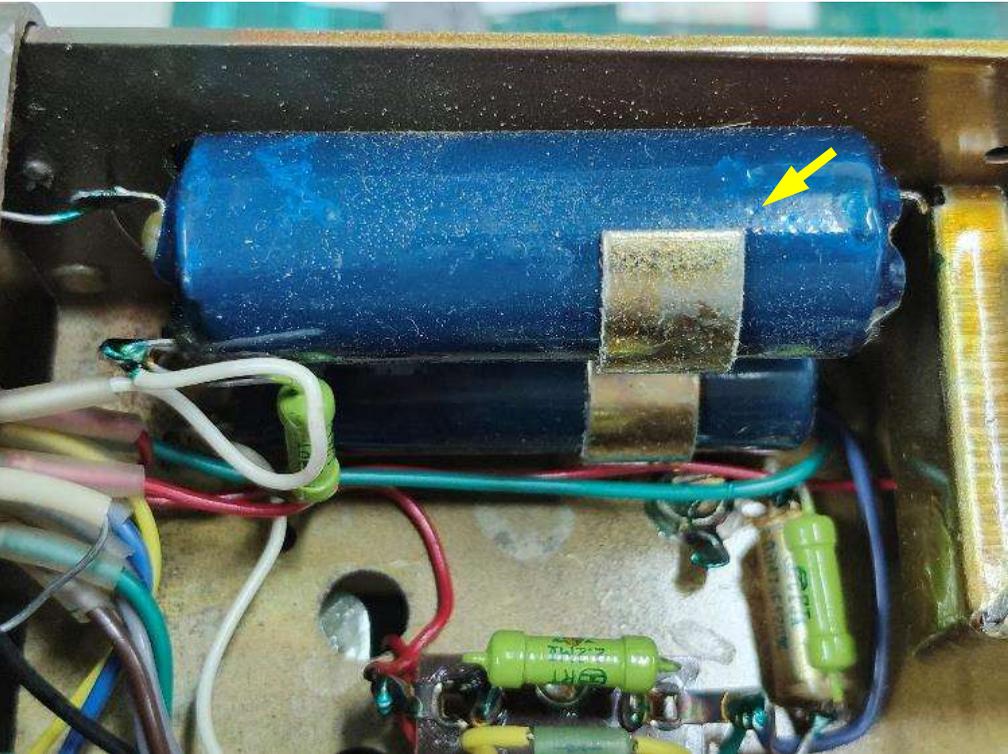
Unit #1 Sep-1971

Photos

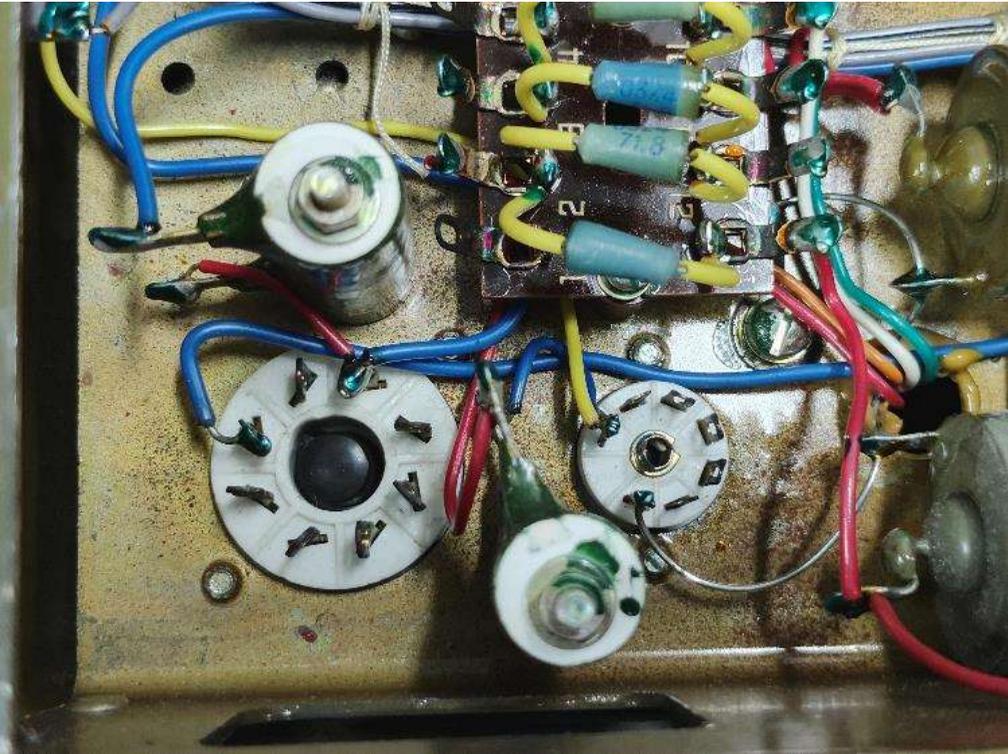
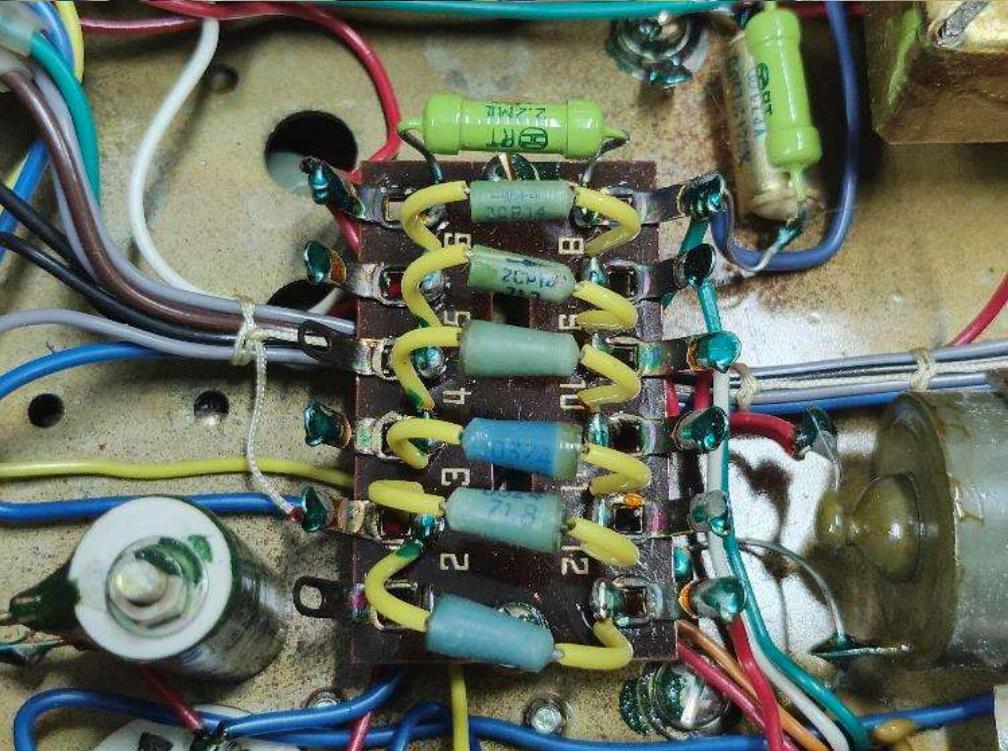




Ecap case is negative, blue jacket insulate case from chassis. Inadequate by today's standard



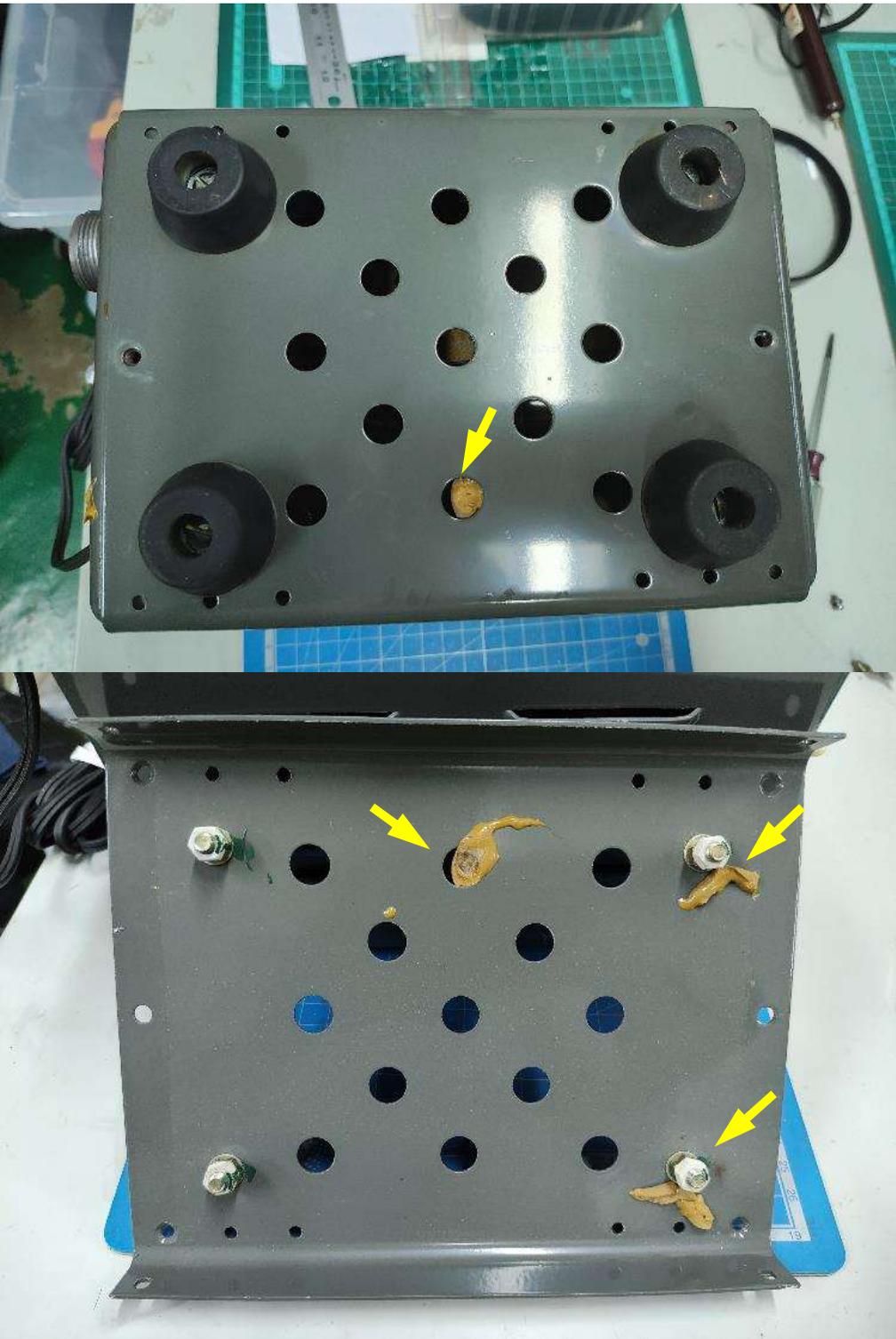
Rectifier diodes with 1971 date code



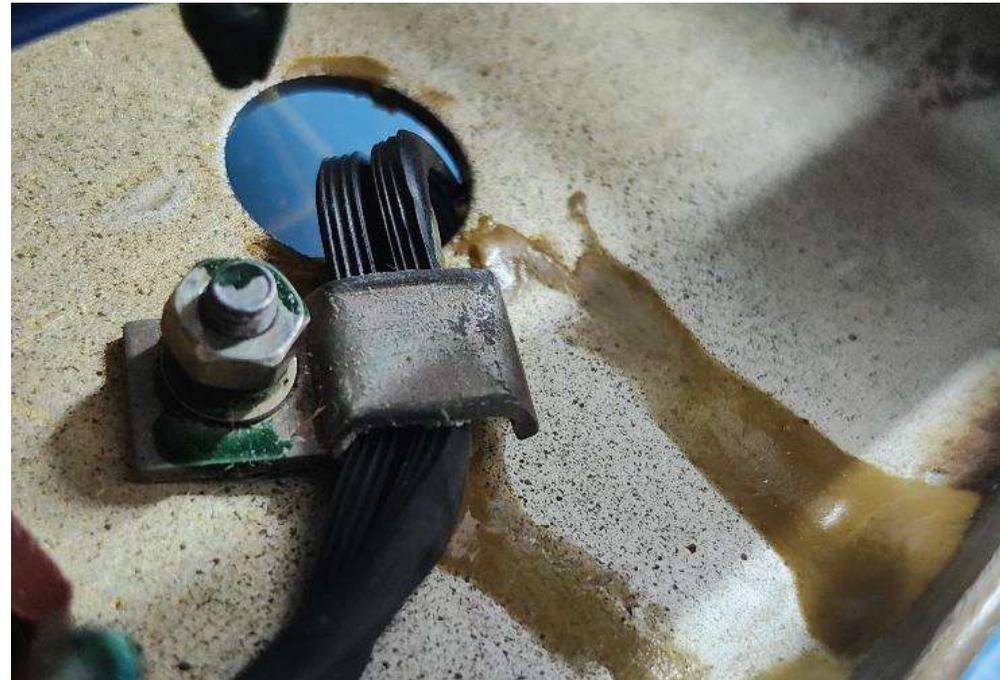
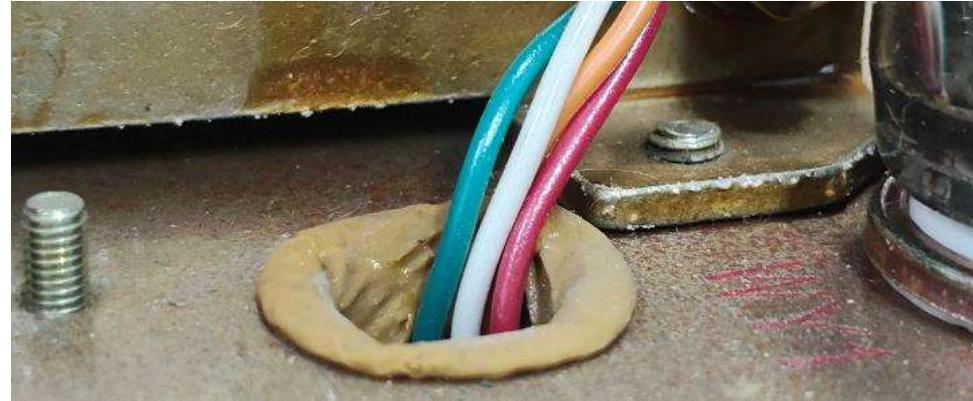
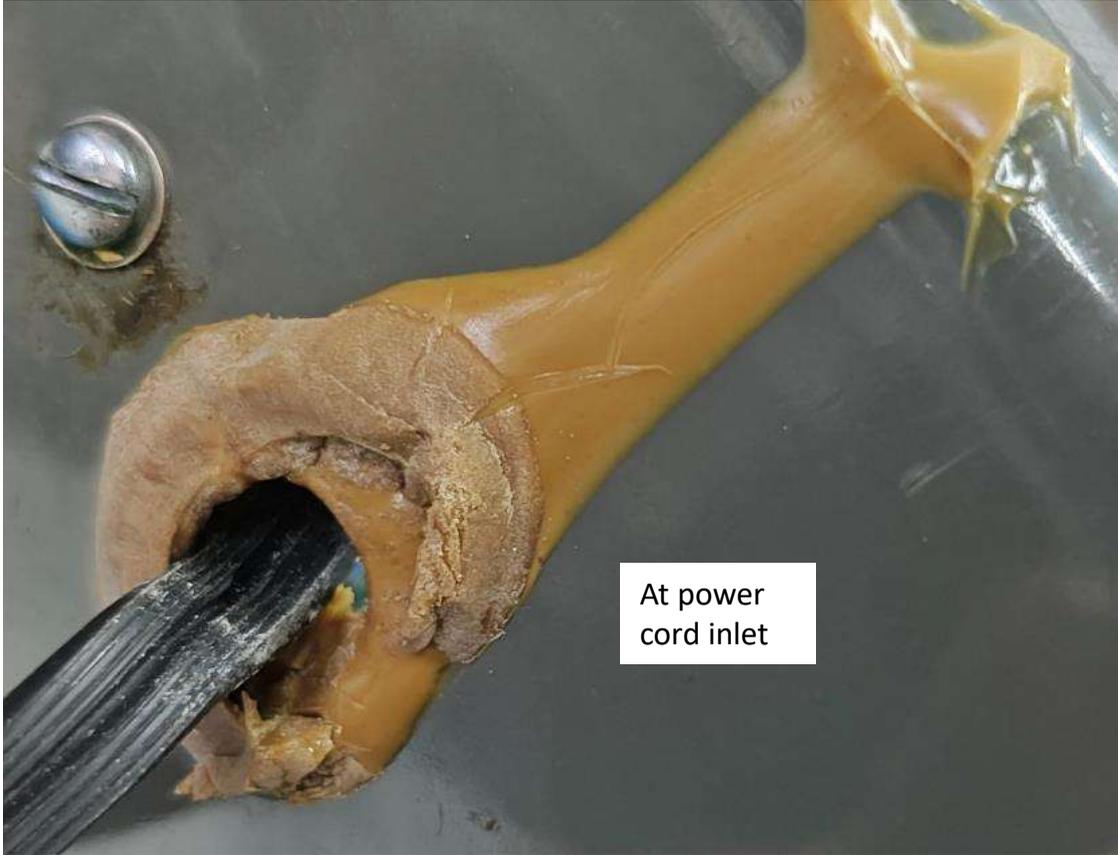
Disintegrated grommet dropped onto harness and chassis



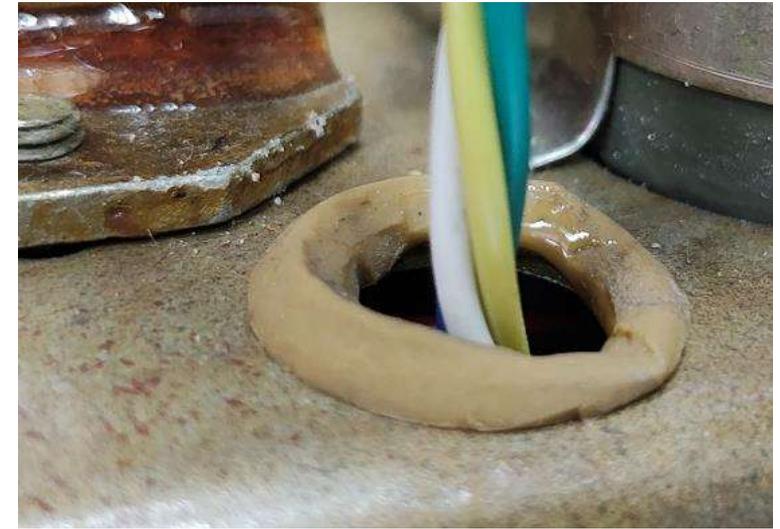
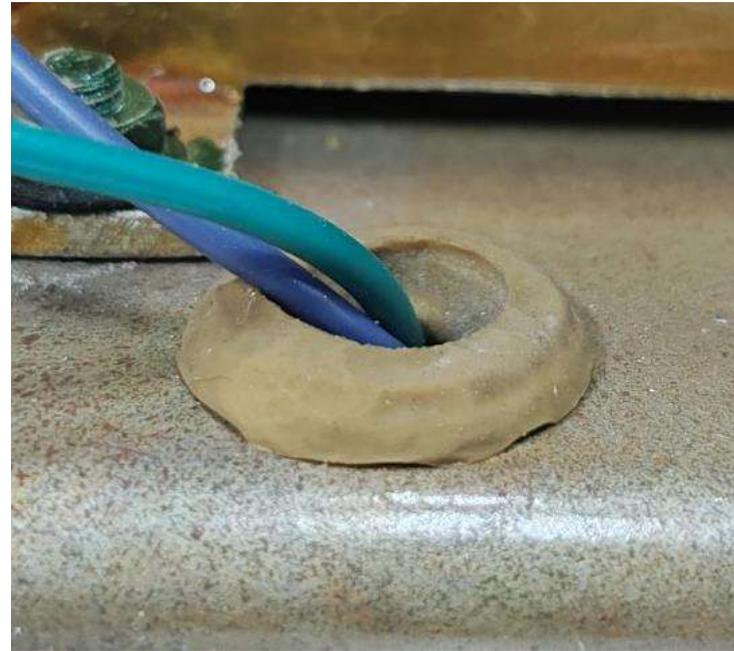
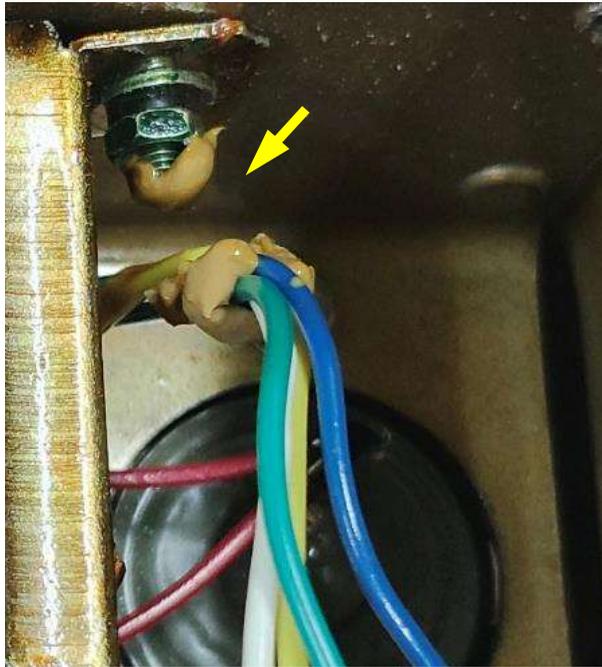
Grommet residue on bottom cover



Grommet disintegration

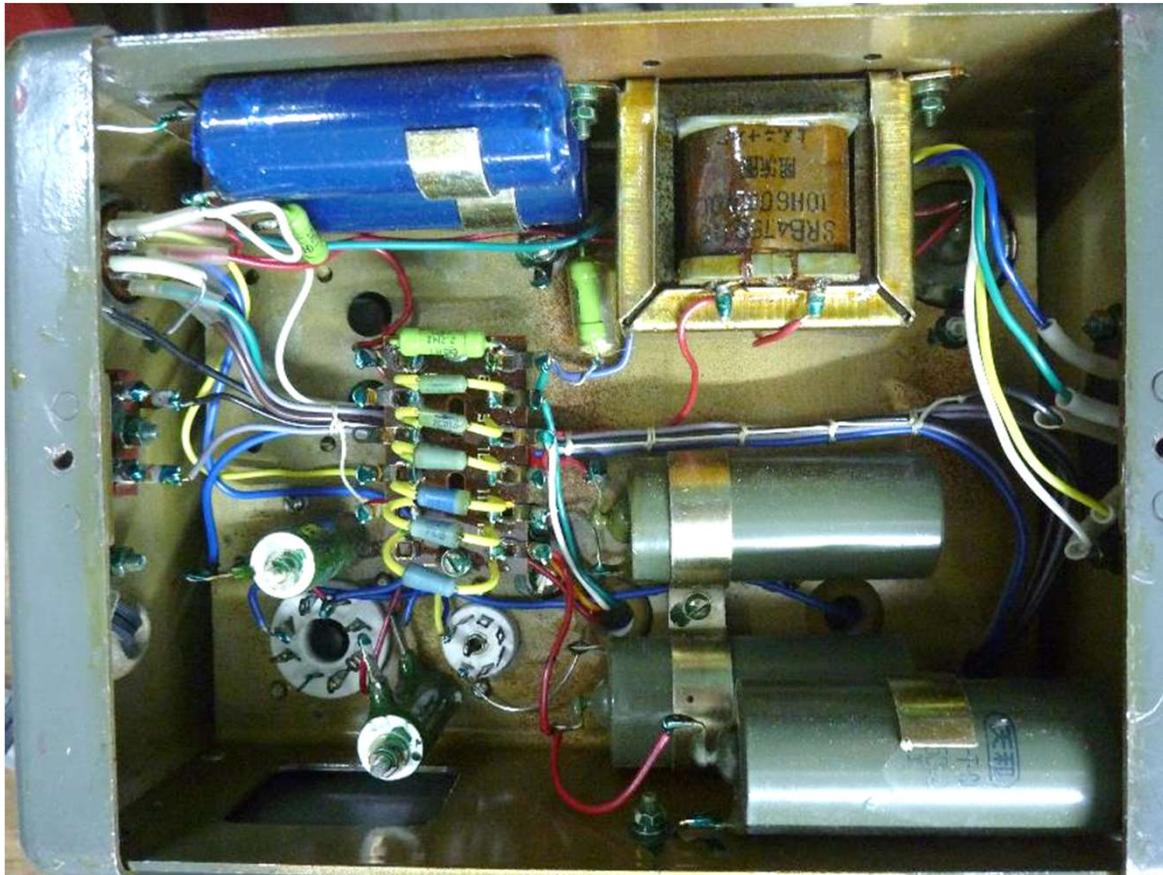


Grommet disintegration

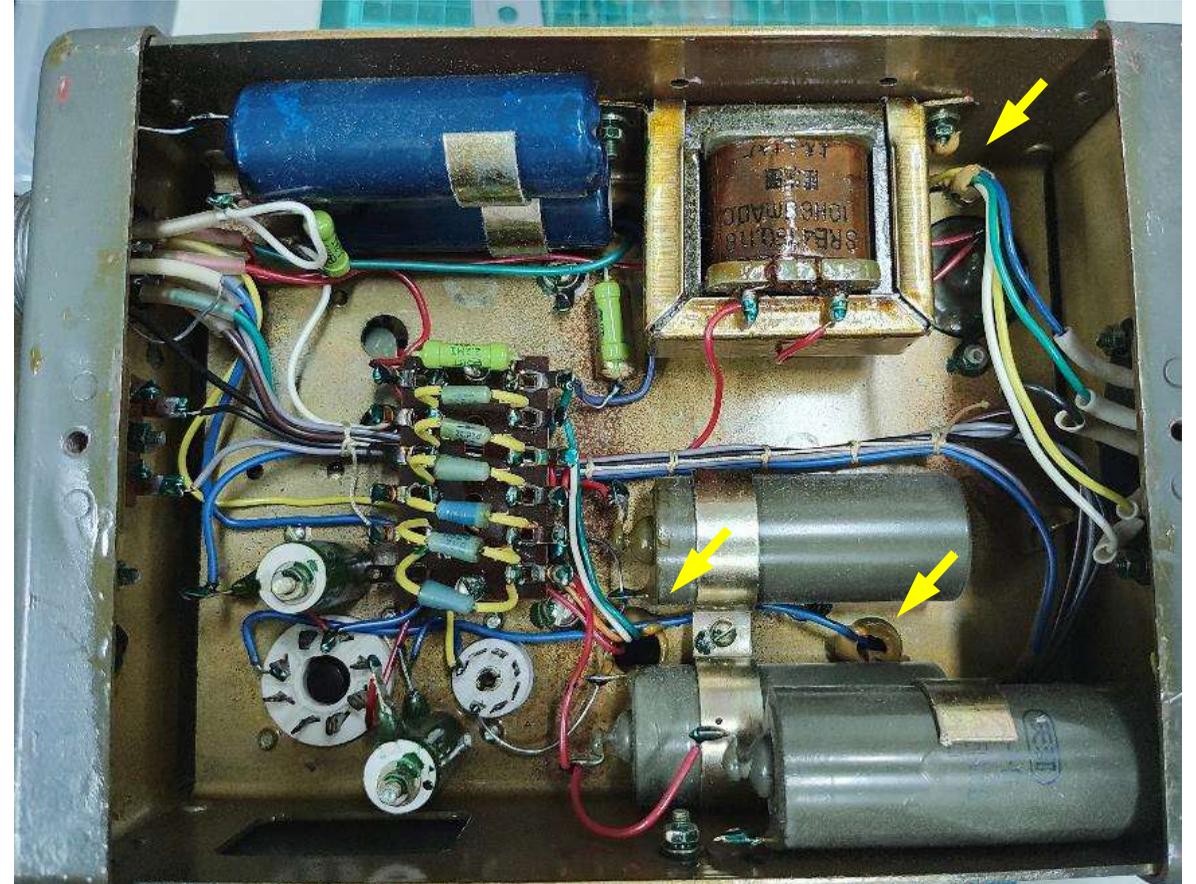


Unit condition comparison present and 14 years ago, rubber grommets melted away

Jun-2011



Mar-2025



Summary:

Visual defects:

- Rubber grommet disintegrated; fluid dropped to various places in chassis

Components in doubt:

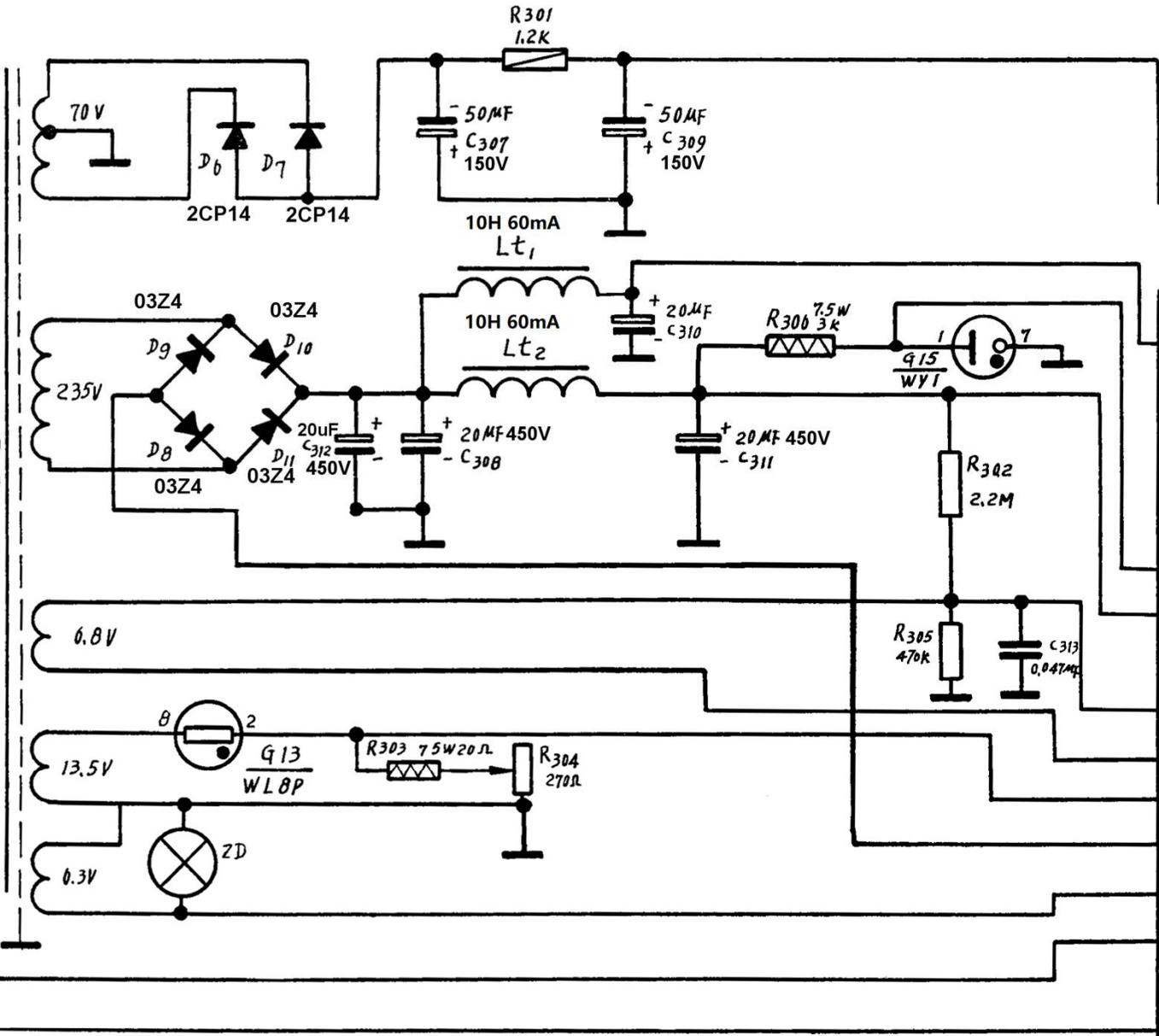
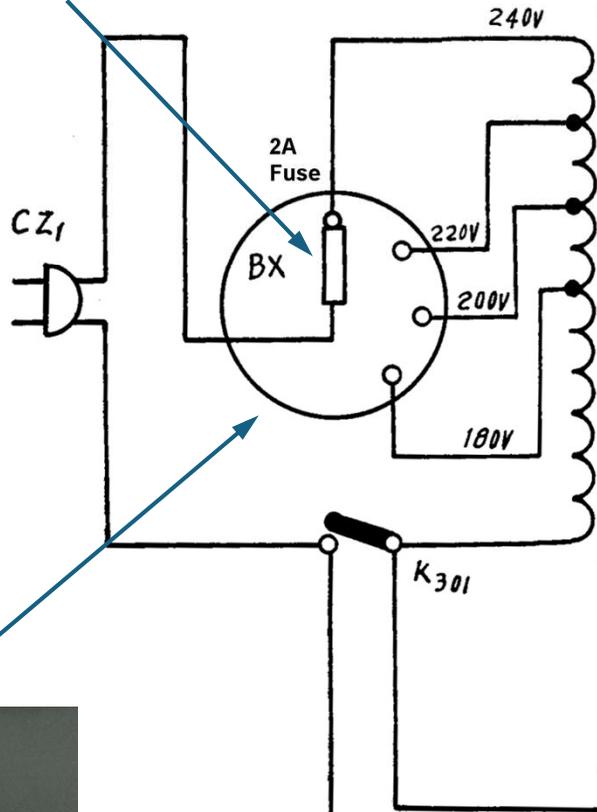
- Electrolytic capacitors need replacement
 - Long term reliability or vintage part preservation ?
 - Sealed part, tested functional, [keep vintage part](#)
- Rectifier diodes with 1971 date code, rating lower than popular 1N400x series diode first released in 1963
 - Long term reliability or vintage part preservation ?
 - Tested functional, current rating low by today's standard, [keep vintage part for the moment](#)

Other checks:

- Mechanical mounting
- Passive components, resistance, capacitance, ESR, ripple
- Insulation material integrity: lead wires, power cord/plug, terminals, insulation sleeves
- Switch, voltage selector
- Indicator
- Clearances, creepage distances
- Tubes, tube sockets

PSU schematic, operator's manual pg.55

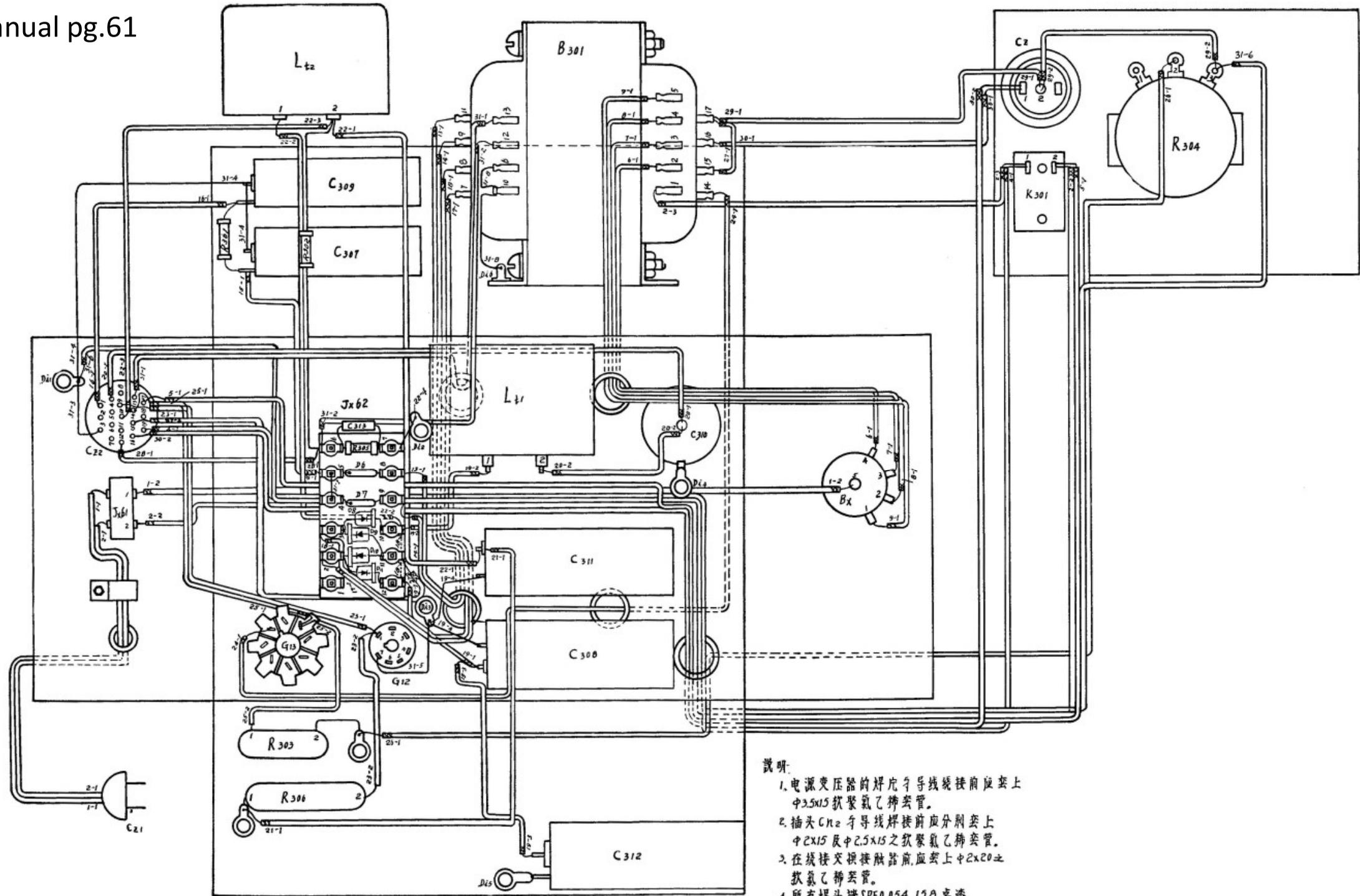
Fuse inside voltage selector
 Rotate anticlockwise one step
 beyond 240V position to eject fuse
 from side slot, **DO NOT PULL**, this is
NOT a plug



CZ ₂	
编号	特性
1	-40V
2	
3	地
4	+250 (910 911)
5	
6	
7	
8	
9	+150V (總)
10	+250V
11	
12	~6.8V (+40V)
13	0
14	~6.3V (總)
15	0
16	~6.3V
17	~220V
18	
19	~220V

Update 6-Apr-2025

4. 整流器电原理图



说明:

1. 电源变压器的焊片与导线接线前应套上中3.5x15 款聚氯乙烯套管。
2. 插头C21 与导线焊接前应分别套上中2x15 及中2.5x15 之款聚氯乙烯套管。
3. 在焊接交换接触器前, 应套上中2x20 之款聚氯乙烯套管。
4. 所有焊头抹SPE0.054.150 油漆。

10. 整流器接线图

Parts list, operator's manual, pg.49,51

D ₆		硅二极管 2CP14		1	Diode Si, 200V 0.1A, 2CP14
D ₇		硅二极管 2CP14		1	Diode Si, 200V 0.1A, 2CP14
D ₈		硅二极管 03Z4 (2CP24)		1	Diode Si, 400V 0.3A, 03Z4/2CP24
D ₉		硅二极管 03Z4 (2CP24)		1	Diode Si, 400V 0.3A, 03Z4/2CP24
D ₁₀		硅二极管 03Z4 (2CP24)		1	Diode Si, 400V 0.3A, 03Z4/2CP24
D ₁₁		硅二极管 03Z4 (2CP24)		1	Diode Si, 400V 0.3A, 03Z4/2CP24
C ₃₀₇		电容器 CDM-T-150-50-C ₁		1	Capacitor, electrolytic, sealed Aluminum, 50uF 150V, CDM-T series
C ₃₀₈		电容器 CDM-T-450-20-C ₁		1	Capacitor, electrolytic, sealed Aluminum, 20uF 450V, CDM-T series
C ₃₀₉		电容器 CDM-T-150-50-C ₁		1	Capacitor, electrolytic, sealed Aluminum, 50uF 150V, CDM-T series
C ₃₁₀		电容器 CDM-T-450-20-C ₁		1	Capacitor, electrolytic, sealed Aluminum, 20uF 450V, CDM-T series
C ₃₁₁		电容器 CDM-T-450-20-C ₁		1	Capacitor, electrolytic, sealed Aluminum, 20uF 450V, CDM-T series
C ₃₁₂		电容器 CDM-T-450-20-C ₁		1	Capacitor, electrolytic, sealed Aluminum, 20uF 450V, CDM-T series
C ₃₁₃		电容器 CZJX-400-0.047- I		1	Capacitor, metallized paper dielectric , 47nF 400V, CZJX series

1. 整 流 二 极 管

序 号	型 号	最 高 反 向 工 作 电 压 V_{RM} [25°C, I_{R1}] (V)	额 定 整 流 电 流 I_F (A)	最 大 正 向 压 降 V_F [25°C, I_F] (V)	最 大 反 向 电 流			浪 涌 电 流		最 高 结 温 T_{JM} (°C)	材 料 或 结 构	外 形	序 号
					I_{R1} [25°C, V_{RM}] (A)	I_{R2} [V_{RM}] (A)	T (°C)	I_{RSM} (A)	t_U (s)				
34	2C P14	200	0.1	1.5	5 μ	100 μ	100	2	10m	150	Si	EH-2	34
35	2C P14	200	0.1	1.5	5 μ	20 μ	70					EA-3	35
36	2C P14	200	0.1	1.2		5 μ	100			150	Si	EA-3	36

1. 整 流 二 极 管

序 号	型 号	最 高 反 向 工 作 电 压 V_{RM} [25°C, I_{R1}] (V)	额 定 整 流 电 流 I_F (A)	最 大 正 向 压 降 V_F [25°C, I_F] (V)	最 大 反 向 电 流			浪 涌 电 流		最 高 结 温 T_{JM} (°C)	材 料 或 结 构	外 形	序 号
					I_{R1} [25°C, V_{RM}] (A)	I_{R2} [V_{RM}] (A)	T (°C)	I_{FSM} (A)	t_U (s)				
17	2C P24	400	0.3	1	5 μ	100 μ	100	6	10m	140	Si	EH-2	17
18	2C P24	400	0.3	1	5 μ	100 μ	100						18
35	2C P24	400	0.3	1	250 μ						Si	EH-2	35
36	2A P77	400	0.3	0.5	300 μ	100 μ					Ge	EE	36
37	2C Z83F	400	0.3	1	5 μ		100	6	10m	130	Si	DO-15	37
38	2C P24	400	0.3	1	5 μ						Si	EH-3	38
39	2C P24	400	0.3	1	5 μ	100 μ	100	6	10m		Si	D15-10	39

Hole size: $\phi 12\text{mm}$, metal sheet thickness 1.8mm

Grommet sizes

Panel thickness	2	mm	
Panel hole diameter	12	10	mm
Cable size	10	8	mm
Material	Silicone rubber		



First grommet replacement, de-solder ballast tube terminal, insert grommet, re-route wire, time consuming

Original solder joint



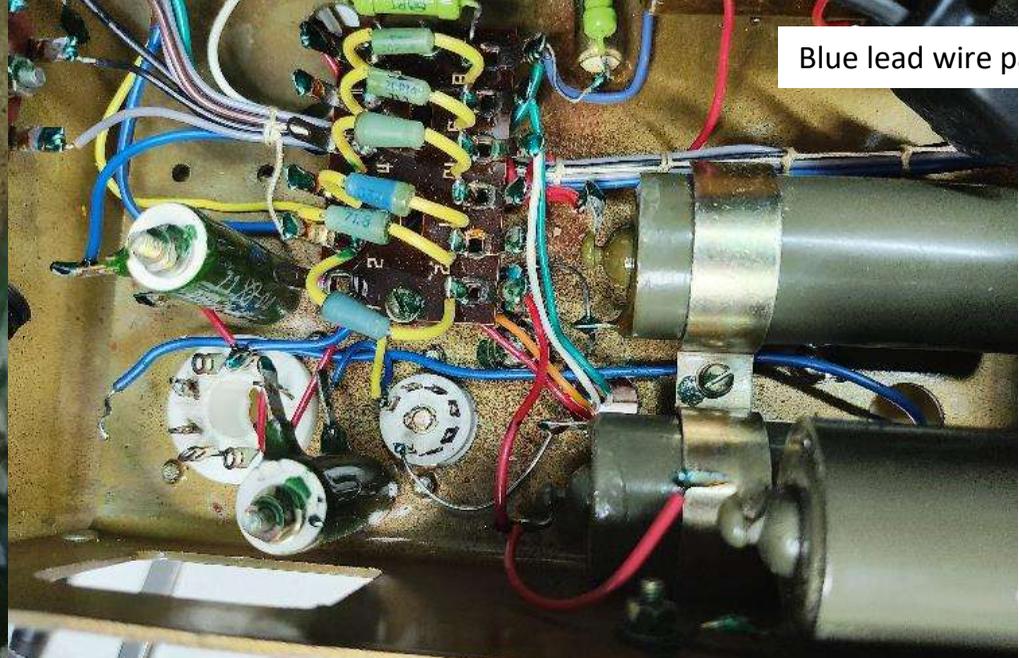
Chassis hole cleaned

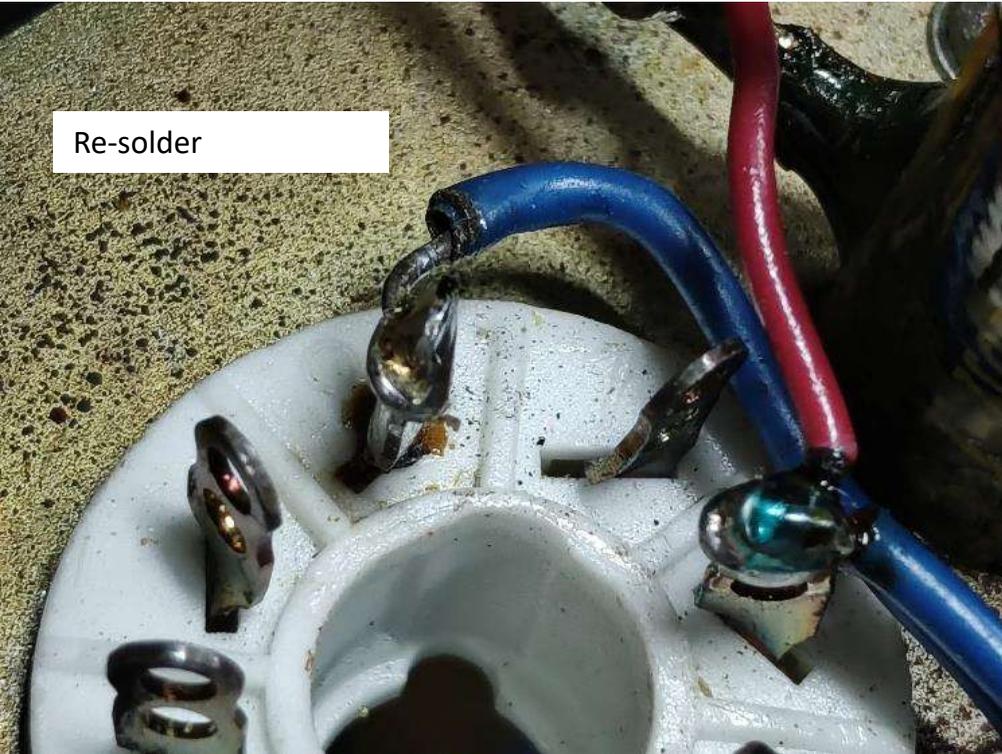


De-solder



Blue lead wire path





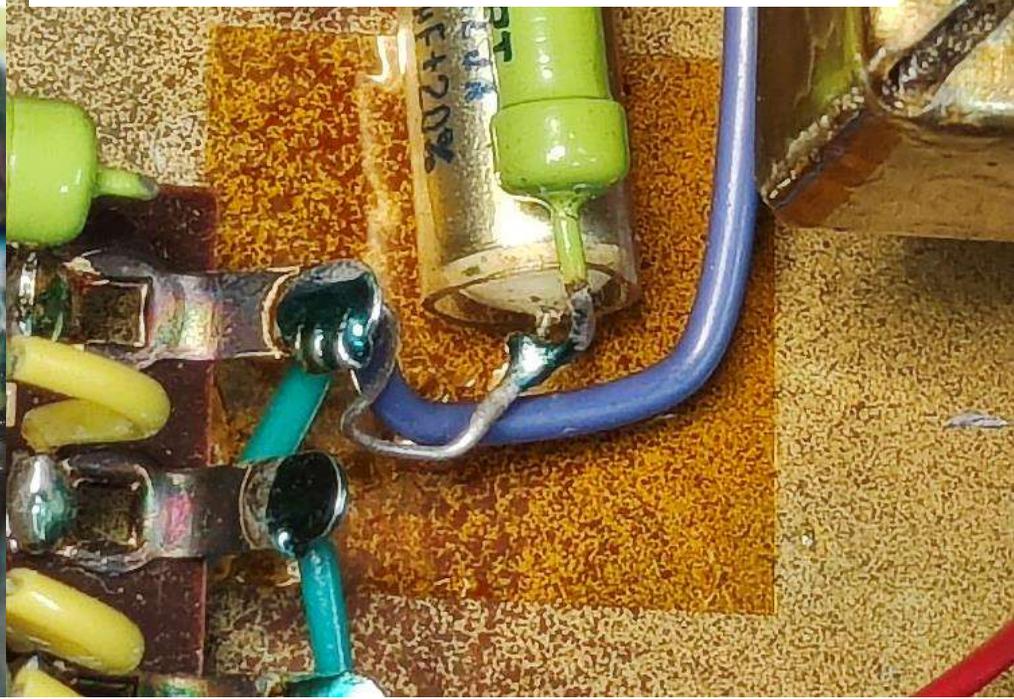
Re-solder



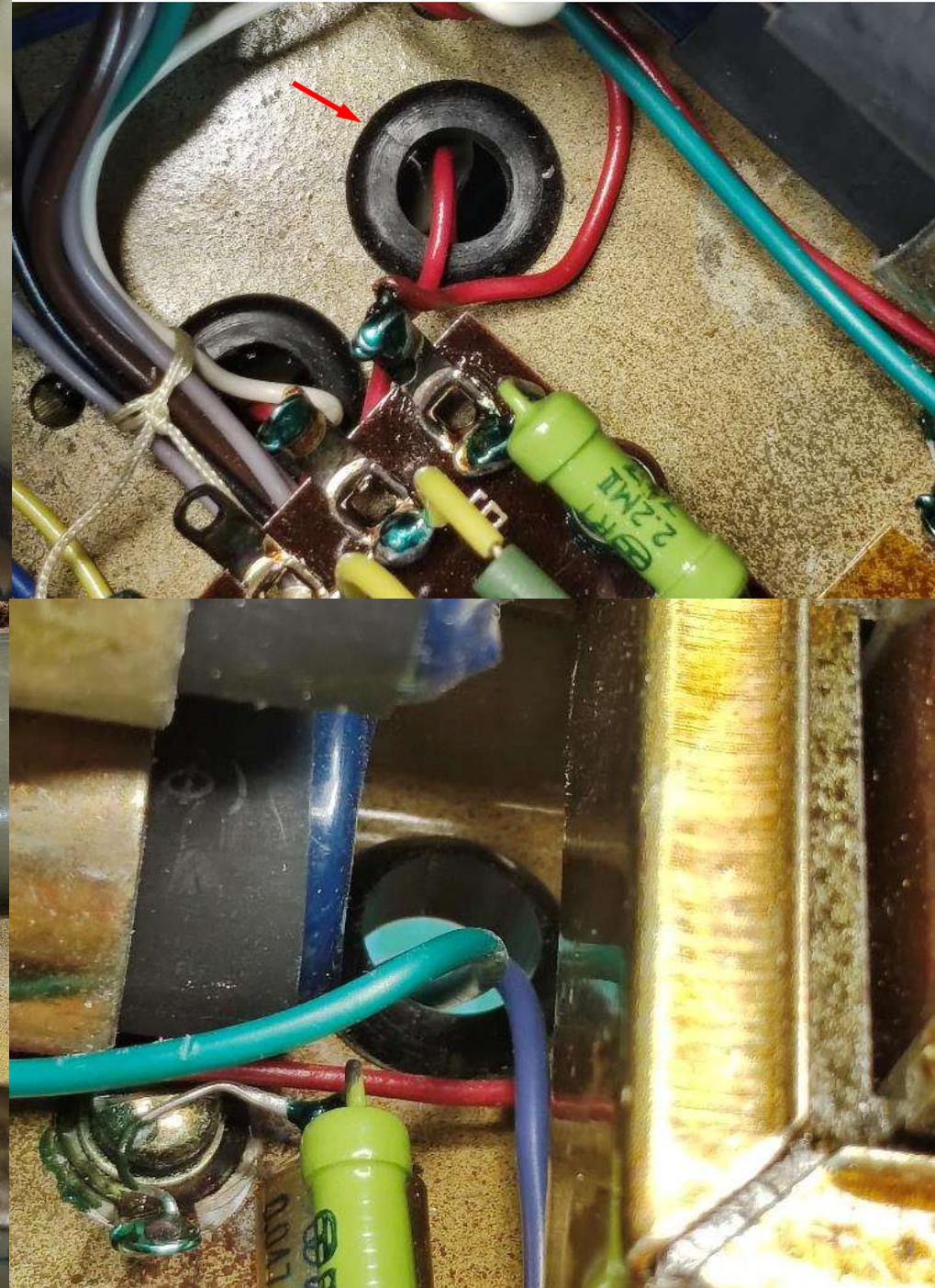
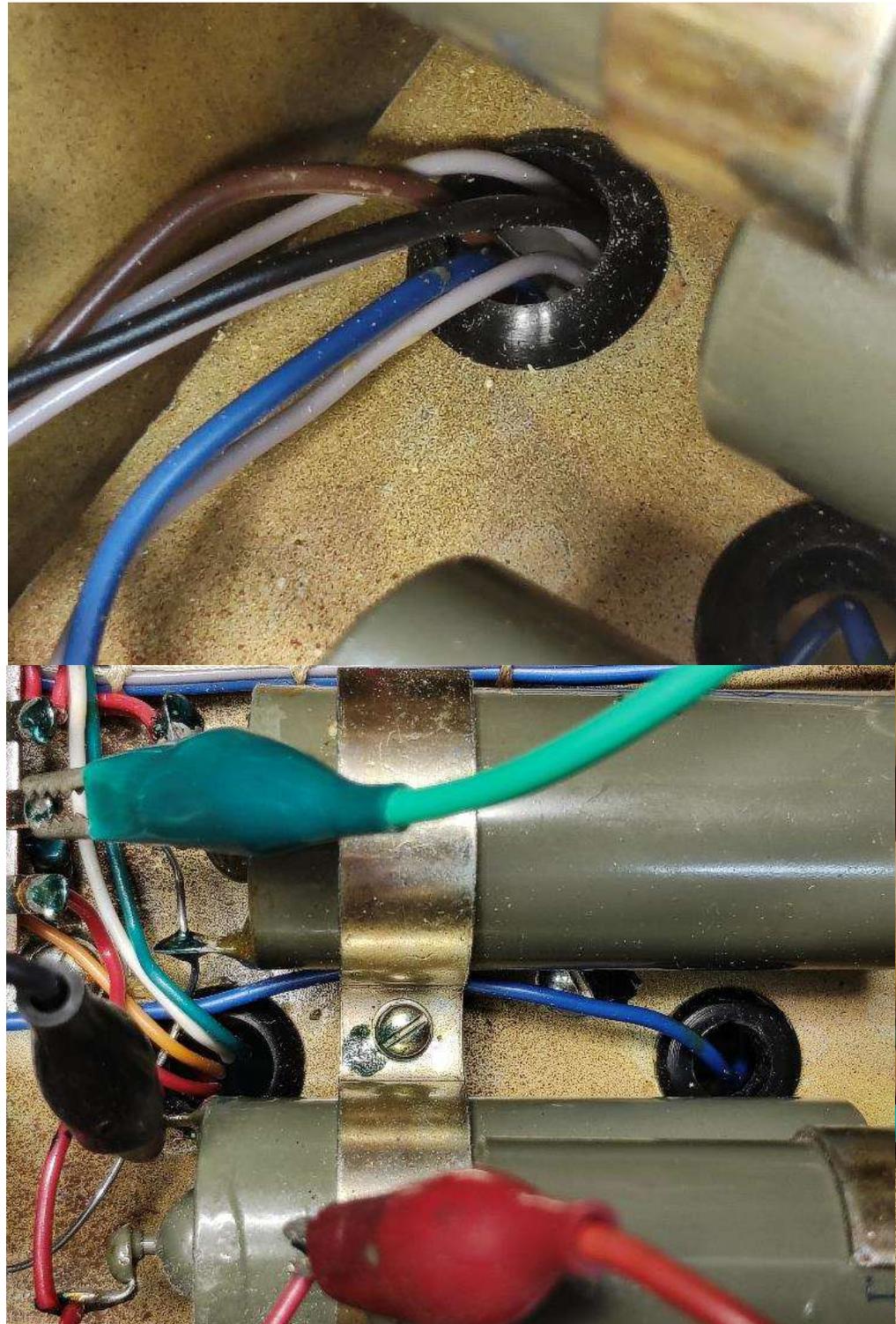
Hole with new Silicone grommet

Adding Kapton tape on resistor body to avoid heating wire insulation

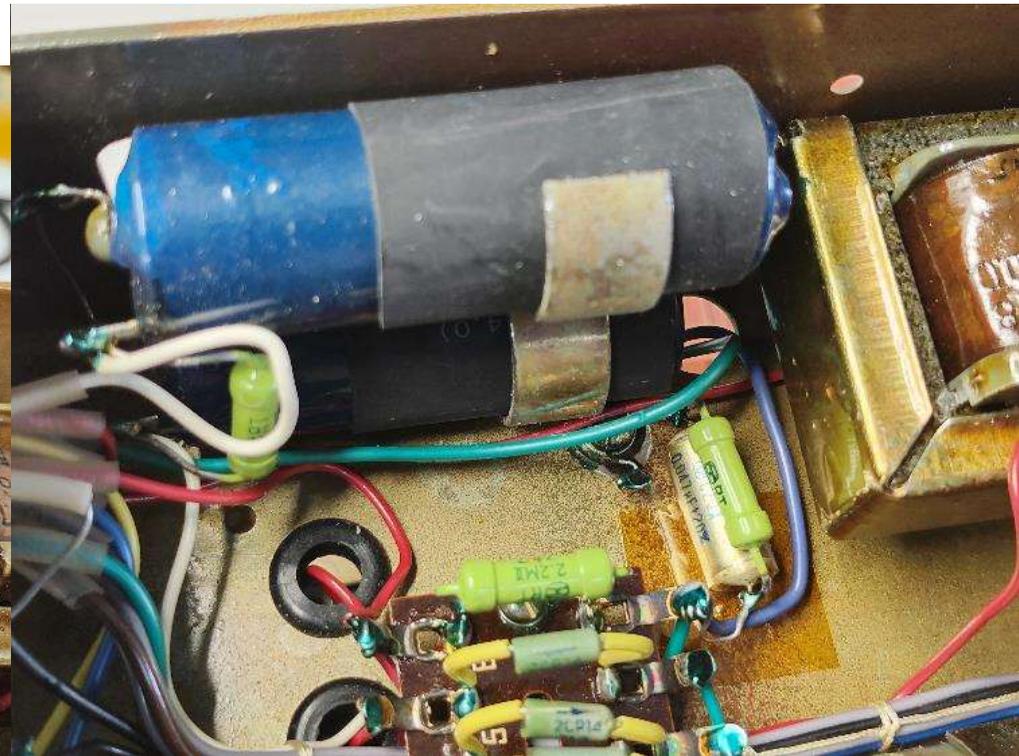
Adding Kapton tape on chassis for better creepage distance



Holes with new grommets, these were done by cutting/splitting grommet allowing insertion without de-soldering many wires



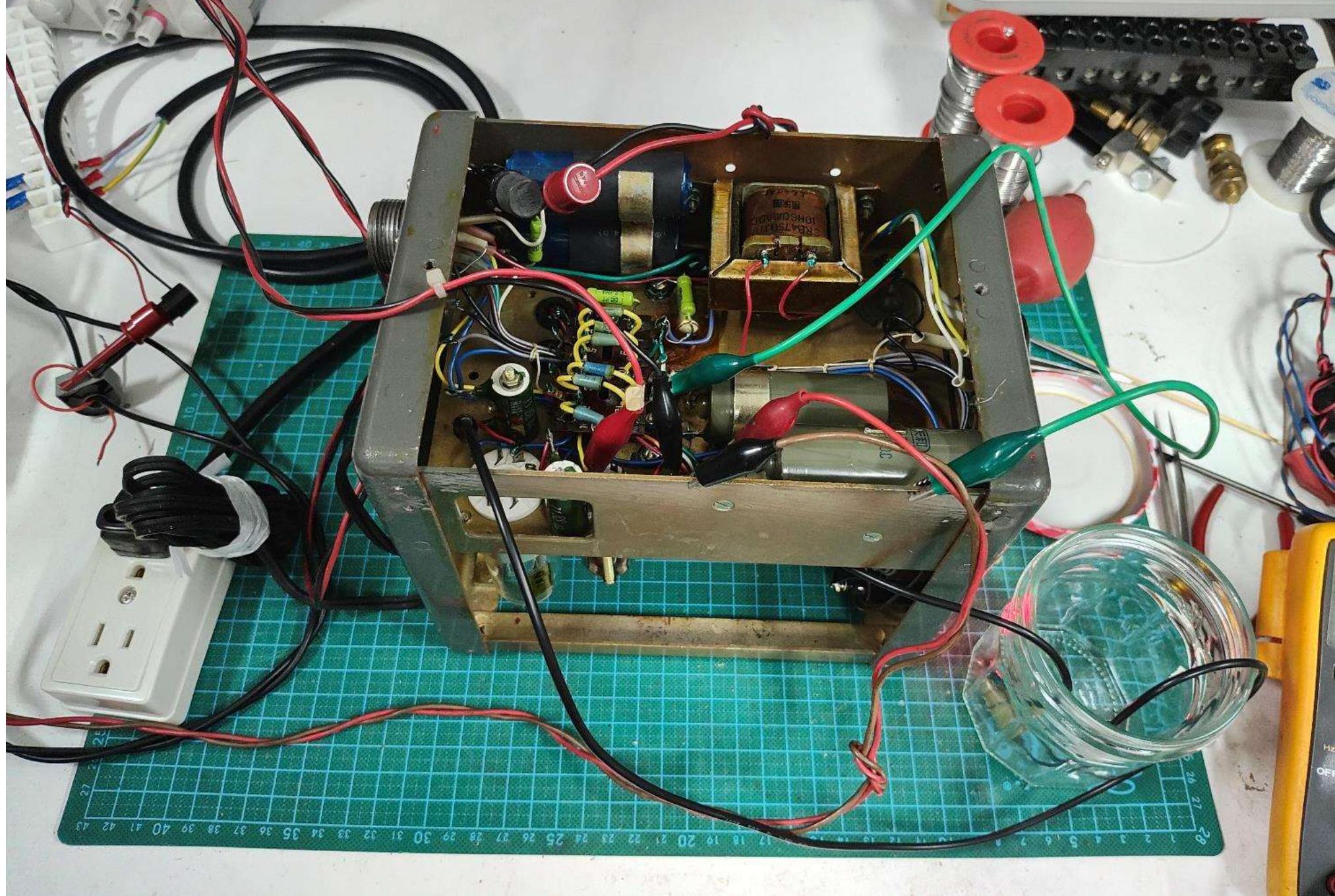
Adding heat shrinkable tube on capacitors casing



AC power cord, new grommet, de-solder, re-solder, add heat shrinkable tubes

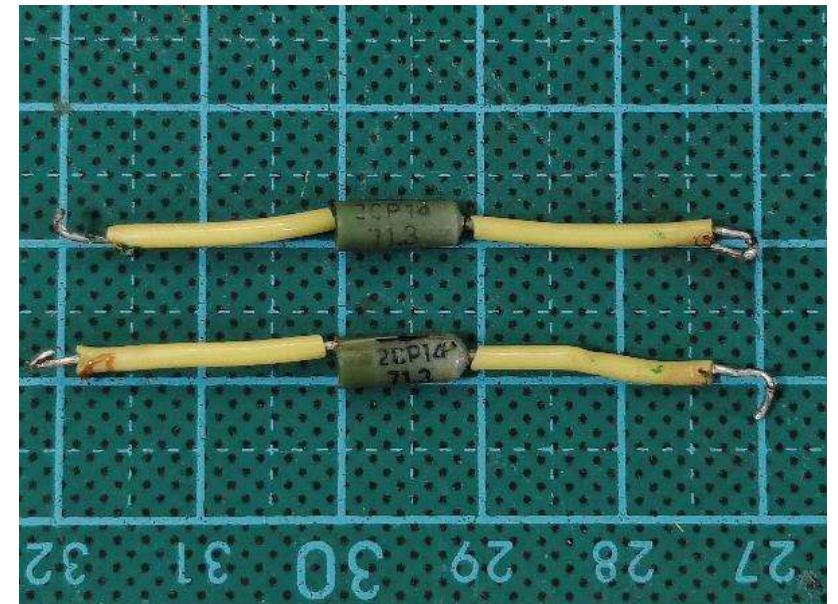


PSU unit check, monitoring capacitor voltages, regulated filament AC power: $6K4(0.3A)+6U1(0.3A)+6J1(0.17A)=0.77A$, loaded with 8Ω resistor



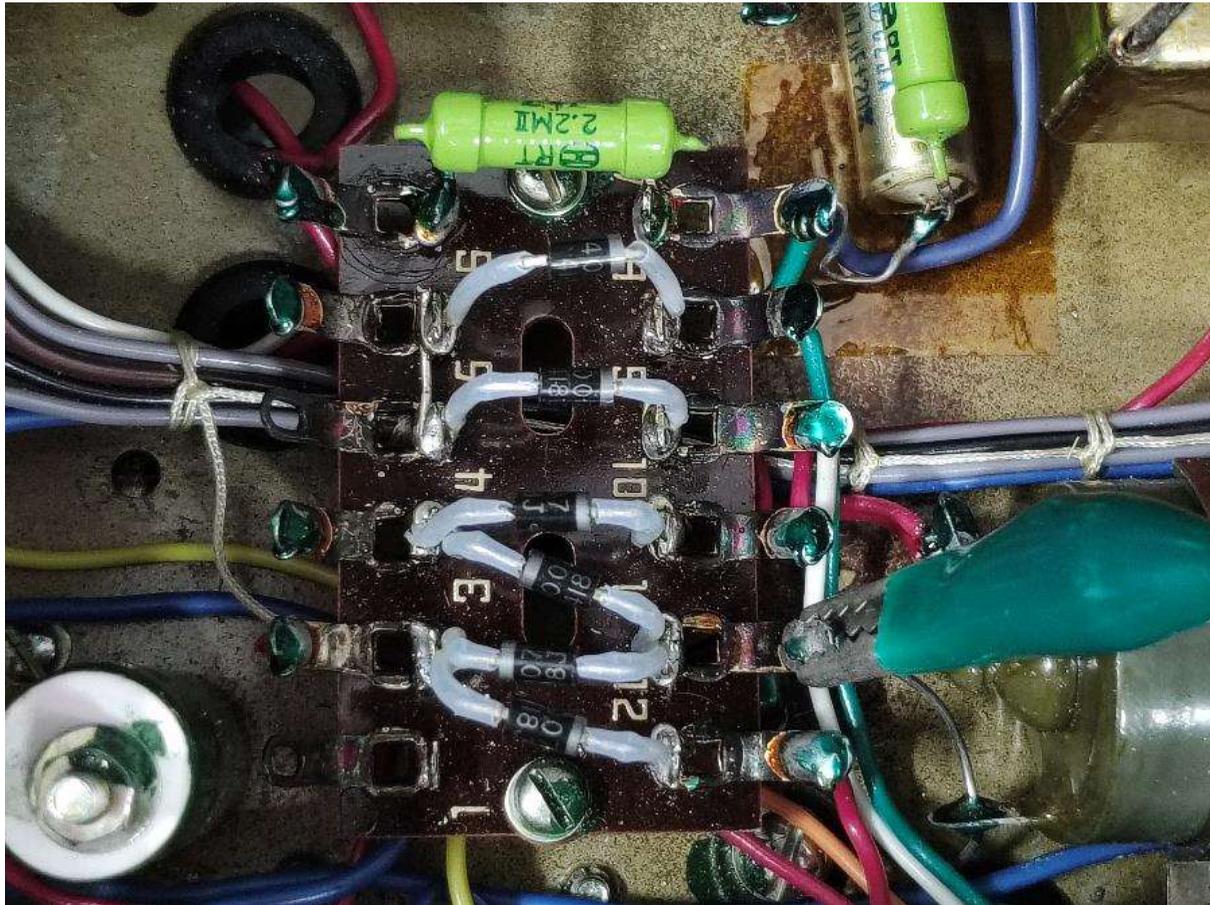
Rectifier diodes replacement 29-Mar-2025

- Noticed -40V output dropped rapidly (~ 10 s to -3V) at power off after few hours burn-in
- ~ 3 V p-p 50Hz (not 100Hz) ripple observed at unloaded -40V output
 - Output unloaded and total capacitance is 100 μ F, indicates excessive leakage present
 - Capacitors C307/309 check good, capacitance 77 μ F/82 μ F leakage ~ 15 μ A at 30VDC
 - Disconnect capacitors -40V output measured 22K resistance to ground/chassis
 - D7 diode check ok but measured 22K with multimeter resistance range, leakage current measured 215 μ A at 30V reverse bias, note 2CP14 leakage current varies with different manufacturer, ranges from 5 μ A to 100 μ A, 215 μ A far exceeded most relaxed spec.
 - Vintage rectifiers quality questionable, replaced

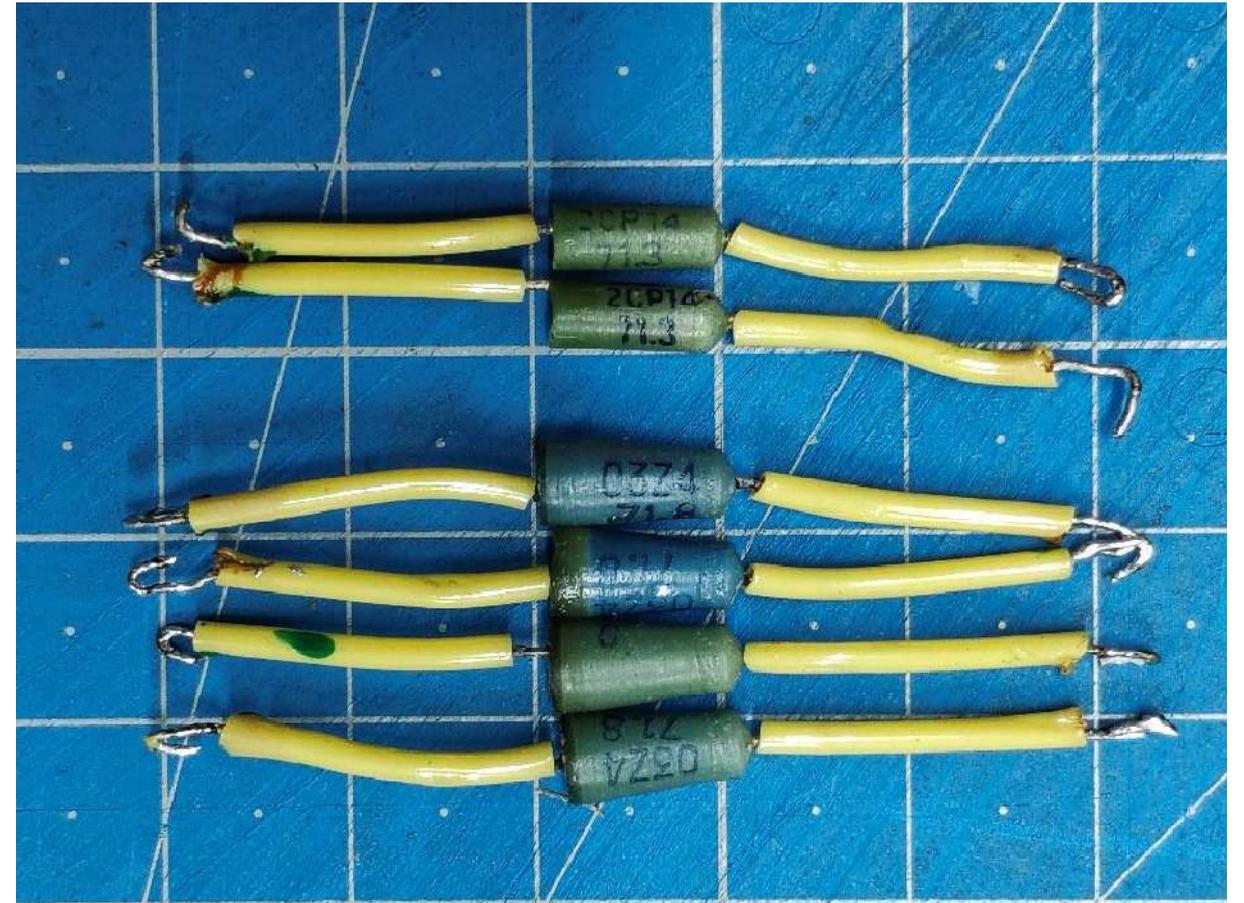


Rectifier diodes replaced 29-Mar-2025

1N4007 x 6 pcs

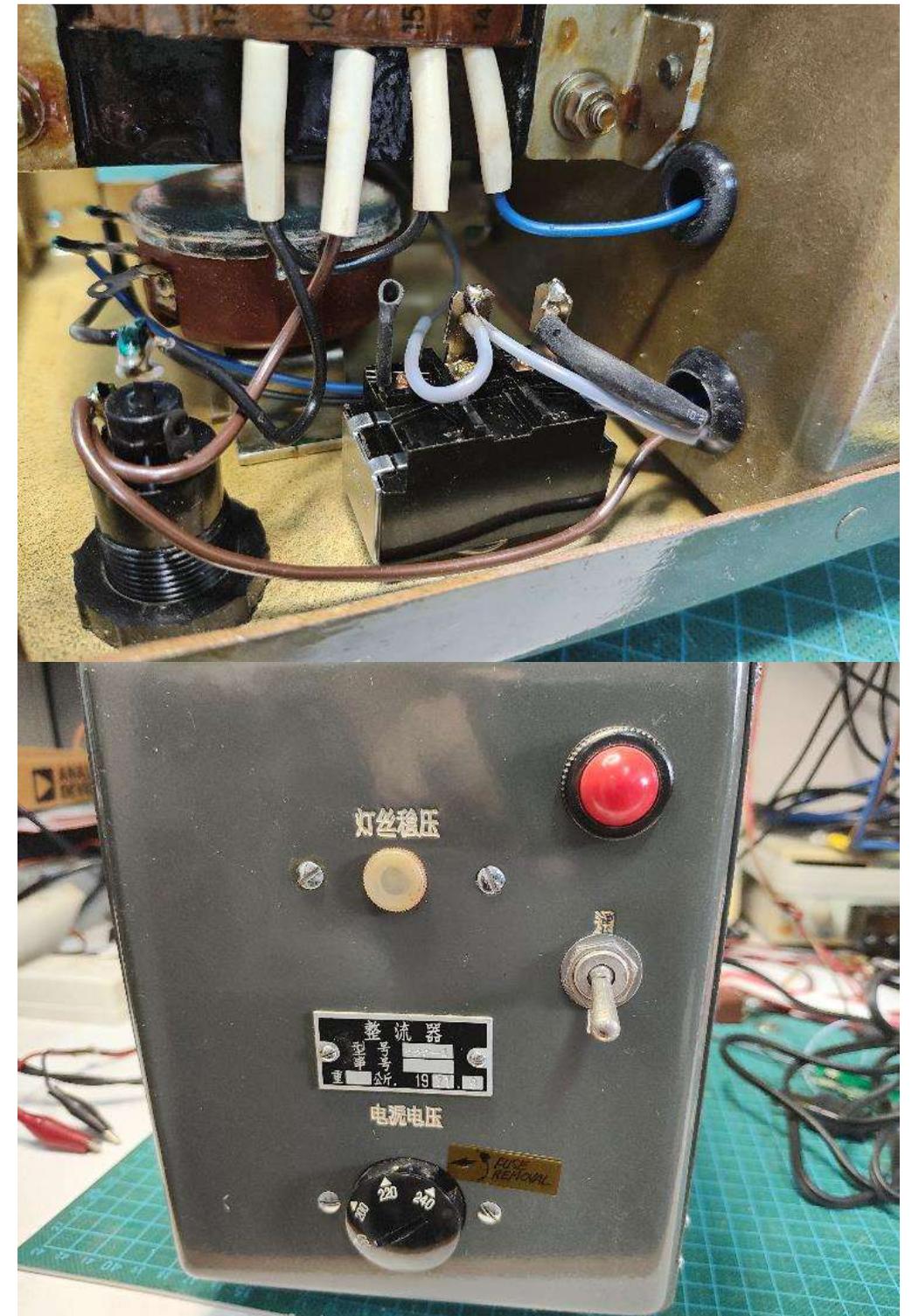


Original parts



1-Apr-2025

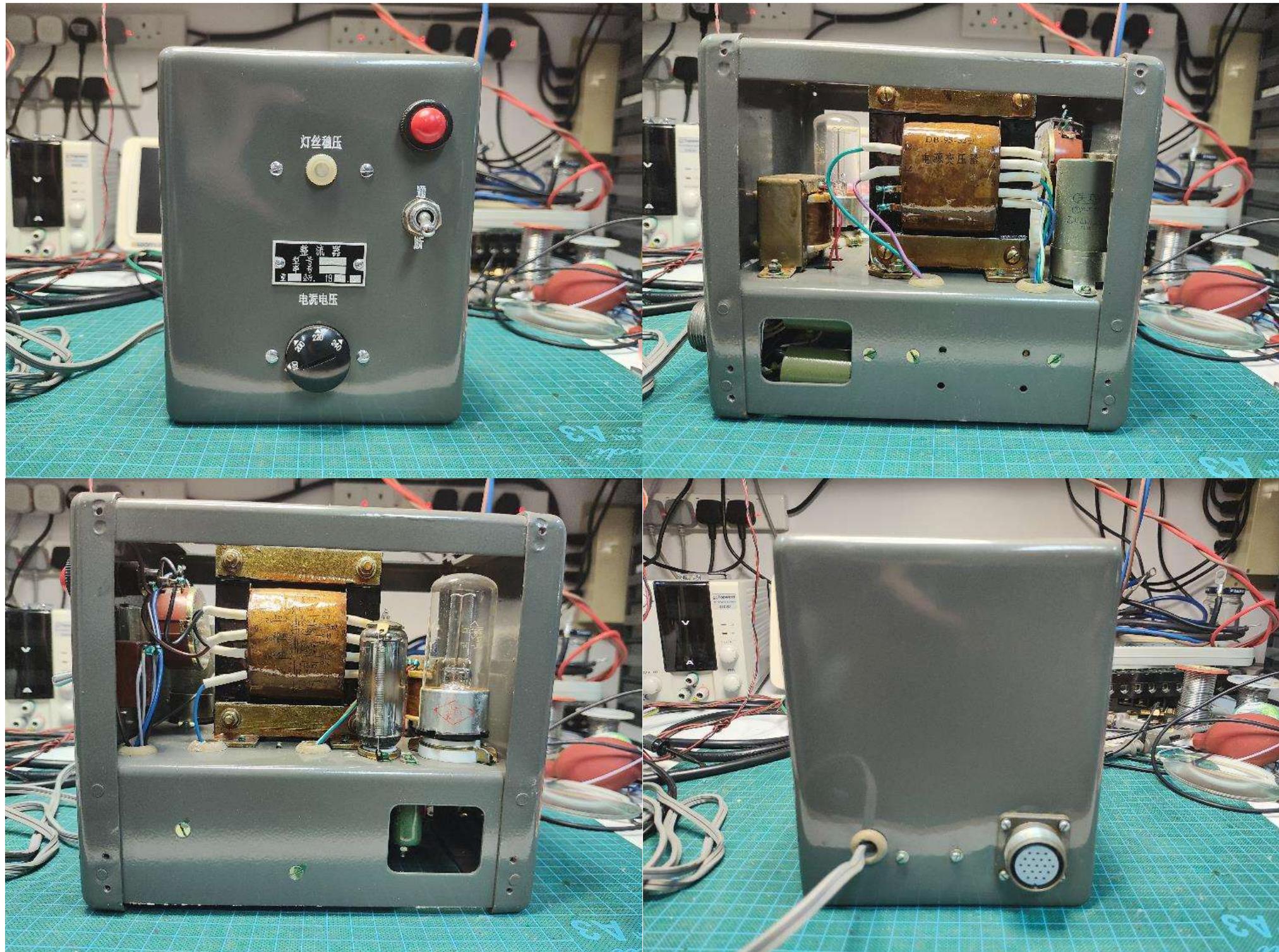
- Power switch broken when flipped to ON position, plastic toggle turned brittle after 50yrs
- Found connector CZ2 pin # 17/19 swapped during switch replacement, not big issue since these two pins are connected to another parallel switch inside 222-1 radio.
- Replaced power switch (250V 10A type w/agency approval), correct CZ2 wiring

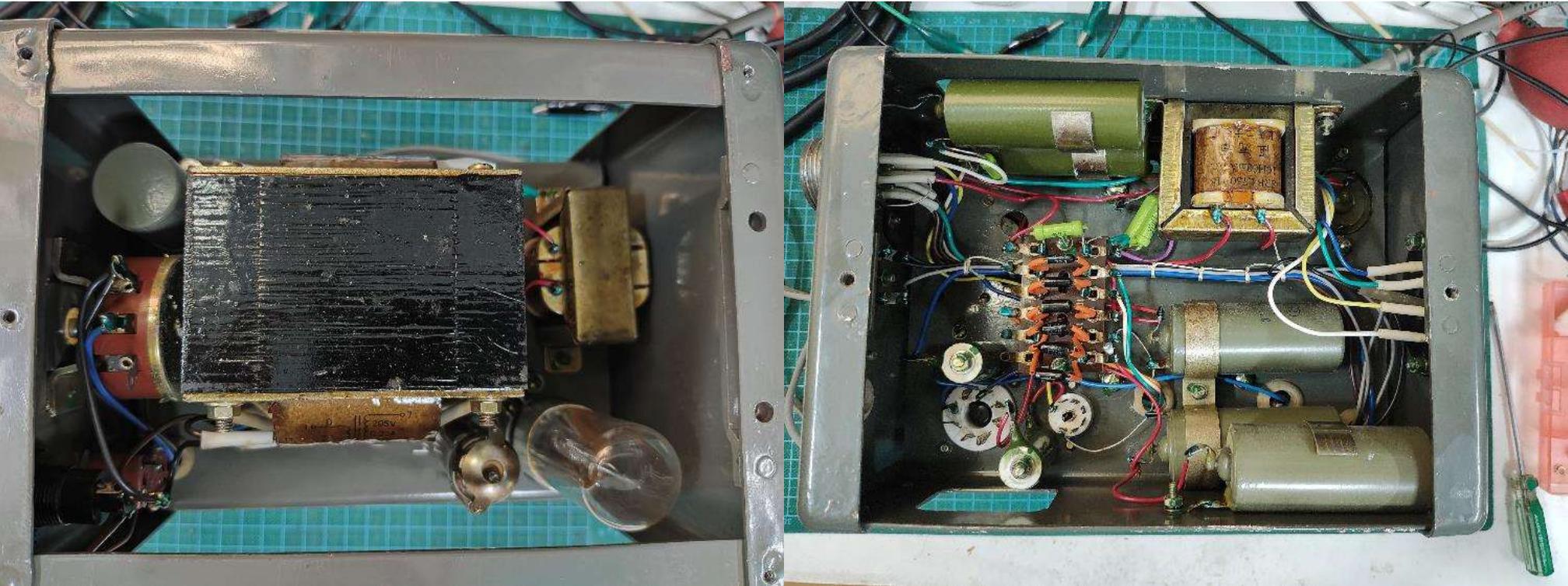


Unit #2 Feb-1974

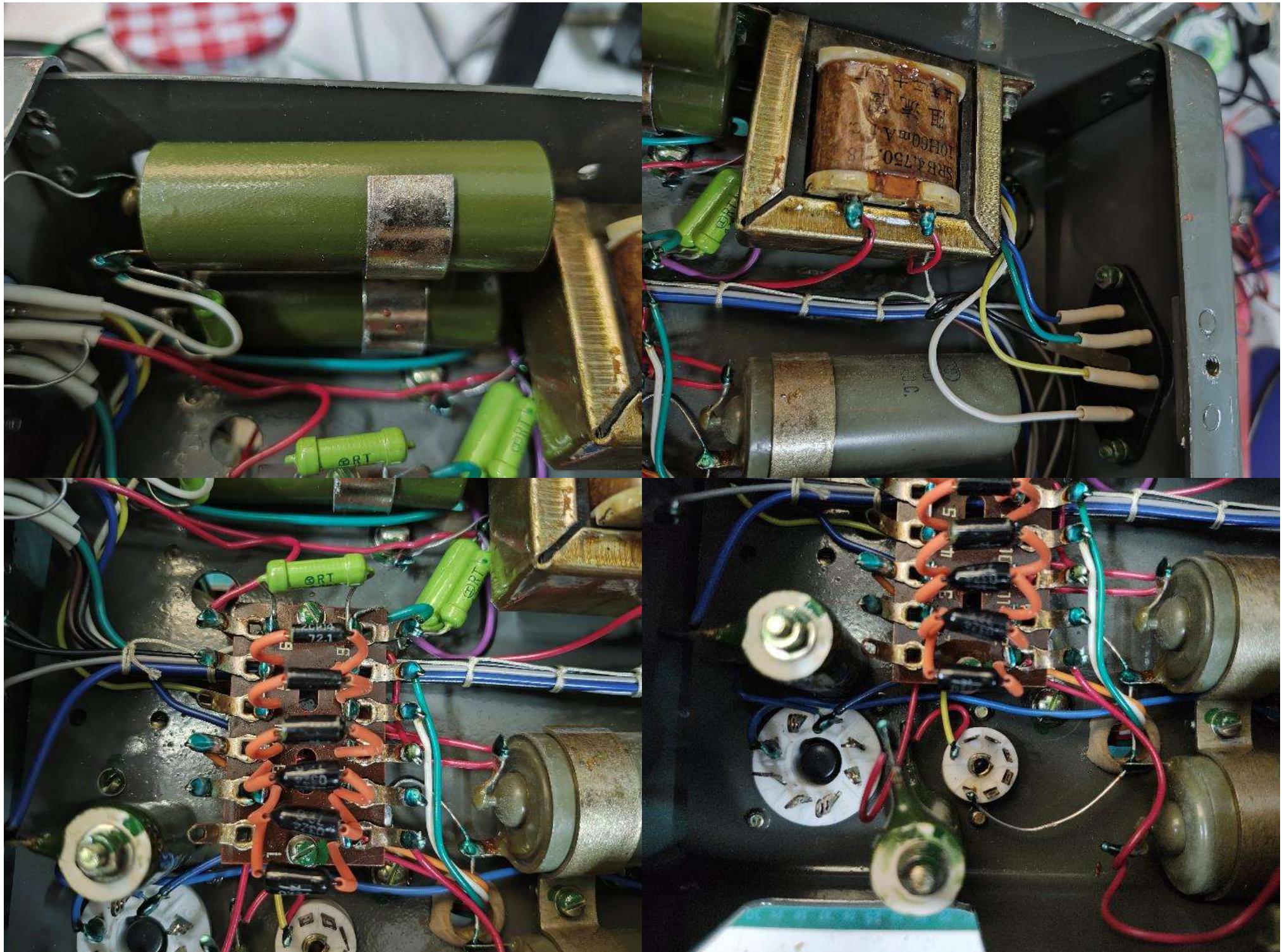
Before Service
Better
condition
Than Unit #1

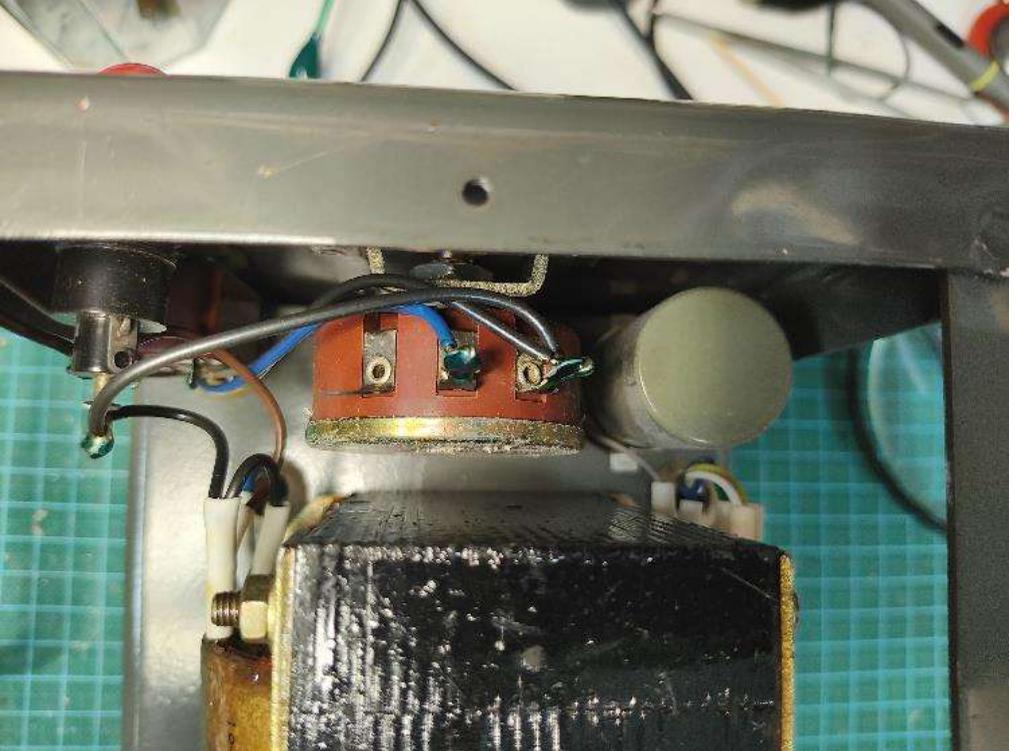
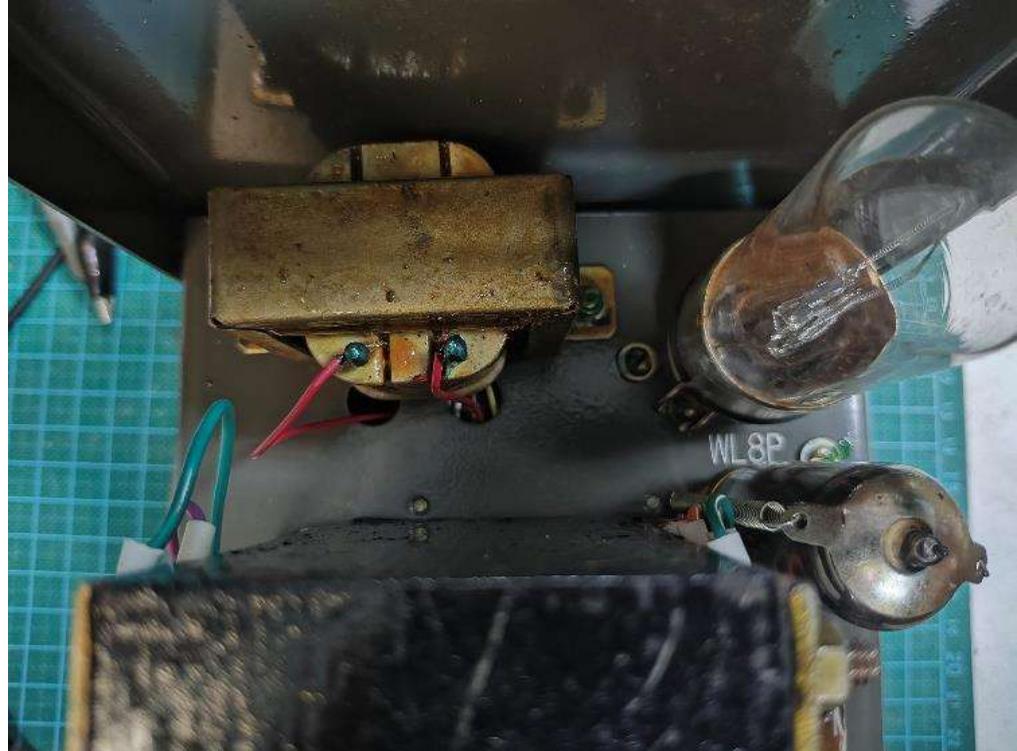
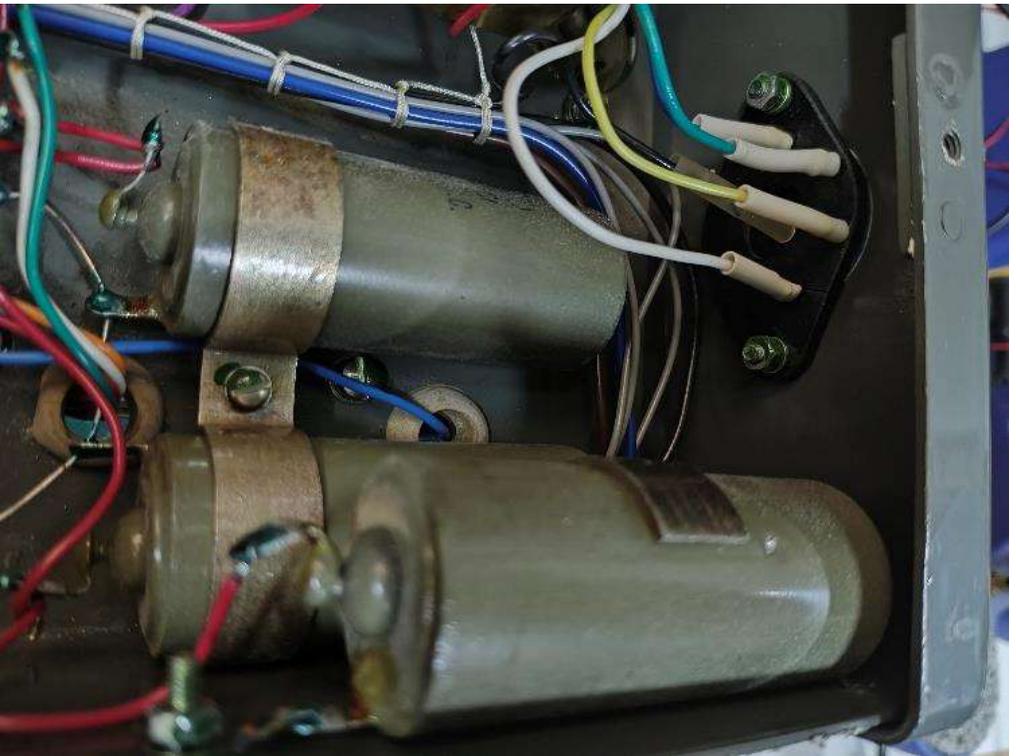
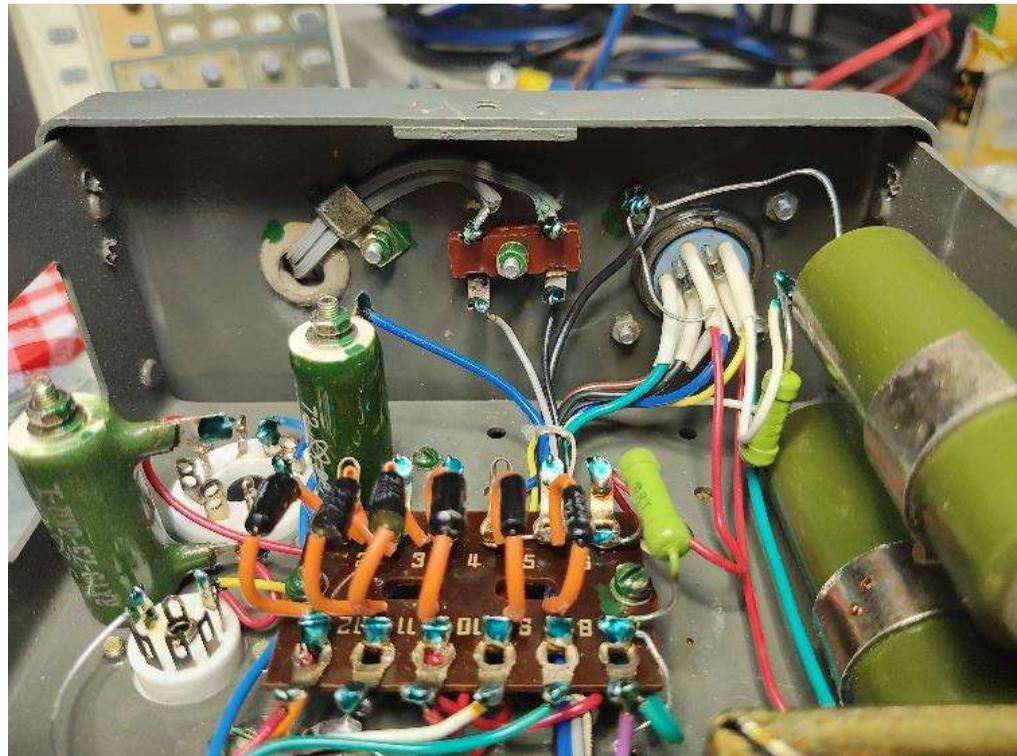
This one has a
painted
chassis
instead of
Zinc
Chromate

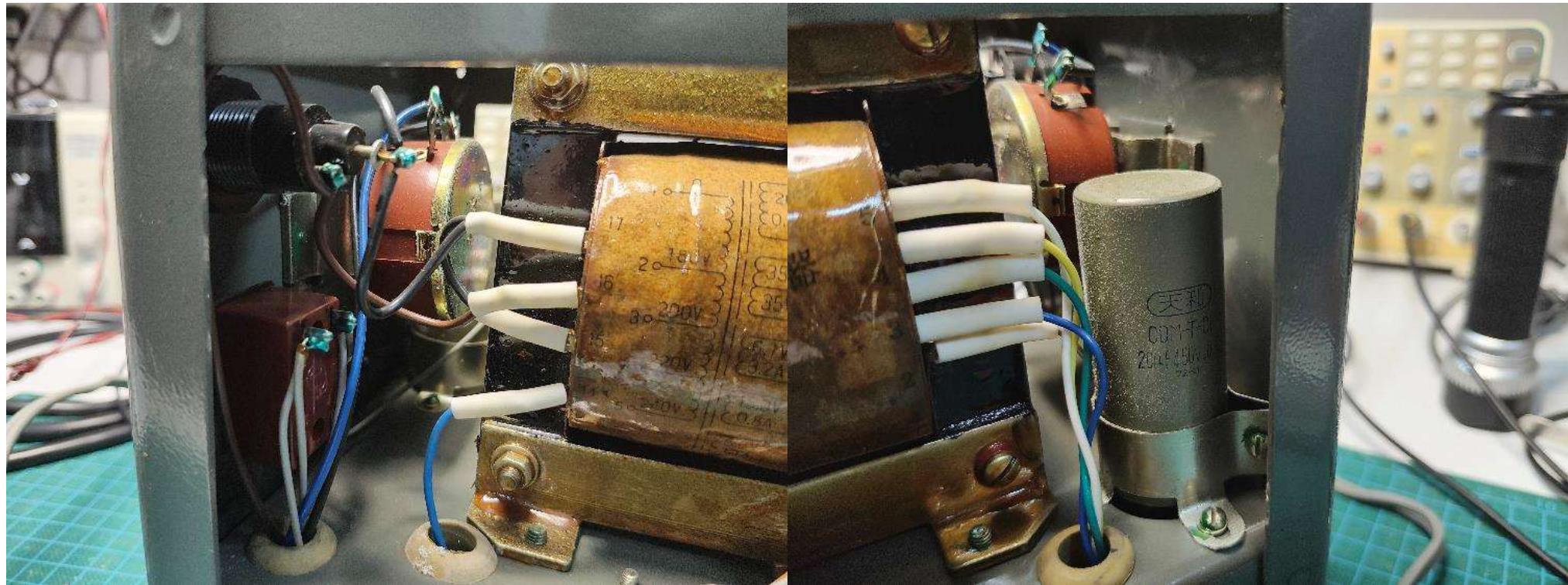




Internal
close-up

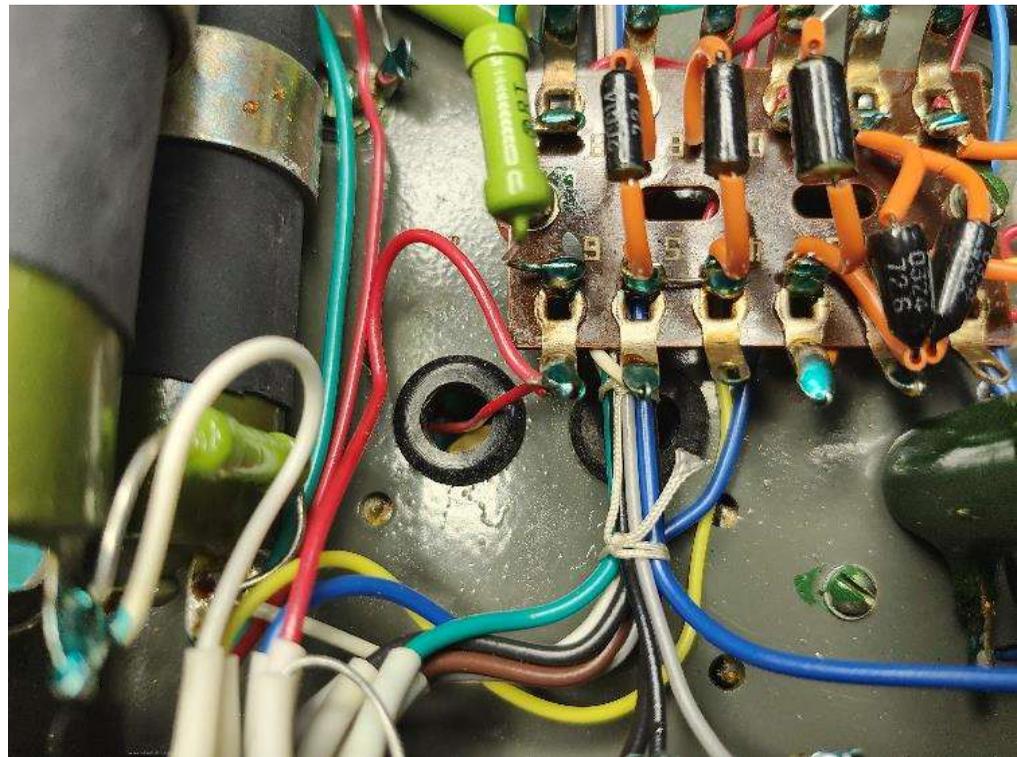




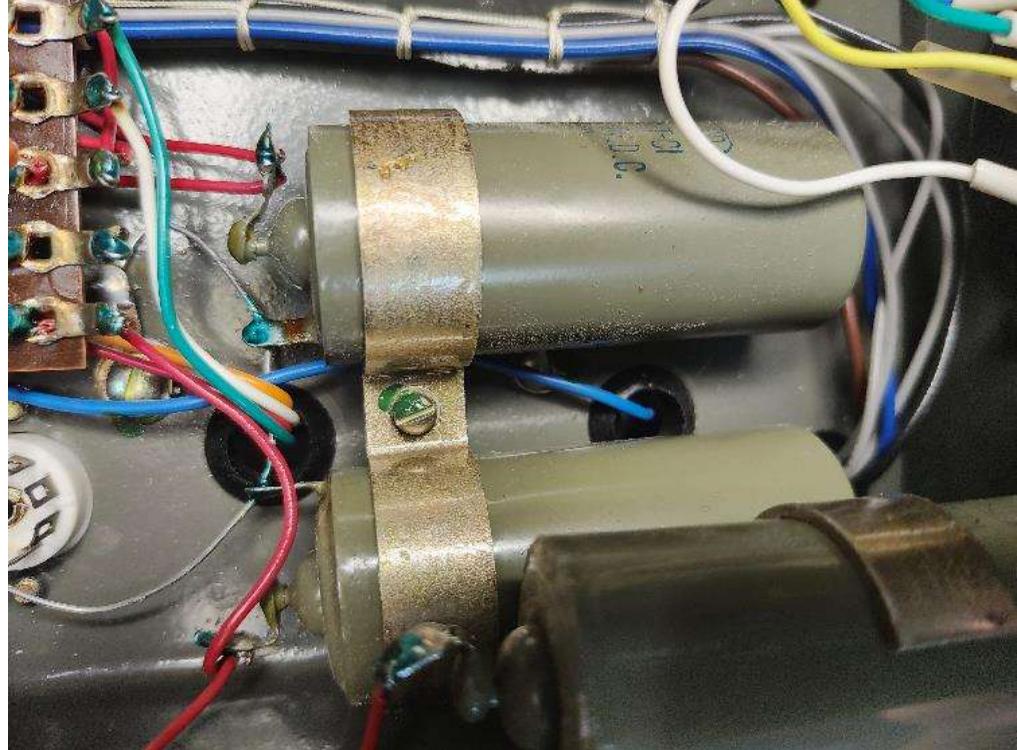


Rubber grommets removed

Rubber grommet replacement, rectifier diodes accidentally bent, later corrected. Diodes checked okay, not replaced



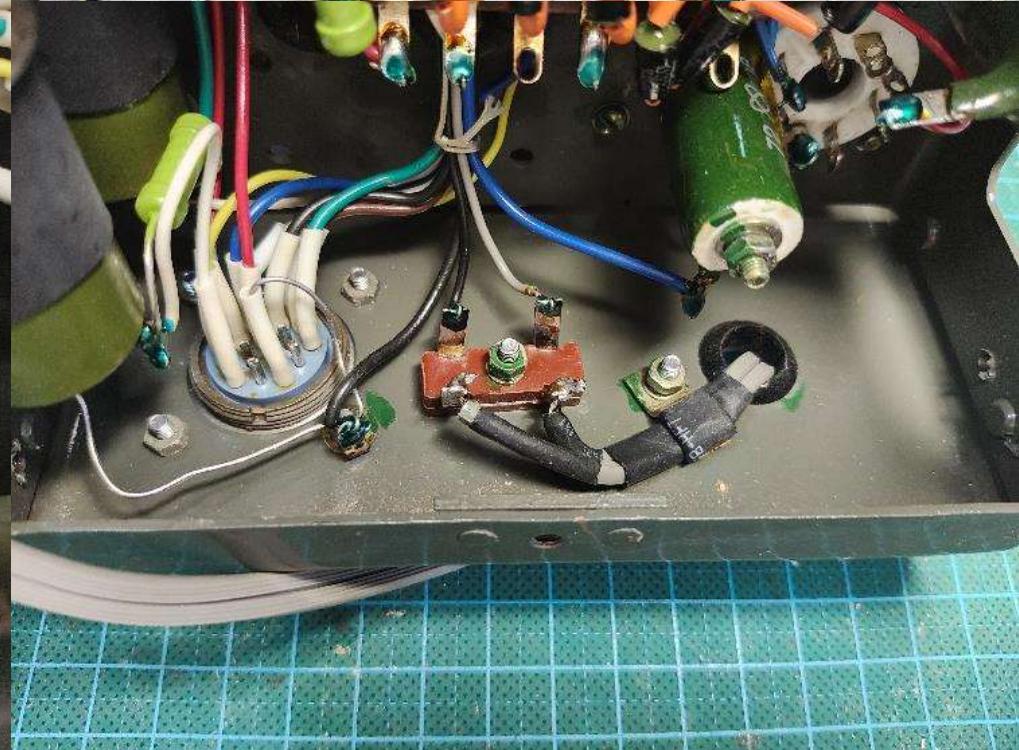
Rubber grommet replacement, retain original Ecaps



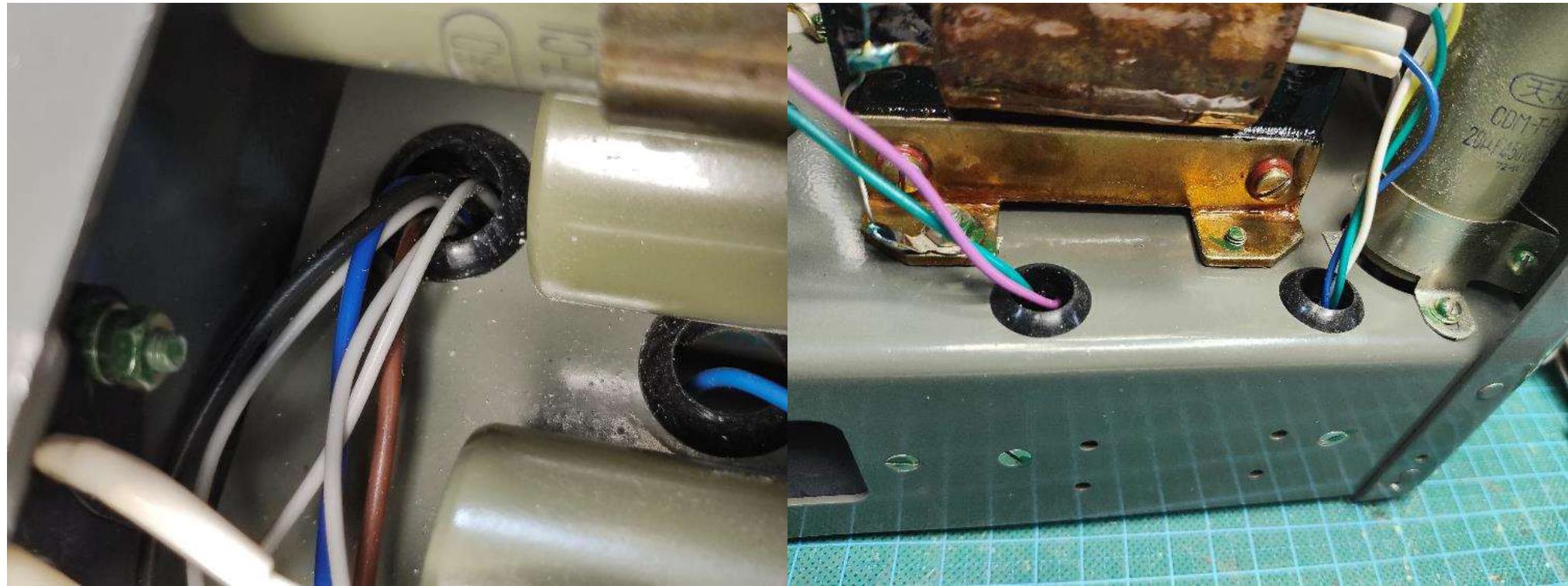
Heat shrinkable tubes on -40V capacitors. Retain original Ecaps. Ripple checked okay.



AC inlet grommet replacement and additional insulation, power cord condition acceptable, retained



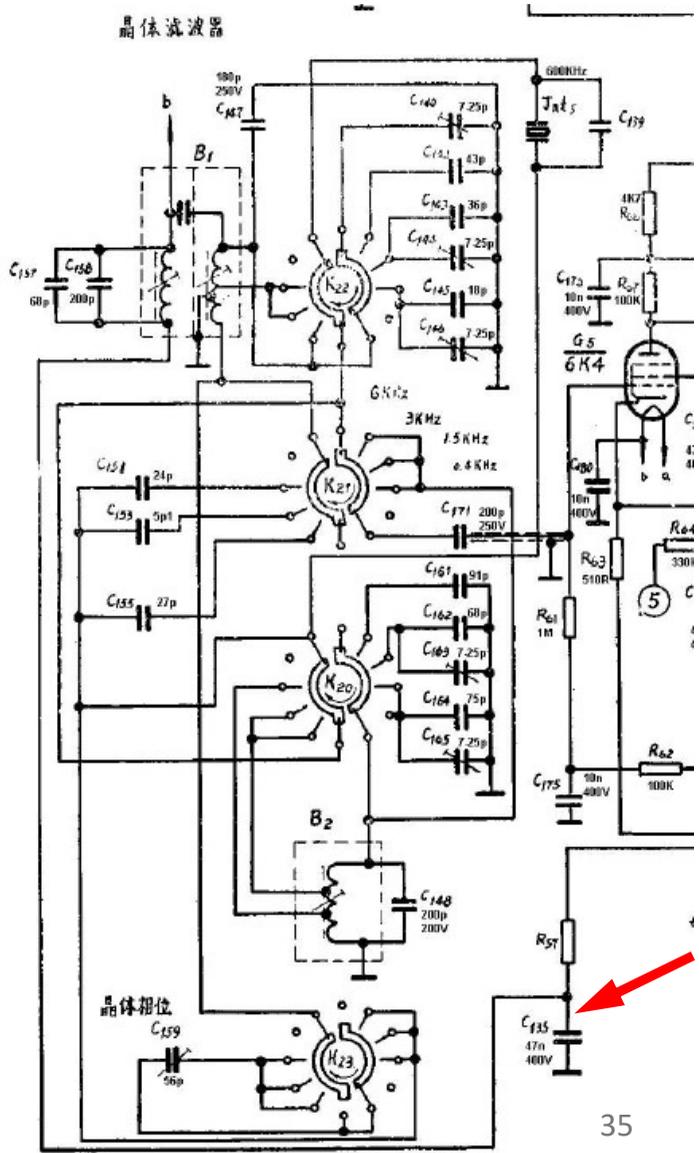
Rubber grommet replacement



Metalized Paper Capacitor Check
26-Apr-2025

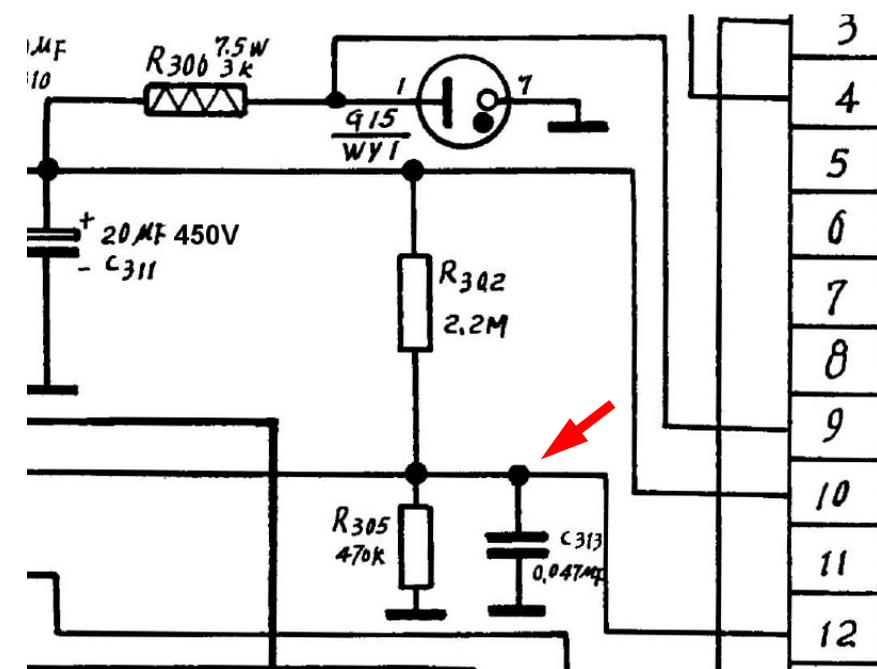
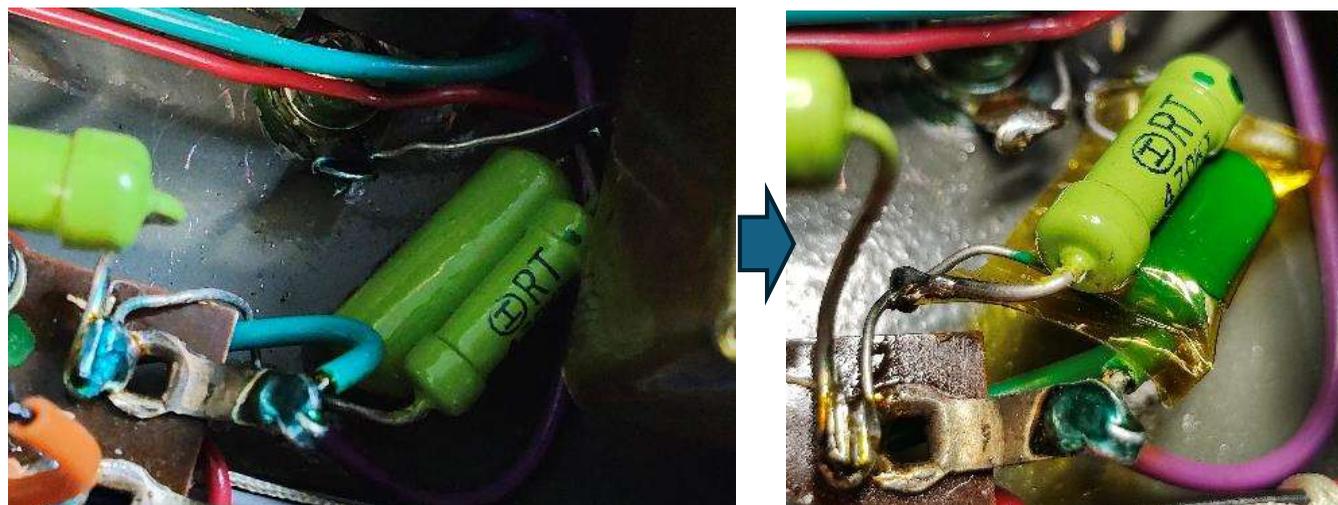
Unit serial number 11849, 26-Apr-2025

- Unit functional, capacitors were only visually inspected
- Picked one easy to remove capacitor for testing, this one was replaced irrespective of test result
 - pick C135, between mixer output and IF band pass filter 47n 400V
- C135, 0.047u 400V +/-10%, type CZJX, (C-电容capacitor, Z纸-paper, J金属-metal), date code 1973-9
 - 29.7n @100Hz, 29n @1KHz, 28n @100KHz, -36%
 - Leakage 0.27uA @200V DC
 - Replaced with Vishay Sprague 715P 47n 400V Polypropylene
- Capacitor deteriorated, schedule re-capping



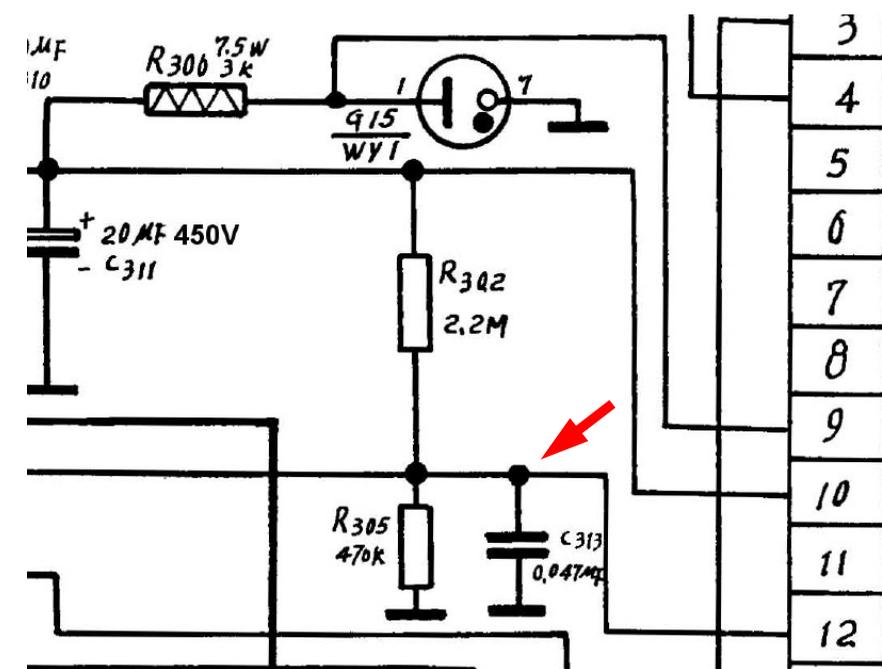
Feb-1974 PSU, no S/N, metallized paper cap replacement, 26-Apr-2025

- Unit checked functional ~ 1 month ago, capacitor C313 not replaced for vintage reason.
- C313, 0.047u 400V +/-20%, type CZJX, date code 1973-9
 - 70n @100Hz, +48% tolerance
 - Leakage 22uA @200V DC, ~100x previous result **high**
 - Replaced with Marcon/Taitso 2G473K 47n 10% 400VDC polyester, space constrain
 - Resistor R305 470K in parallel with C313 de-soldered / re-installed



Sep-1971 PSU, no S/N, metallized paper cap replacement, 27-Apr-2025

- Unit checked functional ~ 1 month ago, capacitor C313 not replaced for vintage reason.
- C313, 0.047u 400V +/-20%, type CZJX, date code 1971-9
 - Oil leakage trapped inside jacket, marking partially dissolved
 - 21n @1KHz, -55%
 - Leakage 25uA @200V DC, **high**
 - Replaced with Marcon/Taitso 2G473K 47n 10% 400VDC polyester
 - Keep original R305 470K in parallel with C313 de-soldered / re-installed
- Confirmed capacitors questionable



Notes:

- On tube replacement, Chinese 6K4 is equivalent to Russian/USSR 6K4n, has 7BD base pin 2 (suppressor grid g3) and 7(Cathode) are internally shorted, it is **NOT** 6BA6 compatible (7CC base, pin 2 and 7 separate) as described in many sources. A remote cutoff pentode with 7BD base is 9003, but Gm much lower than 6K4/6BA6
- Chinese 6K7 has 7CC base, separate pin 2 & 7, compatible with 6BA6, only shortform spec available
- 3-May-2025, correction to radio schematic on manual pg.56
 - G4 (6K4) used a 6K7 symbol with separate pin 7 (Cathode) and pin 2 (suppressor grid/shield), changed to 6K4 symbol

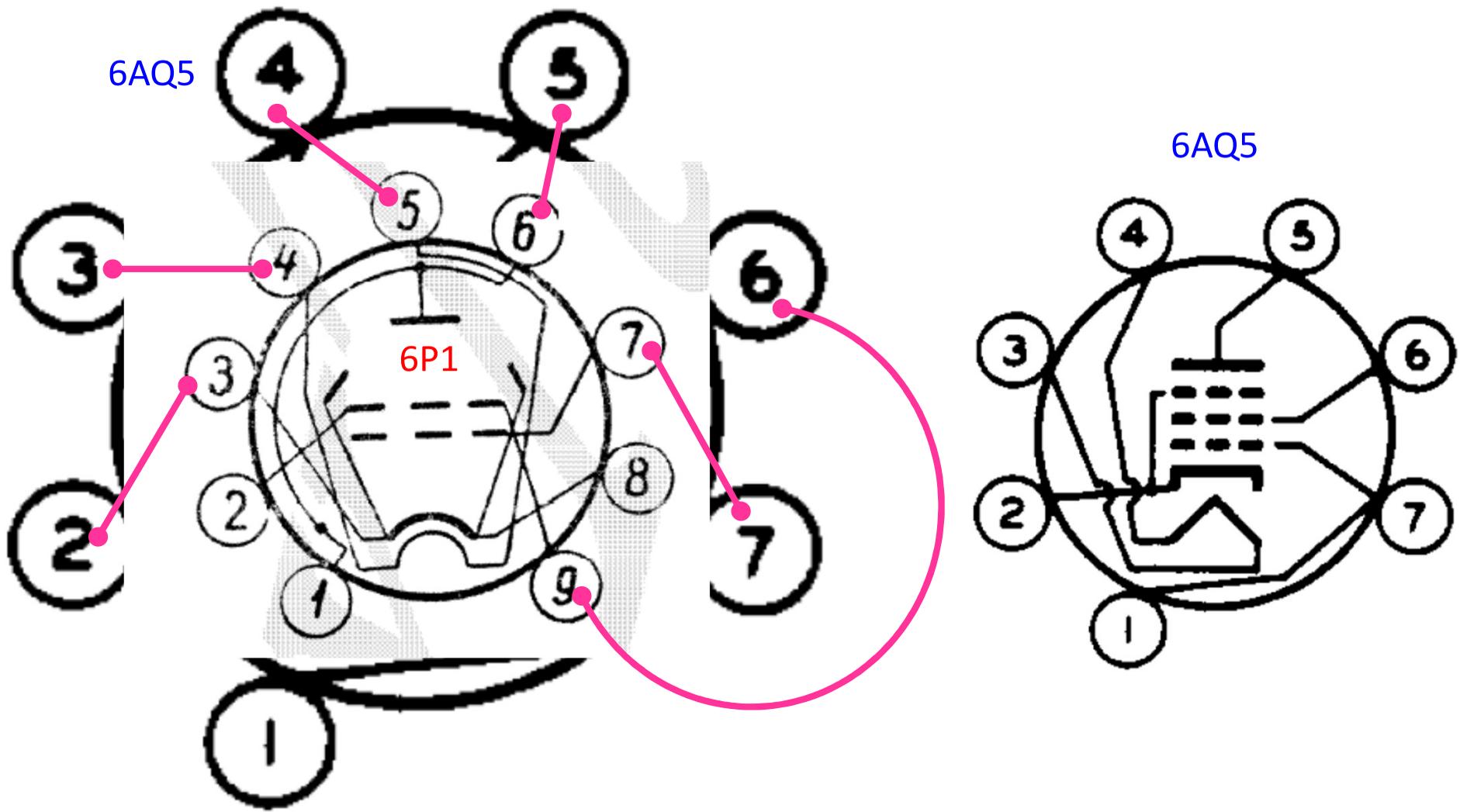
1.3.4 遥 截 止 五 极 管

序 号	型 号	结 构 与 用 途	类 别	灯 丝 电 压 U _f (V)	灯 丝 电 流 I _f (mA)	阳 极 电 压 U _a (V)	帘 栅 电 压 U _{g2} (V)	控 制 栅 电 压 U _{g1} (V)	抑 制 栅 电 压 U _{g3} (V)	阳 极 电 流 I _a (mA)	帘 栅 电 流 I _{g2} (mA)	跨 导 S (mA/V)	内 阻 R _i (MΩ)	阴 极 电 路 电 阻 R _k (Ω)	输 入 电 容 C _{gk} (pF)	输 出 电 容 C _{ak} (pF)	跨 路 电 容 C _{ag} (pF)	阳 极 电 压 U _{amax} (V)	帘 栅 电 压 U _{g2max} (V)	板 耗 P _{amax} (W)	栅 耗 P _{g2max} (W)	阴 极 电 流 I _k (mA)	灯 间 丝 与 电 阴 极 压 U _{fk} (V)	控 制 栅 电 路 电 阻 R _{g1} (MΩ)	外 形 图	电 极 接 线 图	国 外 类 似 型 号	备 注	序 号
1	6K2B(T)	高频电压放大	超小型	6.3	200	120	120	自偏	0	7.5	≤4.0	4.8		200	5	4	≤0.035	150	125	1.2	0.3	14	±150	1	D1.3.1-4	B1.3-36	6K1B		1
2	6K3P	高频电压放大	八脚管	6.3	300	250	100	-3	0	9.25	2.5	2	0.85	68	6.5	7	≤0.007	330	140	4.4	0.44		±100		D1.3.3-2	B1.3-37	6K3,6SK7-GT		2
3	6K4	中频、高频电压放大	拇指管	6.3	300	250	100			10	≤5.5	4.4	0.85	68	6	6.3	≤0.0045	300	125	3	0.6	20	±100		D1.1.4-4	B1.3-38	6BA6,6F31,6K4Π		3
4	6K5	同上	同上	6.3	300	250	100		0	10	≤5.5	4.4	0.5	100	6	5.8	≤0.0045	300	125	3	0.6	20	±100	0.5	D1.1.4-4	B1.3-38	EF93		4
5	6K7	高频电压放大	同上	6.3	300	250	150			11	≤3.5	5.7						300	150	3.5	0.5	18	±200	0.5	D1.1.4-4		6K7Π		5
6	12K3P	同上	八脚管	12.6	150	250	100	-3	0	9.25	2.5	2			6	7	0.007	330	140	4.4	0.44		100		D1.3.3-2	B1.3-37	12K3,12SK7-GT		6

4-May-2025, tube compliment

Legend	Chinese	Russian	American	European	Base	Comment
G1	6K7 class J	6K7П TBD	6BA6		7CC	Pentode, remote cutoff
G2	6K7 class J	6K7П TBD	6BA6		7CC	Pentode, remote cutoff
G3	6U1	6И1П	6AJ8	ECH81	9CA	Triode-Heptode
G4	6K4 class J	6K4П			7BD	Pentode, remote cutoff
G5	6K4 class J	6K4П			7BD	Pentode, remote cutoff
G6	6K4 class J	6K4П			7BD	Pentode, remote cutoff
G7	6K4 class J	6K4П			7BD	Pentode, remote cutoff
G8	6H2	6X2П	6AL5	EB91	6BT	Twin diode
G9	6J1 class J	6Ж1П	6AK5	EF95	7BD	Pentode, sharp cutoff
G10	6F2	6Ф2П	6U8	ECF82	9AE	Triode-Pentode
G11	6P1 class J	6П1П				No Western equivalent
G12	6K4 class J	6K4П			7BD	Pentode, remote cutoff
G13	WL8P		9-8			Ballast tube, 900mA, 8V, Amperite 9-8 different pinout
G15	WY-1 class J	СГ1П	0A2	STR150	5B0	Regulator 150V

6AQ5 to 6P1 conversion, rarely required as 6P1 available for reasonable price
6AQ5 is close to 6P1 in terms of application and characteristic, requires 7pin to 9pin base conversion, fortunately most pins in good order agreement. Conversion plugs available from audio retailers.



End of document